



PRESIDENT'S MALARIA INITIATIVE



LIBERIA: National Policy and Strategic Plan on Integrated Vector Management 2012 - 2017

Integrated Vector Management (IVM) Task Order 2

Contract GHA-I-02-04-00007-00

Prepared for:

United States Agency for International Development

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August 2012

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Republic of Liberia

Ministry of Health and Social Welfare



**National Policy and Strategic Plan
On Integrated Vector Management for Liberia
(2012-2017)**

March 2012

Foreword

Malaria is a major public health burden in Liberia. It results in unacceptable morbidity and mortality. With the whole population of the country is at risk of the disease, control of malaria is a primary emergency. Other vector borne diseases such as filariasis and other neglected tropical diseases (NTDs) also impose severe health and socio-economic burden on the country. The Government of Liberia is engaged in serious efforts to control these diseases; For malaria, actions include introduction of a new drug policy; ongoing strengthening of case management and pharmaceutical systems; the implementation of universal coverage of populations at risk with long lasting insecticidal nets (LLINs) which has resulted in millions of LLINs being distributed to address an assessed national gap in coverage; as well as complimentary use of indoor residual spraying. With regards to NTDs, a recently reconstituted NTD program is accelerating national mapping of diseases and the introduction of mass drug administration.

In spite of the above progress, there are significant constraints to vector borne disease control, as the country rebuilds a national health system that was largely destroyed by a prolonged civil war. Constraints to vector control include a growing threat of insecticide resistance in local vector populations of malaria; shortage of trained personnel in the various competency areas of vector control; absence or inadequate infrastructure for entomological evaluations; inadequate inter-sectoral collaboration; less-than-desirable level of community involvement in vector control and an over-reliance on external funding support, which often exposes to the country to uncertainties in future resources..

Recognizing the challenges, and consistent with recommendations of the World Health Organization, the government of Liberia has, in principle, adopted integrated vector management (IVM) as a national strategic approach for malaria control. This national IVM Policy and Strategic Plan, is proposed to promote and guide national transition. IVM will focus on strengthening and reorganizing the existing vector control services, and developing critical competencies/skills, to ensure that all national assets are mobilized appropriately and at all levels, for joint action by all stakeholders.

This policy and strategic plan will enable more cost-effective, ecologically sound and sustainable vector control interventions to speed up control of malaria and other vector borne diseases. The Ministry of Health and Social Welfare fully supports this Strategic Plan and I am

confident that IVM implementation will continue to receive support governmental support, as well as from stakeholders, development partners and the communities.

Honorable Minister of Health and Social Welfare

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Acronyms and Abbreviations

AIDS	acquired immunodeficiency syndrome
CAMA	Corporate Alliance for Malaria in Africa
CDC	US Centers for Disease Control
CHWs	Community health workers
ELISA	Enzyme-linked immunosorbent assay
EUVT	End Use Verification Tool
FAO	The Food and Agriculture Organization of the United Nations
GEF	Global Environmental Facility
GFATM	Global Fund for HIV/AIDs, TB and Malaria
HMIS	Health Management Information Systems
IEC/BCC	Information, Education and Communication/Behavioral Change Communication
IRS	Indoor Residual Spraying
IVM	Integrated Vector management
LIBR	Liberia Institute for Biomedical Research
LLIN	Long lasting insecticide treated nets
MOA	Ministry of Agriculture
M&E	Monitoring and Evaluation
MOE	Ministry of Environment
MOH&SW	Ministry of Health and Social Welfare and Social Welfare
MPR	Malaria Programme Review
NGO	Non-Governmental Organization
NISC	National Inter-sectoral Steering Committee
NMCP	National Malaria Control Program
NMIMR	Noguchi Memorial Institute of Medical Research, Ghana
PCR	Polymerase chain reaction
PMI	US President Malaria Initiative
RBM	Roll Back Malaria
RDT	Rapid diagnostic test
RTI	Research Triangle Institute
UNEP	United Nations Environment Programme
UoL	University of Liberia
USAID	United States Aid for International Development
VBD	Vector Borne Disease
VCNA	Vector control needs assessment
WHO	World Health Organization
WHOPES	World Health Organization Pesticide Evaluation Schemes

Target and Purpose of this Document

This document targets all the stakeholders of vector borne disease control in Liberia in both the public and private sectors; It includes policy makers who set national disease control agenda; technocrats who routinely translate policies into strategies and programs; managers and implementers of vector control programs; stakeholders whose actions or inactions could aggravate or reduce the local transmission of vector borne diseases; as well as local communities at risk of malaria and who are the target of control efforts. This document is also targeted at development partners of Liberia, including donor communities and technical partners.

This policy and strategic document is intended to guide national transition to IVM. It should guide the development of detailed and costed work plans on IVM, which among others should:

- (i) Enable coordinated national action towards ecologically sound, cost-effective and sustainable vector control implementation in Liberia.
- (ii) Enable forward planning by government on the allocation of national resources.
- (iii) Provide enhanced context for collaboration and support by Liberia's developmental partners in national VBD control. The development of overarching plans will enable the Ministry of Health and Social Welfare will enable

Structure of this Document

There are three sections in this document.

Section 1 presents a situational analysis and justification for the need for IVM implementation in Liberia. The major needs for vector control needs are summarized, as well as opportunities to improve national efforts.

Section 2 presents Policy guidelines for creating an enabling environment for IVM implementation. Various policy instruments are proposed for implementing the IVM policy.

Section 3 proposes a National IVM strategy based on the IVM Policy outlined in Section 2. Modalities for mobilizing all relevant national resources for an ecologically sound, cost-effective and sustainable management of the local vector of vector-borne diseases, particularly Malaria are proposed.

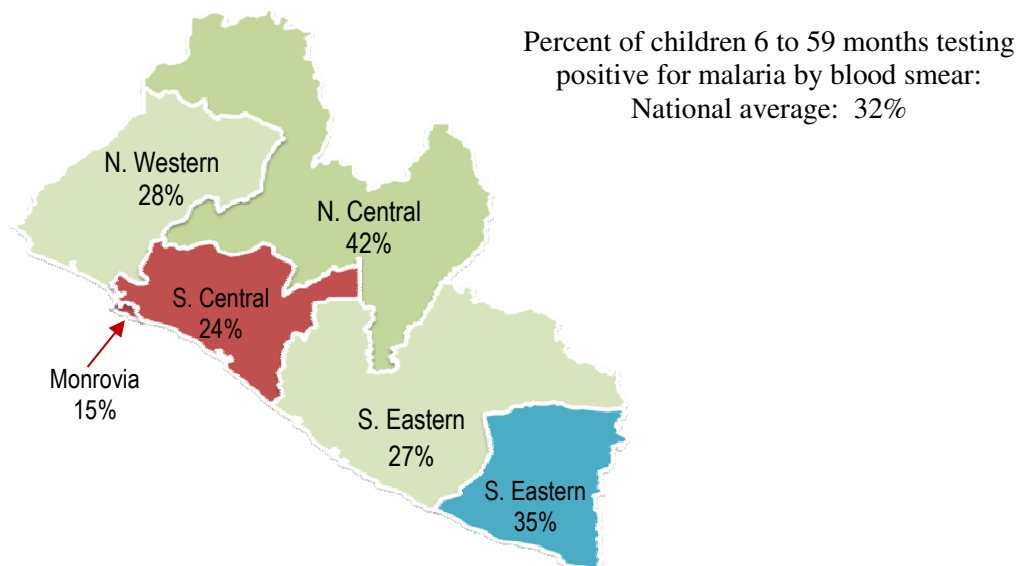
SECTION 1: SITUATIONAL ANALYSIS ON VECTOR CONTROL

1.1 Summary of Vector Borne Diseases Liberia

There are several vector borne diseases (VBDs) in Liberia, although, apart from malaria, knowledge of the burden of the other VBDs is less known:

Malaria is hyper-holoendemic, perennial, and prevalent throughout Liberia with the entire population at risk. The prevalence of malaria is higher among rural communities. A 2009 Malaria Indicator Survey¹ showed that the average national malaria prevalence is 32% in children under five years. This is almost a 50% reduction compared to prevalence of 66% in 2005.² Prevalence is generally higher in the rural areas (38%) than in the urban areas (21%). A 2009 Health Facilities Survey indicates approximately 6.6 million episodes of malaria across all age groups. Malaria is responsible for 34.6% of outpatient visits and 33% of in-patient deaths. More than 90% of reported malaria cases are caused by *Plasmodium falciparum*, the most deadly species of malaria parasite. The primary vectors are *Anopheles gambiaes.s.*, *An. funestus*, and *An. melas*.

Fig 3: Prevalence of Malaria in Children in Liberia by Region (NMCP 2011)



¹ 2009 Liberia Malaria Indicator Survey

² 2005 Liberia Malaria Indicator Survey

At the time of development of this strategy, the 2011 indicator survey has not been official validated and thus could not be authoritatively included. However, early indications show further improvement in control of malaria in Liberia.

The other vector borne diseases reported to be present in the country are not well studied and their distribution and prevalence not well understood. These include:

Lymphatic filariasis, another mosquito-borne disease, is present in Liberia. A 2010 Immuno-Chromatic Test (ICT) survey revealed that the disease is prevalent in 13 out of 15 counties. A detailed base line survey is scheduled for 2012, which will provide more insight into the burden and distribution of the disease. There are plans for a community-based mass drug administration intervention, which will be integrated with on-going onchocerciasis treatment with Mectizan and Albendazole.

Dengue hemorrhagic fever has not to date been reported in Liberia. However, the risk exists as the vector *Aedes aegypti* mosquitoes are present in the country.

Schistosomiasis is prevalent in Liberia in rivers and swamps where vector snails are abundant. This is also a chronic debilitating disease that affects the intestinal organs and urinary tract. Children are the most vulnerable because of their behavioral activities near water bodies that harbor the vector snails. A 2007/8 study indicated prevalence of about 2.7% among children. There was however substantial variability in prevalence with counties and amongst schools; some schools located near lakes and swamps had prevalence above 30% (GOR Report, 2008).

A rapid epidemiological mapping of onchocerciasis in 1999 indicated the disease as prevalent in 14 out of 15 counties, with about 1.1 million persons at risk. Currently, a Community-Directed Treatment Strategy is involving an annual MDA of Ivermectin

The major interventions currently used for malaria control (LLINs and IRS) have the potential to impact other VBDs such as lymphatic filariasis. Investment in infrastructure and related health system strengthening linked to malaria control, could also provide synergistic support to the control of those other VBDs. Therefore IVM, with its focus on enhancing integrated and multi-disease approaches, presents an exceptional opportunity to mobilize joint stakeholder efforts to improve overall efficiencies in the utilization of resources for diseases control.

