PROVISIONAL STRATEGY FOR INTERRUPTING LYMPHATIC FILARIASIS TRANSMISSION IN LOIASIS-ENDEMIC COUNTRIES

REPORT OF THE MEETING ON LYMPHATIC FILARIASIS, MALARIA AND INTEGRATED VECTOR MANAGEMENT

LYMPHATIC FILARIASIS

ACCRA, GHANA, 5–9 MARCH 2012

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World Health Organization

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1. Background

The Global Programme to Eliminate Lymphatic Filariasis targets the global elimination of lymphatic filariasis as a public-health problem by 2020. The main strategy is to interrupt transmission through integrated preventive chemotherapy, using mass drug administration to treat entire populations at risk of the disease, with a combination of albendazole plus ivermectin or albendazole plus diethylcarbamazine administered as a single dose once a year for at least 5 years.

Because ivermectin or diethylcarbamazine can cause serious adverse effects in people infected with *Loa loa* causing loiasis (African eye worm), an endemic disease in a large part of central Africa,[1] the current guidelines for preventive chemotherapy contain no recommendation for areas where lymphatic filariasis and loiasis are co-endemic but where onchocerciasis is hypo-endemic or non-endemic. Consequently, mass drug administration to eliminate lymphatic filariasis using the combination of medicines recommended by the World Health Organization (WHO) could thus far not be implemented in these communities. In order to meet the 2020 goal, it has become urgent to develop an alternative strategy for interrupting transmission of lymphatic filariasis adapted to the specific situation of co-endemicity with *Loa loa*. This strategy could potentially include both medication and vector control.

The milestones for the Global Programme to Eliminate Lymphatic Filariasis 2010–2020 stipulate that by 2012, a provisional strategy for interrupting lymphatic filariasis transmission in loiasis-endemic countries should have been developed; and that by 2013, a revised strategy for interrupting lymphatic filariasis transmission should have been implemented in all loiasis-endemic countries.[2]

In June 2011, a preliminary meeting on *Loa loa* in Lusaka, Zambia, proposed the following provisional strategies for eliminating lymphatic filariasis in areas where *Loa loa* is co-endemic: integrated vector management as the main strategy, and mapping of lymphatic filariasis and *Loa loa* at the lowest possible administrative level to potentially identify small areas that can be treated for lymphatic filariasis.

2. Objectives of the meeting

The meeting convened experts in lymphatic filariasis, malaria and integrated vector management to discuss how multiple disease programmes (for lymphatic filariasis and malaria) could be implemented to achieve elimination of lymphatic filariasis. Participants included country representatives of national programmes for elimination of lymphatic filariasis and control of malaria from Angola, Cameroon, the Central African Republic, Ghana and Liberia (Annex 1). The objectives of the meeting were:

> to identify an alternative strategy for elimination of lymphatic filariasis in areas where loiasis is co-endemic but whose populations are not eligible for treatment with ivermectin to control onchocerciasis; and
>
> to develop strategic action plans with Member countries for implementing integrated vector management of lymphatic filariasis and malaria in areas where lymphatic filariasis and loiasis are co-endemic.

[1] Zouré HGM et al. The geographic distribution of *Loa loa* in Africa: results of large-scale implementation of the rapid assessment procedure for Loiasis (RAPLOA). *PLoS Neglected Tropical Diseases*, 2011, 5(6):e1210.

[2] *Progress report 2000–2010 and strategic plan 2010–2020 of the Global Programme to Eliminate Lymphatic Filariasis: halfway towards eliminating lymphatic filariasis*. Geneva, World Health Organization, 2010 (WHO/HTM/NTD/PCT