1.2 Achievements in Malaria Control

Liberia's health system was severely undermined by the long civil war and is still fragile, with a significant part of its physical infrastructure damaged and facing a shortage of health workers. Since the cessation of the unrest, there have been very credible efforts to rebuild the country health system, expanding access and improving quality of services. For malaria control, actions taken by government include:

Enhancing malaria diagnosis and case management: The majority of health facilities now use Rapid Diagnostic Tests (RDTs). Microscopic diagnosis of malaria is however limited to hospital, health centers and a few clinics. Refresher training and accreditation of laboratory technicians in microscopy and laboratory supervision was initiated in 2011, as part of efforts to address the low diagnostic capacity. In addition, the National Public Health Reference Laboratory is being strengthened with laboratory supplies and equipment for malaria diagnosis. Access to health services is gradually improving, although currently only 46% of the total population has access to these services. There was a 5% increase in the proportion of children under five receiving prompt and effective treatment for malaria within 24hrs from the onset of fever - rising from 12% in 2005 to 17% in 2009. Similarly, the percentage of women receiving two or more Intermittent Preventive Treatment in Pregnancy, during their most recent pregnancy, rose from 35% in 2005 to 45% in 2009. The Government of Liberia, with the collaboration of developmental partners, is training health workers, general community health volunteers (GCHVs), traditional birth attendants, and students in pre-service institutions, on various critical areas to improve malaria case management. The MOH&SW is implementing a strategy to strengthen the overall national pharmaceutical systems, including an integrated community case management of malaria to rationalize the use of malaria medicines, as well as facilitate increased population access to subsidized ACTs through the private sector.

a. Enhanced vector control and prevention:

- (i) The national malaria strategic plan for 2010-2015, has a distribution target, under its universal coverage policy, of one LLIN for each sleeping place or three bed-nets per

household³, and the utilization level among the whole population, particularly pregnant women and children under five years, is targeted at 85%. With an estimated 670,295 households in the country, about 1.713 million insecticidal nets were distributed between 2010 and December 2011, via door-to-door campaigns using a network of local NGOs, and through antenatal clinics. This enabled the distribution target to be achieved in the first half of 2012. This compares with a low figure of 29% of households that had at least one ITN in 2005. In collaboration with developmental partners, Liberia continues to strengthen the management of LLIN implementation – emphasizing improvement in logistics, forecasting, storage, distribution, training, and associated behavior change and communication for improved LLIN utilization. A national LLIN strategy is being developed to provide a robust framework for implementation going forward.

- (ii) An indoor residual spray (IRS) campaign began in 2009 with the support of the US President's Malaria Initiative (PMI). Coverage increased from 22,000 houses in three counties to cover 8 counties and a population of about 420,532 people (12% of country's population) in 2010, to 80,000 houses protecting 500,000 people in 2011. The 2010-2015 National Malaria Strategic Plan indicates the objective of increasing the use of IRS in rural areas and to cover approximately 50% of the entire population, covering 85% of households in the target areas. This will require considerable investments. With the support of developmental partners the NMCP has drafted a national strategy on IRS meant to guide national preparation, including subsequent development of specific implementation work plans.
- (iii) There have also been efforts to develop national capacity for entomological surveillance and monitoring. This includes training over 45 persons from the counties in basic entomological surveillance techniques; partnership plans between NMCP and LIBR for entomological and epidemiological surveillance and monitoring, including the establishment of a central insectary and entomology laboratory. Modalities are being developed to ensure that the excellent capacities of the research outfit are harnessed to assist routine monitoring and operational research priorities in vector control.

³³ An average household is estimated to have 5 persons (2009 Census)

- b. *Strengthening public education efforts on malaria control:* There has been an aggressive investment in strengthening national capacity for well-designed and targeted IEC/BCC tools and messages on malaria prevention and control. Materials are widely disseminated through multiple channels, including community health workers, local NGOs and the mass media.
- c. *Strengthening monitoring and evaluation of malaria control:* Liberia has developed a monitoring and evaluation strategy to enable proper assessment of the impact of malaria control activities. This strategy is being implemented within the ambit of the Global Fund Round 10 Grant and includes assessment of LLIN campaigns and enhanced supervision of MOH&SW and NMCP on country level activities through the use of End Use Verification (EUV) tools. With FY 2012 funds PMI will support the DHS 2012-2013 to include parasitemia, continue quarterly End Use Verification and provide supportive supervision by NMCP to health county teams.

There is an exceptionally strong government support for malaria control. The President of Liberia is the current Chair of the African Leaders Malaria Alliance (ALMA) and has demonstrated nonnegotiable commitment to reducing the scourge of malaria in the country.

1.3 Addressing the Challenges to Vector Control

Liberia is rebuilding its health systems that were mostly dismantled during the prolonged civil war. In spite of the gains mentioned under Section 1.2, there are very significant challenges to vector control. There is a need for a national framework that is geared at a systematic strengthening of the range of capacities and competencies required for evidence-based and cost-effective vector control. Table 1 provides a summary of some main constraints and opportunities for effective vector control in Liberia. Among the primary vector control needs are - a harmonized policy environment to more effectively control the local vectors of VBDs; institutional mechanisms for intersectoral action; establishment of national capacity (human and infrastructure) to generate, manage and utilize relevant local data for vector control; enforcement of health and environment impact mitigation in natural resources development (e.g. water, agriculture, housing) to prevent proliferation of disease vectors; empowerment of communities and stakeholders for sustainable community-based strategies.

The following sections propose guidance for national transition and implementation of IVM in Liberia: Section 2 proposes guidance for an IVM Policy, while Section 3 outlines the strategy to translate the policy into actionable agenda. This document should undergo periodic review and update, to stay relevant to evolving country's needs for effective control and prevention of VBDs in Liberia, particularly malaria.

Table 1: Major challenges & opportunities foreffective vector control in Liberia

AREA AND MAJOR CONSTRAINTS	OPPORTUNITIES FOR IMPROVEMENT
Policy Environment	
<ul style="list-style-type: none"> • <i>Absence of a harmonized and overarching vector control policy</i> • <i>Absence of a functional intersectoralmechanism for regular review of the effectiveness/impact ofvector policies.</i> • <i>Inadequate translation of strategies into work plans on vector borne diseases (VBDs), particularly outside of malaria.</i> 	<ul style="list-style-type: none"> • <i>Existence of policies that can be enhanced and adapted into an overarching integrated national VBD policy: national health policy, discrete policies for various VBDs, guidelines for Malaria vector control, legislation and regulation of pesticides, current vector control programs, environmental impact assessment policies</i> • <i>Drafting of a National IVM Policy and strategy to provide additional basis for enhancing national policy on IVM</i> • <i>National Intersectoral Steering Committee (NISC) to establish policy review mechanisms to ensure ongoing adequacy of policy environment for effective vector control</i>
Institutional Arrangements	
<ul style="list-style-type: none"> • <i>Absence of either a unified vector control department or coordinated system of Units within VBD programs in MOH&SW for harmonize and cross-cutting joint efforts;</i> • <i>Absence of mandatedmechanism inter-sectoral action on vector control;</i> • <i>Need to further harness the full potential of communities for vector borne diseases control</i> 	<ul style="list-style-type: none"> • <i>Implementation of National IVM strategy provide opportunity to establish framework f or intersectoral action at all levels:</i> • <i>NISC established in February 2012 to foster collaboration</i> • <i>NMCP and NTD programs explore opportunities for synergies b/n malaria and lymphatic filariasis control</i> • <i>NSIC to be reflected within the counties to facilitate stakeholder coordination/ collaboration</i>
Tools, technologies and logistics of intervention	
<ul style="list-style-type: none"> • <i>Less than maximal deployment of malaria vector control tools:</i> <ol style="list-style-type: none"> a. <i>LLINs:</i> b. <i>Absence of effective monitoring of LLIN utilization and field performance</i> c. <i>Lack of clarity of methods for ongoing/routine LLIN replacement outside of traditional facility based distribution</i> d. <i>Significant dependency on external funding for LLIN procurement and associated uncertainties</i> • <i>IRS</i> <ol style="list-style-type: none"> a. <i>Absence of a clarified national strategy on coverage and geographical targeting</i> b. <i>Uncertainties of funding for scaling up coverage to meet national IRS coverage targets</i> c. <i>Limited national capacities within NMCP for IRS implementation and evaluation</i> • <i>Larval Source Management</i> <ol style="list-style-type: none"> a. <i>Absence of a contextualized environmental management strategy including larviciding</i> • <i>Control of other vector Borne Disease control</i> <ol style="list-style-type: none"> a. <i>Absence/inadequate vector control efforts for other VBDs</i> b. <i>Vertical programs with inadequate collaborations</i> 	<ul style="list-style-type: none"> • <i>Existence of national coverage targets for IRS and LLINs</i> <ul style="list-style-type: none"> • <i>LLINs:</i> <ol style="list-style-type: none"> a. <i>Gap analysis in coverage conducted- will facilitate planning &resource mobilization</i> b. <i>Strong partnership with local NGOs enabling scaled up distribution to remote areas.</i> c. <i>Funding and technical support by developmental partners (GF, PMI, UNICEF, RCRS etc.)</i> d. <i>Opportunity to support with LLIN field performance evaluation</i> e. <i>Opportunity to document lessons from ongoing scale up campaigns to develop tailored best practices for Liberia</i> • <i>IRS</i> <ol style="list-style-type: none"> a. <i>Opportunity form existing limited IRS implementation supported by PMI to (i) document best practices (ii) build technical capacity in various competencies of IRS implementation (iii) develop national scale up plans, including proper costing</i> • <i>Larval source management</i> <ol style="list-style-type: none"> a. <i>Opportunity to establish limited community based LSM especially within cities to validate cost effectiveness and generate best practices</i> • <i>Control of other vector Borne Disease control</i> <ol style="list-style-type: none"> a. <i>MOH&SW has initiated efforts, with the support of developmental partners, to address NTDs in the country, beginning with disease mapping in 2012</i>

Table 1 (cont'd): Major challenges & opportunities for effective vector control in Liberia

AREA AND MAIN CONSTRAINTS	OPPORTUNITIES FOR IMPROVEMENT
Entomological surveillance and M&E of vector control	
<ul style="list-style-type: none"> • <i>Inadequate national capacity for eco-epidemiological and entomological assessments to support decision making and evaluate outcomes and impact of vector control</i> <ul style="list-style-type: none"> a. <i>Lack of central insectary and associated entomological laboratory</i> b. <i>Absence of sentinel sites for ongoing</i> c. <i>Inadequate entomological equipment</i> d. <i>Absence of a national entomological surveillance plan</i> e. <i>Inadequate numbers of field entomology technicians</i> f. <i>Limited NMCP entomological capacity</i> g. <i>Need to properly characterized local vectors of malaria and other VBDs and their distribution</i> • <i>Need to proactively prevent and manage the development of resistance to WHOPES approved insecticides in local disease vector populations.</i> <ul style="list-style-type: none"> a. <i>Inadequate information on existing resistance levels</i> b. <i>Absence of in-country capacity for assessment of bio-molecular drivers of resistance</i> c. <i>Absence of a resistance management plan</i> d. <i>Inadequate national capacity for insecticide quality validation</i> • <i>Inadequate capacity for program monitoring and evaluation due to limited staffing of M&E Unit of NMCP</i> • <i>Inadequate clarification of indicators for vector control and M&E strategy</i> 	<ul style="list-style-type: none"> • <i>Ongoing collaboration with developmental partners (PMI/IVM, NAMRU/Noguchi/LSHTM) provide opportunity to further strengthen technical and infrastructural capacities</i> • <i>Relevant assets in existing institutions outside of NMCP (e.g. LIBR, University of Liberia) can be mobilize to support vector control</i> • <i>Establishing insectary at LIBR will enable credible national entomological surveillance</i> • <i>Previously trained staff on standardized entomological methods (2010 & 2011), provide basis to build field surveillance capacity</i> • <i>Establish entomological sentinel stations linked to existing epidemiological sentinel stations</i> • <i>Strengthen staffing and training of M&E unit. Opportunity to mobilize existing competencies in other national institutions to support M&E functions.</i> • <i>Adapt existing WHO guidance on IVM and vector control indicators into a national vector control M&E strategy</i>
Human Resources	
<ul style="list-style-type: none"> • <i>Inadequate clarification of human resource development policy, as well as job functions/description for vector control, particularly within counties</i> • <i>Inadequate human resources and system structures that are critical to integrated vector Management</i> • <i>Inadequate placement of staffing/competencies, especially within the counties</i> 	<ul style="list-style-type: none"> • <i>Very committed NMCP leadership, providing visionary and excellent direction to malaria control efforts.</i> • <i>Existence of vector control unit within NMCP with committed staff that could be further trained to strengthen VC competencies</i> • <i>Existence of CHW within counties whose job functions could be augmented to include IVM functions</i>
Funding	
<ul style="list-style-type: none"> • <i>Limited funding - far below existing needs to scale up vector control to desired coverage levels</i> 	<ul style="list-style-type: none"> • <i>Development of multi-year vector control work plans to augment planning for in-country budgetary allocation</i> • <i>Opportunity to widen scope of funding partnership with</i>

SECTION 2: POLICY GUIDELINE FOR INTEGRATED VECTOR MANAGEMENT

Effective, vector control requires appropriate national policy framework, which, among others, clarifies the objectives of national efforts. The framework will include tools to effectively implement and evaluate the impact of the existing policies.

2.1 Vector Control Policy Scenario in Liberia

The Government of Liberia demonstrates strong political commitment and will to reduce the transmission and burden of vector borne diseases, especially malaria. Liberia is signatory to the Abuja Declaration on Roll Back Malaria (RBM). The president of the republic is currently Chair of the African Leaders Fighting malaria (ALMA), an alliance created by *“African Heads of State and Government to utilize their individual and collective power across country and regional borders” to “end malaria-related deaths”*. In an effort to support access to antimalarial medicines and vector control tools, tariffs and taxes on insecticide treated nets and insecticides have been reduced from 25% to 2.5%.

The national malaria strategic plan (2010- 2015), specifically mentions IVM as the strategic approach to managing the local vectors of malaria in the country. The position denotes clear governmental desire for national transition to IVM implementation, through the creation of appropriate policies and institutional environment.

The Government of Liberia recognizes the need to improve efficiencies within the MOH&SW. As part of preparations for IVM implementation, a National Intersectoral Steering Committee (NISC) was established in February 2012, under the auspices of the MOH&SW, to coordinate stakeholder-action. The NMCP and program on Neglected Tropical Disease control (NTDs) are engaged in ongoing efforts to enhance synergies between malaria and lymphatic filariasis.

2.2 IVM concept and key principles

The World Health Organization (WHO) defines IVM as *“A rational decision making process to maximize the use of resources for vector control”* (WHO 2008), and recommends IVM as the desirable strategy for ecologically sound, cost-effective and sustainable control of VBDs. There are 6 core principles aimed at ensuring that all the factors that are important to the effective and

sustainable management of the local vectors of human diseases, are fully considered. The core principles of IVM are:

- Mobilization of all stakeholders and development of appropriate vector control policies to guide actions
- Effective collaboration within the health sector and with other sectors, with adequate supporting frameworks for functional collaboration by all stakeholders.
- Creation of regulatory and legislative framework for vector control and to safeguard the environment and human health.
- Integrated approach to the use of tools and methods for rational utilization of available resources, through informed selection of non-chemical and chemical vector tools/methods and multi-disease control approaches.
- Evidence-based decision-making: generate and utilize relevant local data on disease eco-epidemiology to support viable strategies and implementation.
- Capacity-building: strengthen critical infrastructure, financial and human resources at all levels for vector control

The National Policy on IVM herein described aims at establishing a robust framework for coordination national efforts and mobilizing appropriate resources to accelerate the achievement of national goals on malaria control and other vector borne diseases.

2.3 Policy Objectives

National preparation for IVM will aim at establishing the following six broad conditions, aligned with the six core principles of IVM. The aim will be to enable a comprehensive implementation of ecologically sound, cost-effective, and sustainable vector control interventions in Liberia. The specific objectives of the National IVM Policy will be to:

1. Embed in the development policies of all relevant sectors, organizations and civil society, policies to prevent or minimize the negative impacts of natural resource development on vector borne diseases.

2. Establish appropriate legislative and regulatory regimes for public health insecticides to promote judicious use, safeguard human health and the environment, and enable effective management of insecticide resistance.
3. Establish an appropriately mandated inter-sectoral coordination mechanism to ensure empowerment and active involvement of all stakeholders, including the private sector, for joint planning, resource mobilization and oversee the implementation of vector control activities.
4. Foster a rational decision making process in the choice, diversification, and deployment of vector control interventions. Efforts will focus on the generation and management of relevant knowledge of the local disease eco-epidemiology, to promote the ecological soundness of interventions, appropriate integration of chemical and non-chemical vector tools/methods and multi-disease control approaches.
5. Establish, at all levels, relevant capacities including essential physical infrastructure, technical human competencies, and empowered communities, for an effective management of malaria and other vector borne diseases.
6. Promote cross-border vector borne disease control initiatives aimed at harmonizing and coordinating interventions across the border areas with neighbouring countries. This will be in line with the goals of the sub-regional cross border health intervention initiative, being pursued by the West African Health Organization (WAHO)

2.4 Policy Framework

To achieve the objectives of the national IVM Policy, a range of policy instruments will be utilized. The policy instruments are listed under Table 2. The focus of these instruments will be on:

- Establishing procedures for appropriate policy changes for IVM implementation. Appropriate communication systems/infrastructure will be developed to target the various stakeholders with relevant information. This will include trained human resources and the expansion of standards and harmonized procedures for developing, storing and utilizing relevant data by stakeholders. Adequate consideration will be given to protecting intellectual property rights linked to the information generated to encourage timely disclosure/sharing of relevant scientific results on vector borne diseases to improve vector control operations. There will be concerted effort to empower

stakeholders and elicit appropriate changes in attitudes and practices to reduce disease transmission risks.

- Measures will be established to promote the development of appropriate technical human resources at various levels (central and county). Career paths and positions will be created to reduce attrition of trained personnel. There will also be policy instruments aimed at strengthening relevant legislative and regulatory enforcement mechanisms for the procurement, sound utilization and appropriate disposal of vector control products.
- Appropriately mandated inter-sectoral mechanisms will be established to encourage collaboration and joint action on vector control by stakeholders. Particularly within the primary public sector stakeholders (e.g. MOH&SW, Environmental Protection Agency, Ministry of Agriculture), performance based review systems will be evolved, as appropriate, to recognize/reward collaboration and to entrench a culture of joint action..
- Another area of focus will be the establishment of relevant infrastructure (e.g. insectaries, laboratories, harmonized protocols, integrated information management systems) to generate local evidence base for decisions making. This will include promoting well-targeted operational research and close collaboration with regional and other external centers of excellence to address knowledge gaps in local eco-epidemiology of malaria transmission and prioritizations of surveillance and monitoring to ascertain the distribution and levels of vector borne diseases, as well as the outcomes and impact of interventions/strategies

Table 2. Enabling policy instruments for IVM implementation

Key element of IVM	Policy objective	Policy instrument
Advocacy, social mobilization	Political and administrative hierarchy involved in advocacy through meetings and mass media campaigns	<ul style="list-style-type: none"> • Government position statement on IVM • Mass media support for IVM • Support IEC/BCC for vector control • Support local and World Malaria Day
	Sector stakeholders and developmental partners empowered to rationalize contribution	<ul style="list-style-type: none"> • Develop level appropriate IEC/BCC and partner opportunities • Develop information sheets clarifying national and program objectives, strategies, lessons achievements/impact and needs
	Communities empowered to participate in vector control	<ul style="list-style-type: none"> • Support community based services through CHWs • Community awareness and education programs through IEC/BCC • Support decentralization in decision making • Provide incentive programs for community participation in vector control
Legislation and regulation	<ul style="list-style-type: none"> • Effective legislation and regulation in place 	<ul style="list-style-type: none"> • Augment and enforce legislation and regulation on pesticide management • Enforce legislation and regulation on environmental management • Enforce compliance with environmental impact assessment in development projects • Encourage subsidies and tax exemptions on vector control products • Develop Best Practices for vector control
Collaboration within the health sector and with other sectors	Intra-sectoral collaboration achieved within the health sector	<ul style="list-style-type: none"> • Ministerial position statement on IVM • Directive on collaboration between health divisions and units • Revise job descriptions
	Inter-sectoral collaboration achieved with other sectors and partners	<ul style="list-style-type: none"> • Government position statement on IVM • MOH&SW facilitate and endorse VCNA report • Establish national inter-sectoral steering committee (NISC) on IVM • Establish a vector control working group (VCWG) • Designate an IVM focal point • Facilitate inter-ministerial meetings • Facilitate institutional arrangements and framework for IVM • Compliance with Health Impact Assessment by sectors • Facilitate cross-border high level planning meetings on vector borne diseases control

Table 2 (cont'd). Enabling policy instruments for IVM implementation

Key element of IVM	Policy objective	Policy instrument
Integrated approach to tools and methods, as well as multi-disease approaches	Efficiency and effectiveness of multiple diseases control achieved	<ul style="list-style-type: none"> • Directive on joint planning and implementation of vector control within and outside the health sector • Performance based recognition/reward for collaboration • Allocation of resources for M&E
	Generate local evidence on cost-effectiveness and added impact of IRS in the context of universal coverage with LLINs	<ul style="list-style-type: none"> • Allocation and strategic direction for operation research on country-specific programmatic issues • Encourage networking with local and international research organizations • support reporting, documenting and publication of findings/lessons
	Encourage appropriate larval source management at the community level - and recognize settings where it is not appropriate	<ul style="list-style-type: none"> • Evaluation of full utility of larval source management to control breeding of mosquito vectors • Community based/involvement in larviciding and environmental management • Community education on vector control
Evidence-based decision making	Efficient epidemiologic and entomologic surveillance undertaken	<ul style="list-style-type: none"> • Allocation of resources for strong surveillance systems through sentinel sites • Support laboratory services for entomological monitoring • Support decentralized decision making • Strengthen data management system (integrate into HMIS) and reporting for decision making • Allocation of resources for strategic direction on operation research on vector control • Allocation of resources for M&E on impact of vector control on disease transmission
Capacity building	Ensure a critical mass of vector control specialists at national and county levels	<ul style="list-style-type: none"> • Allocation for human capacity building and career paths • Allocation for IVM training curriculum at all levels • Promote decentralized decision making on appropriate vector control interventions at county level • Revisit job descriptions to include vector control
	Strengthen infrastructure capacity for epidemiological and entomological surveillance	<ul style="list-style-type: none"> • Allocation of resources for infrastructure development • Re-organize and appropriately staff the NMCP to address other VBDs • Support exchange and sharing of human and infrastructure resources between sectors • Facilitate inter-sectoral budgeting for IVM

2.5 Policy Implementation Plan

The policy instruments and expectations outlined above are prioritized and divided into categories of expected activities and related outputs in Table 3. The activities will be implemented to achieve the set objectives.

Table 3. Expected outputs and indicators on policy implementation

Expected outputs	Activities	Time frame	Indicators	Responsibility
1. Advocacy -High level political, administrative and scientific campaigns for IVM achieved	Engage policy makers, civil society and media in IVM advocacy: conduct stakeholders validation of IVM strategy	July 2012	IVM Strategic Plan adopted by stakeholders	MOH&SW, Stakeholders, Media
	Resource mobilization	Continuous	Funds available for vector control	Ministry of Health and Social Welfare, other sectors and partners
	Develop IVM training curriculum for basic and mid-level personnel drawn from all relevant sectors	Sept-Dec 2012	IVM training modules available for Trainers of Trainers	NMCP, Stakeholders
2. Capacity building - National and county capacities for IVM built and strengthened	Develop career path and incentives for IVM personnel	Continuous	Critical mass of expertise in entomology, epidemiology, vector control appropriately developed at all levels	NMCP, Main stakeholders
	Clarify job functions/descriptions at various levels			
	Strengthen infrastructure for public health entomology	June 2012 - Sept 2012	Fully functional entomology laboratory	NMCP
	Enhance community awareness and education programs	Continuous	Number of farmers and communities actively engaged in vector control	CHWs, farmers, Local leadership, NGOs, Civil societies
3. Community empowerment- Communities involvement in personal protection and vector control strengthened	Encourage decentralized decision making in vector control	Continuous	Develop plans detailing decision making responsibilities at various level	NMCP, Health facilities, County Health Teams
	Prescribe incentives for participation in vector control	Continuous	Performance based appraisals	All sectors

Expected outputs	Activities	Time frame	Indicators	Responsibility
4. Collaboration between the health ministry and other sectors achieved	Establish a national inter-sectoral steering committee (NISC) for IVM	February 2012	Inter-sectorial meetings	Ministry of Health and Social Welfare, NMCP, sectors
	MOH&SW issues a position statement on IVM	August 2012	An IVM position paper available	Relevant sectors
	MOH&SW issues directive for all relevant department and units within the Ministry to collaborate	August 2012	Shared resources	Ministry of Health and Social Welfare, NMCP
	Allow institutional arrangements towards IVM	August 2012	Policy adjustments towards vector control	All sectors
	Hold inter-ministerial meetings on VBDS control	Bi-annual	Approved joint work plans for vector control	All sectors
	Initiate cross-border collaboration	Annual	Joint work plans for vector control	WAHO; ECOWAS health ministers meetings
5. Evidence-based decision making - Vector control interventions	Facilitate entomological and epidemiological surveillance	Continuous	Data available, utilized and published	NMCP, CHTs; and research organizations; partners
	Support staff to undertake operational research on programmatic issues of vector control	Continuous	Number of projects that generate new evidence for decision making	NISC, VCWG, NMCP, Universities and research organizations
6. Integrated approach- Combinations of vector control interventions undertaken	Conduct operational research on efficiency and cost-effectiveness of chemical and non-chemical methods of vector control	Continuous	Best Practices for vector control adopted	NMCP, Universities, Research organizations
7. Enforce legislation and regulations for vector control	Ensure sectors and development partners undertake Environmental Impact Assessment before development projects are commissioned to mitigate vectors proliferation	Continuous	Environmental Impact Assessment	All sectors and development partners, EPA, MOH&SW (DEOH; NMCP); MOA
	Ensure compliance with legislation and regulation on pesticide use and management	Continuous	Insecticide resistance management strategy	MOH&SW; MoA; EPA, etc.
	Ensure compliance with legislation and regulation on environmental management	Continuous	Environmental Impact Assessment	EPA; MOH&SW (DEOH & NMCP)
	Tax exemptions for vector control products for public sector and non-profit making initiatives	Continuous	Tax relief on pesticides and personal protection equipment	Ministry of Finance, National Legislature

SECTION 3: STRATEGIES FOR INTEGRATED VECTOR MANAGEMENT

Section 3 describes the broad strategies that will be implemented to achieve the IVM objectives listed under Section 2.3. Procedures that will be used are outlined for the policy instruments that are associated with the objectives as described in Section 2.4 (Table 2). This IVM strategy is intended to provide boundaries/end-goals to inform subsequent elaboration of detailed and costed work plans (annual or bi-annual and over the life of the 5-year strategy), and enable milestones to measure progress made in national transition to IVM.

3.1 Advocacy and Social Mobilization for IVM

A core principle of IVM is effective stakeholder participation; all stakeholders will be empowered with appropriate information to facilitate informed decisions and effective participation. The NMCP will coordinate the advocacy and communication (A/C) efforts on IVM, under the guidance of the mandated NISC and in consultation with the major primary stakeholders [e.g. MoE, EPA and the relevant departments and programs within MOH&SW, such as the National Health Promotion Division]. There will be advocacy and communication targeting various stakeholder groupings, which will be tailored appropriately to suit the roles and responsibilities the groups will have in the partnership endeavors:

- Policy makers: In spite of the noted commitment of central government for IVM, it is important that A/C continue to sustain an enabling national environment implementation over the years. A/C to this group will aim at informing on the successes/benefits, experiences/lessons, and requirements/needs for IVM. Projecting funding requirements elaborated through the IVM-work plans will guide forward planning and in-country resource allocation.
- Technical staff implementing intervention: These will target all levels - central, county and community. The A/C will have level appropriate technical and non-technical information to promote sound decision-making at the various program administration levels.
- Communities and general public: A/C to this group will aim at empowering and eliciting proactive participation in IVM activities. A/C will normally be in local dialects and conducted through various public media, group meetings and direct personal communication by implementing stakeholders. A/C will include information on IVM, the interventions

implemented; the roles and responsibility to the target group, including clarifying compliance issues for communities and households.

- Other stakeholders (e.g. private sector): A/C shall solicit participation and contribution (technical, financial, materials and supplies, etc.) to the IVM implementation, either at national level or usually to promote workplace and social corporate responsibility contribution in the business catchment areas.
- Donors and developmental partners: A/C efforts will aim to inform and promote effective resource mobilization and technical cooperation. Advocacy will normally cover the goals, priorities and work plans, intervention and methods utilized, progress on IVM implementation, contributory outcomes/impact as appropriate and feasible, as well as gaps in funding and other resources.

Major Action Points:

- The NISC to provide overall guidance to all aspects of IVM implementation.
- The NMCP to provide day-to-day leadership to A/C efforts, with close consultation and input from relevant stakeholders, especially those with noted IEC/BCC expertise. Every possible effort will be made to solicit and sustain the involvement of mass media.
- The NMCP will work with partners to integrate appropriate BCC/IEC in their vector control interventions.
- The following will be targeted to assist with empowering communities for IVM: mosques, churches, community health workers, rice farmers, brick makers, local authorities, schools, and local environmental committees.
- The NMCP and all stakeholders will participate in mobilization of human and financial resources towards advocacy for vector control.

Indicators:

- Advocacy meetings on IVM at the national and county level in place.
- Advocacy materials for IVM produced targeting various stakeholder groupings
- Number of targeted stakeholders that have allocated resources for vector control.
- Number of targeted communities/administrative areas that have received advocacy information on IVM.
- Number of targeted communities mobilized and engaged in vector control.

3.2 Legislation and Regulation for IVM

An appropriate legislative and regulatory environment is important for effective national scale-up of vector control. The objective of such legislation and regulation (L&R) are two-fold:

L&R may aim to prevent or mitigate negative impacts from human activities on local disease transmission. Human activities such as irrigated agriculture, dams, sand weaning, road construction and other building projects may inadvertently create significant breeding habitats that can alter the local transmission of vector borne diseases. Currently there are regulations in Liberia stipulating the conduct of an environmental impact assessment prior to any major developmental project. Opportunities to further strengthen these regulations by ensuring adequate consideration of health impacts and inclusion of safeguards against diseases will be fully explored.

The second broad aim of L&R in vector control is to protect the environment and human health against potential adverse effects from improper handling and non-recommended use of public health insecticides. Effective management of public health insecticides is a basic requirement for deploying any insecticide-based intervention. Public health insecticides will be fully regulated to protect human health and the environment. Comprehensive assessment of the adequacy of existing national legislation and regulations covering the use of public health insecticides will be made and appropriately strengthened and enforced. Existing procedures for registering, licensing and importation of WHOPES approved insecticides for IRS, larviciding and other vector control products will be reviewed periodically and updated. Criteria for approving local vendors of public health insecticides will include capacity of the vendor to communicate appropriate information on the handling, safe use and disposal of their insecticide products.

The widespread use of an insecticide for vector control will be preceded by a detailed risk assessment of the potential risks to human health and the environment, peculiarities of the intended ecological zone or operational area, and the verifiable implementation of safeguards. This will be to ensure compliance with the national regulations on public health insecticides, as well as relevant recommendations of the WHO and FAO. The selection of specific public health insecticides for broadcast use in any vector control intervention (e.g. IRS, larviciding) will provide clear rationale for the selection including adequate consideration of impact on pre-existing tolerance/resistance in vector populations in targeted areas and potential handling risks.

There will be appropriate educational, advisory, extension and health-care services linked to use of insecticides for vector control. The following will be specifically addressed:

- a. Relevant pesticide management laws, regulations and institutional arrangements will be regularly reviewed and updated to provide adequate protection of human health and the environment in vector control operations. The MOH&SW and partners will establish a framework, involving the police and other relevant agencies, for national enforcement of regulations on public health insecticides. Penalties for breaking laws regulating the use of insecticides will be clarified and broadcasted, and access to public health insecticides will, at all times, be restricted to authorized persons/outfits.
- b. Selected insecticides for vector control will be procured with the full involvement and consent of NMCP and EPA, from internationally recognized/ certified manufacturers and/or their certified and authorized local agents. There will be verifiable chain of custody within country, and country capacity for assuring the quality of procured insecticides will be enhanced in collaboration with advanced laboratories.
- c. All categories of insecticide handlers, particularly spray operators and drivers, will be appropriately trained and certified on Best Practices covering the whole insecticide life cycle – including storage, transportation, end-use and disposal. All spray operators must be certified based on completion of stipulated training or periodic refresher training. Insecticide handlers (transporters, store keepers, spray operators, etc) will use approved personal protective equipment (PPE) at all times during the handling of insecticides.
- d. Harmonized pesticide storage and inventory practices will be established and informed by national regulations and relevant recommendations of WHO and FAO. There will be a certification scheme for all insecticide application equipment.
- e. The broadcast use of insecticides in vector control (e.g. IRS, larviciding) will involve trained environmental compliance inspections as an integral part of programming to monitor field operations and promptly correct anomalies.
- f. Health facilities in the target areas will be selected and equipped as reference points for insecticide poisoning.

3.3 Collaborative Arrangements for IVM

The factors determining local transmission of VBDs usually go beyond the purview of the health sector – cutting across several sectors. This means cross-sectoral action is necessary to fully and adequately address the full range of drivers of local disease burdens. A NISC was established in February 2012, under the leadership of the NMCP to promote a multi-sectoral approach to vector control, ensuring that non-health sectors such as agriculture and environment play proactive roles to fully address disease transmission. Collaboration between the health and agriculture sectors is also critical to judicious end-use of pesticide to protect human health and the environment, and effectively manage insecticide resistance among local disease vector populations.

The NISC will provide appropriate oversight and guidance to the IVM process. Two levels of coordination are necessary for successful implementation:

- (i) Collaboration within the health sector – in this case between relevant department and programs of MOH&SW such as Environmental & Occupational Health, Community Health; Epidemiology; Neglected Tropical Diseases and National Health Promotion Division.
- (ii) Inter-sectoral collaboration between sectors (e.g. Agriculture, Environment, Infrastructure) and other national stakeholders (communities, private sector and other non-governmental groupings, etc). A stakeholder meeting in February 2011, as part of the IVM strategy development process, brought together potential collaborators who expressed interest in participating in vector control as outlined in Table 4. A formal NISC was inaugurated in February 2012 to provide national coordination – advising and guiding the NMCP and other participating partners on IVM process. Sectoral/stakeholder functions and roles will be clarified to foster transparency and accountability in the collaboration

Functions of the National Inter-sectoral Steering Committee (NISC)

The mandate of the NISC will include the following:

- i. Review national policies relevant to vector borne diseases control and develop a unified overarching national policy and strategies for their control.
- ii. Coordinate and provide oversight to the implementation of national IVM strategy and work plans, ensuring cost-effectiveness, efficiencies and sharing of lessons/experiences.

- iii. Coordinate the mobilization of resources for inter-sectoral action consistent with national aspirations for VBDs control ensuring transparency and accountability
- iv. Facilitate rationalized roles and responsibilities among stakeholders and evolve mechanisms to promote/ ensure accountability.

Table 4. Potential Stakeholders and anticipated roles in vector control

Sector/Department	Roles in vector control
<i>Ministry of Health and Social Welfare</i>	<i>Provide leadership on IVM policy and strategy, and disease information, tools procurement, intervention implementation, impact assessment</i>
<i>Ministry of Agriculture</i>	<i>Advise farmers on best practices for rice cultivation and pesticide use</i>
<i>Ministry of Public Works</i>	<i>Ensure compliance in housing, roads, dams and other infrastructure; ensure public health sanitation; promote and advocate vector control mitigation in develop</i>
<i>Ministry of Lands, Mines and Energy</i>	<i>Ensure compliance and conservation in resources development; gather climate data for forecasting and prediction</i>
<i>Ministry of Education</i>	<i>Create awareness on vector borne diseases control</i>
<i>Ministry of Planning and Economic Affairs</i>	<i>Ensure financial sustainability towards vector control</i>
<i>Division of Environmental and Occupational Health</i>	<i>Environmental compliance and vector control and monitoring in communities; water and sanitation</i>
<i>Ministry of Finance</i>	<i>Implement tax exemption and tariffs on public health products including mosquito nets</i>
<i>Environmental Protection Agency</i>	<i>Ensure environmental and pesticide policies are followed. Ensure compliance with international standards on various insecticide products, sound disposal; promote and advocate vector control mitigation in develop through environmental health impact assessments</i>
<i>NGOs: USAID/PMI, WHO, FAO, UNEP/GEF, GFTAM</i>	<i>Technical and financial support for vector control</i>
<i>Private sector: Plantations and Agricultural concessions</i>	<i>Collaboration and support for vector control</i>
<i>Research and Training institutions (e.g. LIBR, LICARE, UL-PIRE)</i>	<i>Operational research and training in vector control</i>
<i>Local NGOs: farmer-Cooperatives, civil societies</i>	<i>Promote end use compliance of insecticide and environmental management best practices among targeted communities</i>

- v. Undertake regular review of the implications of policies, strategies and work plans on VBDs and make recommendations to government and appropriate authorities to enhance the achievements of national objectives on vector control.

- vi. As may be required, establish working groups drawing upon national and international expertise to address priority issues of concern through operational research or surveys.
- vii. Create opportunities for generating broad-based national consensus on issues and ensure that the genuine concerns of at-risk populations and communities are adequately considered.

The NISC will strive to balance sectoral/partner expectations with the broader national VBDs goals and ensure that all VBDs risks are given appropriate consideration. It will also have the responsibility of ensuring that individual partner agendas fit and are integrated into the overall national strategic objective. Roles and responsibilities of stakeholders will be established to facilitate collaboration (Table 5). The inter-sectoral arrangements at the national level will be reflected within the counties to enable effective joint action on vector control at all levels.

Table 5: Potential functions and roles for inter-sectoral action in health

<p>Health Sector Functions</p> <ul style="list-style-type: none"> • Periodic eco-epidemiologic evaluation & surveillance, • Document and disseminate lessons • Update priority R&D needs and agenda • Establish and update institutional and operational frameworks • Harmonize relevant sectoral policies and legislation • Evaluate policy, institutional and operational framework • Identify sector-specific vector control measures, quality control of activities and monitor compliance • Capacity building
<p>Functions of Other Sectors</p> <ul style="list-style-type: none"> • Include health criteria in sectoral operational frameworks and procedures • Undertake health impact assessment for new development projects and ensure the implementation of mitigation measures proposed for potential negative health impact • Implement vector control measures in line with sectoral mandates • Participate in joint activities of an integrated nature • Inform health sector on new technical and project developments

The NISC will absorb existing committees on major interventions, such as the IRS Task Force and LLIN Coordination committee, as substantive subcommittees. The NISC will also pool relevant stakeholders into *ad hoc* subcommittees around focal issues to support IVM implementation. The areas may include entomology, epidemiology, environmental management,

and program management. Specialists in these adhoc sub-committees will work under the day-to-day leadership of the NMCP to complete assignments. They will advise on the management of VBD programs; make recommendations to enhance national policy for VBDs; provide technical support to the organization, monitoring and evaluation of national programs; and support training of intermediate level staff and conducting priority research on VBDs. At the national level the NMCP, will provide overall strategic and technical guidance to county level planning, implementation, monitoring and evaluation of the IVM strategy, ensuring a multidisciplinary, multi-disease approaches and proactive inter-sectoral action.

Major Action Points for inter-sectoral collaboration

- The MOH&SW to lead the development of a formal mandate, terms of reference and commissioning of an NISC to oversee the national implementation of IVM.
- The MOH&SW shall appoint a senior level staff for the NISC and identify major stakeholders to invite as members. Each member-sector and organization of the NISC shall appoint a senior staff representative.
- The NISC will oversee collaboration between stakeholders on control of malaria and other vector borne diseases and evolve criteria for recognizing stakeholders who excel in collaborative efforts
- The MOH&SW will promote adequate consultations on the national IVM Policy by all stakeholders.
- The NMCP will recruit at least two senior entomologists to incorporate capacity into the NISC to address other vectors apart from malaria vectors. As needed, entomologists in other sectors will also be mobilized to support specific vector control efforts.
- The NMCP will facilitate development of county work plans for IVM.

Indicators:

- National IVM Policy and Strategy in place.
- The NMCP fully functional and addressing all VBDs in the country.
- Number of institutions and stakeholders that participate in vector control activities.
- Fully functional NISC.
- Number of counties that have annual work plans for IVM.

Major Action Points for NISC

- The MOH&SW and NMCP will identify stakeholders and potential partners within and outside the health sector and agree with partners on anticipated roles in vector control.
- The partners and stakeholders will designate senior staff representation to the NISC. The representative should be senior enough to make decisions on behalf of their respective institutions and ensure partner commitment and implementation of NISC decisions.
- The NMCP and NISC will establish a vector control working group (VCWG) to monitor IVM implementation, follow-up of actions and report back to NMCP and NISC.
- The NISC will designate an IVM focal point for day-to-day operations on IVM. The focal point will be staff of NMCP.
- The MOH&SW and NISC will organize regular formal and informal consultation meetings with all key stakeholders to discuss relevant issues, provide feedbacks, strategic orientation, technical support and resource mobilization for vector control.
- The NISC will identify and build the necessary technical capacity of the partner sectors to ensure participation and sustainability of desired actions within those sectors.
- The MOH&SW and NISC will facilitate cross-border collaboration for disease surveillance and control.

Indicators

- A technical vector control working group (VCWG) in place.
- A national IVM focal point in place.
- Number of joint planning sessions held with communities, MOH&SW and other stakeholders.
- Number of target subjects of training identified amongst collaborators.
- Number of non-health sectors contributing resources towards vector control.
- Number of senior level meetings held with neighbouring countries for joint planning and implementation of vector control across the borders.

3.4 Vector Control Methods

Interventions used for malaria control may have an added impact on other vector borne diseases present in the country (e.g. filariasis). Table 6 below summarizes the different interventions targeting vectors and the diseases they cause. Some interventions may impact

vectors of more than one disease – either because both diseases have the same vector, or that the different vectors have similar behaviours (feeding and/or resting) which can be exploited by an intervention (e.g. LLINs or IRS targeting indoor feeding and indoor resting mosquitoes). A multi-disease approach to disease control is therefore advisable, where such diseases co-exist in the same geographical area. This will mean, for example, that the separate (vertical) disease control programs conduct joint planning and implementation to enhance synergies and maximize the use of resource in order to gain the maximal impact on the local disease transmission..

Table 6. Vector control interventions and diseasesgenerally target

Type	Interventions	Target vectors	Diseases normally targeted.
Chemical	LLINs	Mosquitoes, bedbugs, lice	Malaria, filariasis, typhus
	IRS	Mosquitoes, fleas, cockroaches	Malaria, filariasis, plague
	Larviciding	Mosquitoes, black flies	Malaria, filariasis, onchorcerciasis
	Space spraying	Mosquitoes, tsetse flies	Malaria, filariasis, dengue fever, trypanosomiasis
	Household products	Mosquitoes, house flies, fleas, cockroaches	Malaria, filariasis, plague, trachoma
Mechanical	House screening	Mosquitoes, house flies	Malaria, filariasis, trachoma
	Baited traps	Tsetse flies, cockroaches	Trypanosomiasis,
	Sticky paper traps	Sand flies, houseflies	Leishmaniasis, trachoma
Biological	Larvivorous fish	Mosquitoes	Malaria, filariasis,
	Predators	Mosquitoes, snails	Malaria, filariasis, schistosomiasis
Environmental	Environmental management and sanitation, habitat management	Mosquitoes, snails, tsetse flies, house flies, cockroaches	Malaria, filariasis, dengue fever, schistosomiasis, trypanosomiasis, trachoma

The main vector control interventions selected in Liberia are the use of LLINs and IRS, with limited use of larval source management for malaria control.

3.4.1 Long Lasting Insecticidal Nets (LLINs)

The use of LLINs is recommended in all malarious areas, especially to protect children, pregnant women and socio-economically vulnerable groups. Liberia has set a universal coverage goal of one LLIN for two persons. As previously reviewed under Section 1, there have

been very successful mass campaigns. These will continue to rapidly scale-up LLIN coverage. Routine services, such as ante-natal clinics (ANC) and the expanded program on immunization (EPI) will also continue to be high priority and complementary modes of LLINs distribution. There will be dedicated efforts to monitor and evaluate field performance of distributed LLINs, to enable proper determination of replacement regimes and related public advisories. There will be on-going efforts for IEC/BCC to sustain high utilization rates for LLINs. Distribution channels to reach disadvantaged households and institutions will be emphasized to identify, assess and strengthen the delivery services. Delivery of LLINs through military services, police and boarding schools has proven to be very effective methods for mass distribution and will continue to be an important model for Liberia. To ensure sustained universal coverage, a procurement plan and resource mobilization for LLINs will be enhanced.

A longitudinal study on LLINs on LLIN field performance/effectiveness will be initiated to enable routine evaluation and assist in determining the development of LLINs replacement plan.

Major Action Points for LLIN Implementation

- The NMCP will develop national LLIN strategy and guidelines for LLIN distribution to sustain distribution and utilization targets for universal coverage.
- The NMCP will track net ownership, gaps in coverage and new sleeping spaces through a national household database regularly updated by CHWs.
- The NMCP will conduct behavior change communication (BCC/IEC) to increase proper use of LLINs.
- The NMCP will develop guidelines on personal protection for travelers.
- The NMCP will monitor the physical condition of LLINs and residual efficacy of distributed LLINs.
- The NMCP will institute adequate planning for procurement and replacement of LLINs after every 3 years or at a time interval as may be established through the on-going LLIN field effectiveness study.
- The NMCP will liaise with WHO on the environmentally safe disposal mechanism of old nets.
- The NMCP will conduct BCC/IEC campaigns to discourage misuse of nets by communities for other purposes such as fishing or chicken housing.

Indicators

- National LLIN distribution guidelines in place.
- Number of LLINs distributed.
- % of population receiving with LLINs.
- % of population using LLINs at night.
- Personal protection guidelines for travelers in place
- Longitudinal evaluation of LLIN field performance
- An LLIN procurement plan and resources available
- Number of old nets stockpiled for sound disposal.

3.4.2 Indoor Residual Spraying (IRS)

WHO recommends IRS for all types of malaria endemicity. The recent history of IRS in Liberia is summarized under Section 1.2. Generally, the strategic objective of IRS operations is two-fold:

- a) It can be used to target high risk and intense malaria transmission areas with the objective and quick suppression of transmission, and/or
- b) It could be focused on preventing and controlling malaria epidemics and emergencies.

Normally household coverage of IRS should be very high in the target geographical area for maximal effect. IRS operations should, therefore, aim as close to 100% coverage of the structures in the targeted geographical area. A national strategy has been drafted specifically for IRS. The reader is encouraged to reference that strategy for more detailed information. A summary of salient points in the IRS strategy are included in this IVM strategy:

Selecting IRS target sites and determining spray rounds

In line with the National Malaria Strategic Plan to halve malaria morbidity and mortality, IRS will be scaled up incrementally, building on successes and lessons learned from ongoing operations in five counties (14 districts) in two regions (Table 7).

Table 7: IRS counties and districts in Liberia (2011)

Region	Counties	Districts
South Central	Grand Bassa	Common wealth; District 1, 2,3 & 4; Nekreen, Owen's Grove
	Margibi	Firestone & Mamba Kaba
	Montserrado	Careysburg
	Bong	Kokoya&Kpaai
Nimba	Nimba	AML Concession Area

Where to target: The selection of IRS target areas will be informed by the following factors:

- i. *Areas with highest malaria burden* - Rural communities in Liberia have been shown to generally have higher parasitemia loads among children, compared to urban communities and are thus preferred targets.
- ii. *Under-served areas, in terms of access to health services* –The strategic approach will be to prioritize and enhance disease prevention interventions in these areas. The principle is to utilize the very effective tool to sharply reduce malaria risks and burdens in those areas.
- iii. *Ease of physical access* - IRS has extensive logistics requirement and large spray teams; remote areas with comparatively difficult physical access may increase operational cost. A strategic approach will be to cover the distal areas with difficult physical access with a robust LLIN intervention geared towards maximal net utilization by households. Selective of intervention IRS or IRS or the mix of combinations will depend on cost-effectiveness and sustainability.

Decisions on the geographical targets for IRS are expected to change over time, as the local eco-epidemiology of malaria changes. This IVM strategy therefore does not prescribe or anticipate those decisions in advance, consistent with the core IVM principle of evidence-based decision making. The objective of future decisions on the target and timing of IRS spray rounds will be to provide maximal protection for the maximum numbers persons most at risk, given the available resources. The guiding principles will be soundness of ecological basis of the decision, cost-effectiveness and sustainability of the interventions. This means issues such as levels of susceptibility of vectors populations in the geographic area, as well as the length of residual

effectiveness of the insecticide compared with the length of malaria transmission, will be paramount. IRS operations will therefore be backed with reliable monthly residual efficacy evaluations (wall bioassays) to establish the actual field performance of WHOPEs approved insecticide on the targeted surface types. Given the length of the extended rainy seasons in Liberia, the development of reformulations and/or new insecticide products with longer residual efficacies provides an excellent opportunity to offer longer durations of protection per spray round.

When to spray: IRS should be timed so that the period of maximal insecticide residual efficacy (and thus the period of maximal killing effect) coincides with peaking of the local malaria transmission risk. Thus, IRS is best conducted at the tail end of the drier period and just preceding the onset of the rainy season. Up-to-date historical knowledge on local rainfall patterns is necessary to improve the timing of operations. IRS also requires months of lead time for effective preparations (e.g. training and transporting spray operators, procurement of equipment and accessories and insecticides; IEC/BCC targeting community and households on compliance).

Given the national policy of universal coverage of LLINs, it will be increasingly prudent that IRS is used as a strategic tool to accelerate the suppression of high malaria transmission in counties and local areas as LLINs is rolled in and coverage and utilization rates increase. There is currently limited guidance on the appropriate levels of a combination of IRS and LLINs in joint deployment, as it depends on varying factors ranging operational, ecological, and even socio-anthropological. Hence, robust M&E is necessary to determine the appropriate combination that is cost-effective and sustainable.

Selection of insecticides for IRS

- Only WHOPEs recommended insecticides may be IRS. All selected insecticides for IRS must be duly registered for that purpose in Liberia. If the insecticides are not registered, the full national requirement for registration will be fulfilled before it is imported, unless a temporary exemption is granted under emergency conditions, by a duly authorized national agency.
- Standardized WHO or CDC protocols on susceptibility will be used to ascertain susceptibility of local vector populations in the IRS target areas to an insecticide formulation before it is selected. Where resistance exists, an insecticide with a different mode of action will be used as part of resistance management strategy – a strategy which should be

consistent with guidance of WHO and related outfits such as the Insecticide Resistance Action Committee.

- Newer insecticide reformulations with longer residual efficacy, or new class(es) of recommended insecticides entering into the market place, will be proactively assessed for suitability to provide viable fall back options for resistance management.
- The cost of insecticide, as well as peculiar operational costs associated with specific insecticides compared to alternatives, may also inform final decision on selection. Other factors include acceptability by targeted households (certain insecticides such as malathion, may have peculiar smell which could undermine or in certain instances actually promote acceptance by households).

Major Action Points for IRS Implementation

- The NMCP will develop a specific national IRS strategy consistent with the guidance in this IVM strategy.
- Based on the WHO-recommended insecticide used and the universal coverage with LLINs in Liberia, the NMCP will assess through operational research whether to implement one or two rounds of IRS per year in high malaria transmission foci.
- The NMCP will conduct monthly wall bioassay tests to determine the levels and length of residual efficacy of IRS insecticides, the results of which will be considered in the determination of the number of spray rounds per year.
- The NMCP will conduct annual vector susceptibility tests to WHOPES approved insecticides at selected sentinel sites. Where existing susceptibility is below 98% and a twice annual spray rounds exist, then evaluations will be done twice a year before each spray round.
- A resistance monitoring and management scheme will be established, including criteria for triggering biochemical and bimolecular evaluations (Section 3.4.4) on resistance of the local drivers of resistance to inform decisions on alternatives or switches to other insecticides.
- The MOH&SW will ensure adequate stocks of insecticides, pumps and PPE.
- The NMCP and partners will support maintenance and service workshops for spray pumps and soak pits.
- The EPA and MOH&SW will ensure that all IRS operations include best practices and recommendations of WHO and FAO to safeguard the environment and human health.

- As appropriate, NMCP will decentralize IRS operations and build capacity at county levels for cost-effective operations.

Related Indicators

- A national IRS strategy in place and operational.
- % of targeted structures covered with IRS.
- % of targeted population protected by IRS.
- Amount of insecticides used.
- Insecticide resistance profile known.
- National policy on pesticide management strengthened⁴⁴.
- Compliance with international standards on safe handling (e.g. % of pesticide handlers using appropriate PPE; % county pesticide storage places with trained storekeeper)
- Compliance with international standards on safe disposal of insecticide contaminated waste
- Number of people trained on the safe use of pesticides.
- Amount of resources allocated for IRS.

3.4.3 Larval Source management (LSM)

There is no documented evaluation of the cost-effectiveness or utility of LSM for malaria control in Liberia. The utility of LSM must first be carefully evaluated – perhaps on a pilot basis - and policy subsequently developed to ensure that any investment made, is both cost-effective and sustainable. Larval source management may be an important vector control option in situations where mosquito breeding places are well defined and amenable to environmental management, for example, in densely populated areas where human activities create significant vector breeding habitats. Where such well-defined and significant breeding places exist, LSM may be an important complementary tool to address outdoor biting vectors as the major tools currently used in Liberia (LLIN and IRS) are both predicated on indoor biting and indoor resting

⁴⁴ Following SWOT analysis the NISC is expected to make recommendations, as required for strengthening policy. This is intended to validate that the

behavior of malaria vectors. LSM may include the use of biological agents such as larvivorous fish and *Bacillus thuringiensis israelensis* (Bti), as well as chemical agents.

Major Action Points for LSM

- NMCP to coordinate ecological evaluation to identify and map vector breeding habitats as a first step to determining the potential utility of LSM as complementary intervention.
- Investment in LSM should start on pilot basis and cost-effectiveness and sustainability assessed, before significant investment decisions are made.

Indicators

- Maps of larval breeding habitats available.
- Study of cost-effectiveness of LSM conducted

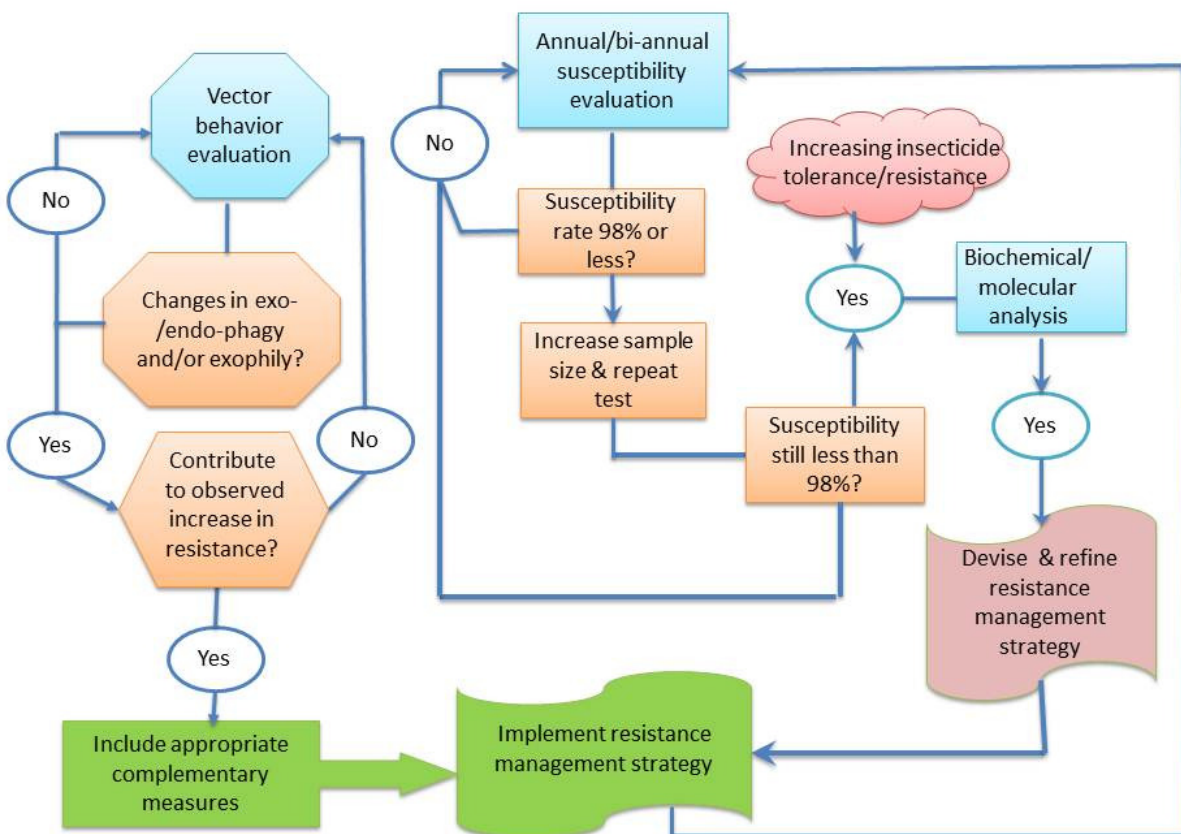
3.4.4 Insecticide Resistance Management

National scale up of vector control will necessarily be accompanied by increase in the use of insecticides. Given the already high levels of pesticides in agriculture, this will mean increased growing selection pressure for the development of resistance in the local vector populations to insecticides for malaria control. In addition, resistance has been reported in the West Africa region, including nearby countries to Liberia. The establishment of a management plan to manage the development of insecticide resistance is a primary consideration for Liberia and should be an integral part of insecticide based intervention from the start.

Assessing resistance mechanisms: The two main vector control interventions currently implemented in Liberia (LLINs and IRS) utilize the same class of insecticide (pyrethroids). Pyrethroid insecticides are also used in agriculture and horticulture. The development of insecticide resistance in the local vector(s) of malaria will directly threaten the continued viability of these vector control tools and will negatively impact on malaria vector control. The NMCP currently evaluates the susceptibility of local malaria vector to the current WHOPEs approved insecticides within the IRS counties. The test will be extended across the country and will also include susceptibility evaluations to the distributed LLINs, as part of a comprehensive evaluation of the field performance of the various LLINs. This will enable the NMCP to develop net replacement strategies. The establishment of a central insectary in LIBR will further

strengthen national entomological capacity - enabling the initiation of biochemical/ molecular monitoring of resistance mechanisms within local vector populations. Fig. 1 proposes a scheme for resistance monitoring. The scheme is based on establishing susceptibility thresholds (less than 98%) that will trigger annual biochemical/molecular evaluations of resistance mechanisms [Knock down resistance (*kdr*), Gluthanione and Gluthatione-S-Transferase (GSTs), Cytochrome P450s, Esterases, Acetylcholinesterase (AChE) or Modified Acetyl Cholinesterase (MACE), and Gamma-Amino Butyric acid (GABA)], using either TaqMan Plasmodium Assay or Polymerase Chain Reaction (PCR)].

Fig. 1. Resistance monitoring and management scheme



Using Resistance Monitoring results: The above bio-molecular evaluations should provide insight into the local drivers of the observed resistance (or lowered tolerance) and assist the selection of insecticides with a different mode of action to help manage the development of the resistant strain(s) of mosquitoes and also determine the strategic approaches in terms of the

timing/sequencing and geographical targeting of the insecticides. There are standard guidelines by WHO, Insecticide Resistance Action Committee (IRAC) and other sources on insecticide resistance management that will inform the development of an insecticide resistance management scheme for Liberia. Methods could include rotation of different classes of insecticides and mosaic application of two different classes of insecticides in the same geographical area or site.

Cross-resistance patterns in different classes of insecticides exist. Normally insecticides that share a common target site, such as DDT and pyrethroids, should not be rotated back-to-back. An ideal rotation would deploy insecticides with different modes of action such as a carbamate or an organophosphate. In case of emergency situations, such as a sudden upsurge of insecticide resistance to available insecticides of choice, limited or temporary use of a new insecticide, particularly of a different mode of action evolved under the Innovative Vector Control Consortium (IVCC), for example, can be a resistance management tool while awaiting full recommendation by WHOPES.

Frequency of Resistance Monitoring Tests: A six-monthly susceptibility test will be adopted where there is pre-existing tolerance to provide better monitoring of susceptibility. Otherwise, once yearly evaluation will be adequate. Vector susceptibility/resistance data will be shared with a WHO-moderated regional database on insecticide resistance to assist region-wide strategies to manage insecticide resistance.

Major Action Points on Insecticide Resistance Management

- The NMCP to conduct susceptibility tests of malaria vectors against different classes of WHOPES recommended insecticides annually. Evaluation will be linked to sentinel site surveillance system using Standardized WHO or CDC protocol in accordance with scheme outline by Fig.1.(ref Section 3.7.1)
- The NMCP to monitor the residual efficacy of insecticides on sprayed structures in IRS, and for distributed LLINs in the field
- The NMCP, in consultation with relevant partners, to evaluate the insecticide resistance profile and recommend appropriate interventions and use of alternate insecticides.
- NMCP in close coordination with NSIC will establish an insecticide resistance management scheme.

Indicators

- A functional insecticide resistance management plan
- Annual reports on insecticide susceptibility evaluations
- Reports on biochemical/molecular evaluations of resistance mechanisms
- Annual review of insecticide resistance data by the MOH&SW and NISC for evidence-based decision making on insecticide selection and resistance management
- Collaboration with international laboratories and organizations (LIBR, NMIMR, WHO) on insecticide resistance

3.5 Strengthen Infrastructure for Entomological Monitoring

Entomological sentinel stations will be established to enable the initiation of a systematic surveillance and monitoring scheme to provide relevant data on the local vectors for a country profile. Entomology surveillance data collected at each sentinel site will include vector density, resting behavior, species composition, larval habitats, vector infectivity rate, blood feeding index, parity, etc.. These sites will form a national network to capture relevant data on the eco-epidemiological settings of malaria transmission in the country.

A central insectary and associated entomology laboratory is being established at the LIBR. The facility will serve as a fulcrum for enhanced collaboration between NMCP and LIBR to undertake a full range of entomological evaluations and assist the coordination of assessments by sentinel future field stations (ref: Section 3.7.1).

Major Action Points on Entomology Capacity Strengthening

- The NMCP will establish and strengthen sentinel sites in different eco-epidemiological zones for entomological monitoring (Table 9).
- The NMCP will establish a central insectary and entomological laboratory and collaborate with LIBR to conduct entomological surveillance and monitoring activities.
- The NMCP in close partnership with LIBR to strengthen capacity for ELISA-based and molecular PCR techniques to enable a full range of entomological monitoring activities.
- The NMCP to support entomological and epidemiological data collection and reporting through the HMIS.

Indicators

- Vector distribution map updated.
- Insecticide resistance profile updated.
- Qualified technicians in charge of sentinel sites.
- Number of sentinel sites with fully functional vector surveillance and insecticide resistance monitoring.
- Functional insectary and laboratory used for evidence-based decision-making.
- Reliable entomological and epidemiological data from eco-epidemiological zones available in HMIS for evidence-based decision-making.

3.6 Strengthen Human Capacity for IVM implementation

Vector control functions at the central/national and county levels will be clarified to better identify the skills/competencies sets needed for effective IVM implementation. Table 8 outlines a generic outline of some envisaged functions. Entomological, epidemiological and environmental skills will be required to provide overall strategic and technical guidance for planning, implementation, monitoring and evaluation of IVM strategy. The central and county level staff will receive appropriate training on vector-borne disease epidemiology, surveillance and control interventions. Based on the WHO core curriculum and other training resources on IVM, national training manuals will be developed targeting county level staff. Training opportunities in entomology surveillance and insecticide management will be expanded to develop the requisite trained human resource to support IVM implementation and evaluation. Disease surveillance and impact of intervention activities will be supported by a well-equipped central entomological laboratory. It is anticipated that collaboration between the NMCP and the LIBR will encourage young graduates to take interest in vector control and IVM, thereby boosting the human resource in this area.

Dedicated IVM coordination county teams will be established/strengthened to support inter-sectoral action and oversee IVM implementation at the county level.

Major action Points of Human Resource Strengthening

- The NMCP will develop comprehensive vector control functions at the central and county levels, and clarify corresponding staff competences/ skills requirements for those levels.

- The NMCP will lead partners to establish training opportunities to create a critical mass of national human resources for the various categories of vector control skill and competency sets required for effective IVM implementation.
- The NMCP will provide training opportunities on the supervision of IVM implementation to staff from stakeholder-sectors to facilitate competent stakeholder contribution to IVM implementation.
- The MOH&SW will train county health teams and community focal points to conduct disease surveillance, data management and reporting and epidemic preparedness and response.

Table 8: Core functions at different administrative levels of national vector control

Central Level	
<ul style="list-style-type: none"> • Strategic direction to programs • policy development • Standard settings, norms and M&E indicators • Programme funding/resource mobilization • Prioritize and allocate financial resources • Epidemiologic analysis • Quality assurance • Training and support for county/sector programs and vector control 	<ul style="list-style-type: none"> • Coordination of emergency response • Evaluation & validation of operational research • Decision-making and planning of region programs/activities • Determine human resource needs • Monitor and evaluate county/sector IVM implementation
County and districts	
<ul style="list-style-type: none"> • Local planning of implementation • Resource prioritization and allocation • Disease surveillance • Programme monitoring • Health education 	<ul style="list-style-type: none"> • Train field staff/village health volunteers • Undertake vector control activities, assist in operational research • M&E: collection and initial collation of local data on various vector control aspects

Indicators

- Number of personnel positions with clarified job description that make reference to vector control.
- Training curriculum on IVM in place and used.
- Number of persons trained on IVM strategy.
- Number of persons trained in the various skill/competency areas in IVM
- Number of targeted communities implementing vector control activities.

3.7 Generating Data for Evidence-Based Decision-Making

There will be targeted operational research aimed at generating information to support decision-making. The focus will be to improve efficacy, cost-effectiveness, ecological soundness and sustainability of vector control interventions. Strategic partnership will be established with national research institutions and universities, as well as with relevant institutions in neighboring countries, to further improve national capacity and collaborate on specific areas of operational research. Critical issues may pertain to (i) the timing and geographical targeting of IRS within a national context of universal coverage of LLINs and anticipated reductions in transmission, and (ii) the role of larval source management (environmental management, sanitation and larviciding).

As needs arise, other programmatic questions that affect vector control interventions will be identified by the VCWG which will work under the NISC. Proposals will be developed and studies conducted in collaboration with academic/research institutes and other partners.

Major Action Points of Evidence Generation

- The NMCP to initiate collaboration with regional and international research institutions on operational research.
- NISC to establish a VCWG to provide expert counsel on quality control of vector control tools and products (insecticides, LLINs, repellents, spray pumps, personal protection equipment).
- The VCWG to identify programmatic issues and gaps in knowledge and operations that require surveys and/ or operational research for consideration by NMCP and NISC.
- The NMCP will conduct investigations on the ecology and behavior of malaria vectors to update information on local mosquito vectors of malaria and other vector borne diseases such as lymphatic filariasis.
- The NMCP to assess the strategy for IRS deployment within the context of national policy of universal coverage with LLINs and for assessing cost-effectiveness of joint deployment of IRS and LLINs.
- The NMCP to assess the feasibility and cost-effectiveness of LSM for vector control as an integral part of a broader strategy to control the local mosquito vectors of human diseases, particularly malaria.
- The MOH&SW and VCWG will conduct entomological and epidemiological surveys of other vector borne diseases in the country.

Indicators

- Number of priority operational research priorities addressed.
- Number of research collaborations between NMCP and research institutions.
- Number of research outcomes used for decisions and updating policies, guidelines and work plans.
- Information on the ecology of malaria and other vector borne diseases in the country available.

3.7.1 Entomological Monitoring

A national entomological surveillance and monitoring system will be established to provide an ongoing evidence-base for decision making. The sentinel system will have the following characteristics:

- i. A central insectary and associated entomology laboratory at Liberia Institute of Biological Research (LIBR) to coordinate field sentinel stations to undertake a full range of evaluations in support of malaria vector control.
- ii. Creation of an adequate number of well-trained field and program level staff for the required entomological evaluations and evidence generation. In the past two years about 45 technicians from the counties, have been trained in basic entomological monitoring methods. These technicians will form the foundation of staffing for a sentinel-based monitoring system in the country. In addition, training in advanced methods in entomological monitoring and surveillance in vector control was provided to designated central insectary staff and NMCP entomology focal points. Additional training and mentoring will be provided, as required.
- iii. Vector surveillance and monitoring regime will comprise clearly defined indicators and standardized protocols. Entomology sentinel sites will be established at selected locations and manned by trained field entomology technicians (ref:Table 9) to capture relevant data on the major eco-epidemiological settings of malaria transmission in the country. A national scheme on entomology surveillance and monitoring will be established to track local vectors and evaluate impact of ongoing vector control interventions on disease transmission.
- iv. A complementary vector control information system that enables efficient and timely data management and utilization. The data collected from the sentinel sites will ultimately be incorporated in the national Health Management Information Systems (HMIS), to facilitate decision making on malaria control.

Due to the pre-existing foci of resistance to DDT and other pyrethroids in the West African region, the effective management of insecticide resistance will be a top-most priority. The LIBR will, through a formal MOU with NMCP, assist with surveillance and monitoring and conduct critical operational research to clarify/fill existing information gaps (Table 3). Institutional arrangements and roles will be clearly outlined for ongoing and integrated support to malaria vector control by the NMCP.

Table 9: Basics of Entomology Sentinel System

- A national entomology sentinel system will be established comprised of a central insectary/entomology laboratory at LIBR and sentinel field stations representing the major ecological zones for malaria: the (i) coastal plains (ii) rolling hills characterized by agricultural and forestry concessions, (iii) plateaus and mountain ranges (areas including the Mano river mountains and the Bea, Bong, Kpo) and (iv) The northern highlands (e.g. Bong, Nimba, Mano, Putu, Bomi).
- The number and location of the sentinel sites will be guided by subsequently developed and periodically updated criteria, ensuring coverage of (a) major ecological zones in the country, (b) potentially isolated vector populations due to geographical barriers and (c) areas with known reduced insecticide tolerance or resistance.
- The sentinel sites will undertake monitoring and surveillance (ref: Table 10) on local malaria vector populations in defined geographical locations, using standardized and internationally recognized methodologies/protocols by WHO and CDC (bottle assays).
- Other ecological/environmental factors with direct impact on the vector populations (e.g. rainfall, temperature) will also be recorded.
- Data generated will focus on vector ecology, vector population structure and distribution, and spatial and temporary changes in species, disease transmission related behavior (biting and resting preferences); efficacy and effectiveness of vector control intervention employed to control malaria.
- Sentinel sites will be manned by formal trained entomology field technicians (two and a supervising technician) with proficiency on required methodologies and assessments to be conducted at the site. The technicians will be literate (with previous technical or secondary education) and able to document data, read and understand simple instructions in the official national language.
- The sentinel sites will have basic equipment and supplies, such as microscopes, insect cages and dissecting kits, to conduct its assessments.
- The technicians will be guided by detailed and user-friendly sentinel site (field) manuals. As needed, they will mobilize and train persons in nearby communities to provide temporary support to field assessments as may be described in the sentinel site manuals.

3.7.2 Epidemiological information

The NMCP routinely collates health facility-based, parasitologically confirmed monthly morbidity and mortality data to provide ongoing data and detailed mapping of disease prevalence. The epidemiological data will be combined with vector control data (entomological data and other parameters) to more effectively target and then monitor the impact of IVM.

Table 10: Desirable entomological monitoring indicators

BASIC Entomological evaluations (measured monthly) – Category 1 (sentinel sites):
<ul style="list-style-type: none"> i. <i>Insecticide residual effectiveness (Cone bioassay)</i> – on major wall surface types (Mud, cement – painted or unpainted, and wood) in the localities where indoor residual activity is conducted and on LLINs. Provides rate of decay of the insecticide determined for (a) IRS by 24 hour mortality of mosquitoes exposed to sprayed walls for 30 minutes and (b) for LLINs as 24 hour mortality of mosquitoes exposed to LLINs for 3 minutes. ii. <i>Human landing catches (indoor & outdoor)</i> - provides insight into biting behaviour of local vectors iii. <i>Pyrethrum spray catches</i> – Done between 6am and 8am at pre-selected houses. Indicator provides insight into vector entry into sprayed rooms over time. Compared with unsprayed homes and other higher category 2 evaluations on the catches (e.g. parity, sporogony, and blood meal analysis) provides insight on effectiveness of intervention and indicate transmission risk changes in sprayed rooms. iv. <i>Species identification (morphological) and composition</i> - from monthly catches listed above. It will enable mapping of vector distribution and tracking of any changes in species composition within the year. v. <i>Insecticide susceptibility evaluation (CDC) bottle assay</i>- 2x/year for WHOPES approved insecticides
Entomological evaluations - Category 2 (Insectary/Entomology laboratory at SPH)
<p>The Category 2 evaluations require advance training and access to relevant ELISA and PCR equipment.</p> <p>The following indicators will be assessed:</p> <ul style="list-style-type: none"> i. <i>Sporozoite rates</i> (quarterly) - provides insight into risk of getting malaria ii. <i>Entomological inoculation rates</i> (quarterly) – measure risk of getting malaria through infected bites iii. <i>Blood meal analysis</i> (half yearly) – provides insight into feeding preference of mosquito vector iv. <i>Age grading</i> evaluations (quarterly) – especially from room catches denotes the effective intervention is in killing off vectors v. <i>Resistance mechanism</i> by molecular techniques (annually)

3.8 Monitoring and Evaluation of IVM Implementation

The NMCP and the NISC will use the process and outcome indicators listed under the various sections in this strategic plan, as the basis for M&E of the IVM implementation and will form a part of an overall M&E plan to assess the impact of IVM implementation and sustainability of vector control interventions. This exercise will be facilitated by the national IVM focal point, the VCWG and the NISC, charged with the responsibility of reporting and documenting achievements, challenges and bottlenecks in IVM implementation.

Major Action Points for M&E on IVM Implementation Progress

- The NMCP and the NISC to monitor and evaluate progress on the IVM strategy in terms of achievements, constraints, resource allocation against the set targets. A review will be done every six months in conjunction with stakeholders, partners and external reviewers. The MOH&SW and the NISC will assure best practices for vector control are used.
- The MOH&SW, with the coordination of the NISC, will collate and submit progress reports to stakeholders and development partners.

Indicators:

- Number of coordination meetings held by the NISC.
- Certified progress reports.
- Decisions influenced by operational research.
- Strategy in place that ensures continuous mobilization of resources for vector control.
- Vector level impact indicators (vector infectivity/sporozoite rates, IER, biting rates)
- % reduction of morbidity and mortality due to malaria and other VBDs.

3.9 Resource Mobilization

Among its responsibilities, the NISC will coordinate the development of a multi-year national work plan for IVM based on the policy framework and strategy outlined in this document - utilizing a process that enables stakeholder input and ownership of output. The work plan will detail and cost all aspects of vector control: planning, managing, intervention deployment, staffing at the various levels (both long term and temporary field workers), training, monitoring and evaluation, and provision of critical infrastructure. The IVM work plan will also elaborate the roles and

responsibilities of sectors/stakeholders and partners. Pledges on stakeholder contribution towards the implementation work plan will be clarified and therefore incorporated into individual sectoral/partner plans. The IVM work plans will:

- (iv) Improve the generation of relevant local data for rational decision-making, with reference to the policy objectives outlined in this strategy (Section 2).
- (v) Enable the development of a more comprehensive resource mobilization plan to:
 - a. Assist forward planning by government on the allocation of in-country resources.
 - b. Properly contextualize and streamline collaboration and support by the country's developmental partners, (e.g. USAID/PMI, Global Fund, World Bank, African Development Bank).
 - c. The NMCP and NISC will provide opportunities for partnership with the private sector, particularly with the agriculture and mining sectors, where malaria poses a significant threat to the profitability through disease-related absenteeism and reduced worker output. Private sector investment in workplace and community-based malaria prevention programs in malaria prevention programs have been shown to reverse the adverse impact of malaria on business operations.

Major Action Points for Resource Mobilization

- The NMCP and the NISC to develop a fully costed IVM work plan to estimate total cost of implementation of National IVM strategy
- The NMCP and the NISC, to develop and implement an IVM resource mobilization plan

Indicators:

- Costed IVM strategy and work plan
- National IVM resource mobilization plan.
- Proportion of annual IVM budget mobilized
- Number of funders (in-country and developmental partners) contributing to IVM implementation

4.0 CONCLUSION: IMPROVING HEALTH OUTCOMES IN VECTOR BORNE DISEASE CONTROL

Liberia has a unique opportunity to embed IVM early in the country's efforts to rebuild systems to effectively control the transmission of malaria and other vector borne diseases.

Institutionalization of IVM will consolidate the gains already made and assure further reductions in mortality and morbidity. The IVM approach involves thoughtful processes that will ensure a solid foundation characterized by deliberate, learning and self-correcting efforts to continually improve efficiencies and maximize impact on disease transmission. The following outcomes are anticipated upon successful implementation of IVM in Liberia:

Programmatic/Operational outcomes

A learning and self-improving system for vector control is established in Liberia that enables the cost-effective utilization of resources. Such a system will be characterized by:

- Appropriate policy and institutional frameworks are established for vector control.
- Appropriate legislation and regulations established to protect human health and the environment in the development of natural resource (e.g. water, land), as well as the management and use of public health insecticides.
- Elaboration of multi-year national IVM work plans that (i) enable coordinated national mobilization of resources, and (ii) improve the targeting of support from developmental partners, due to clarified national objectives and priorities for vector control
- Effective inter-sectoral collaboration ensuring appropriate contribution by all stakeholders, including communities, in the management of the local vectors of malaria and other diseases.
- Adequate capacities established at national, county and community levels for evidence-based decision-making on vector control ensuring timely and adequate response to changing disease eco-epidemiology.

Disease level outcomes

- Ecologically sound, cost-effective and sustainable management of the local vectors of human diseases, especially malaria.
- Significant and sustainable reductions in the transmission of vector borne diseases, particularly malaria, resulting in reductions in morbidity and mortalities.

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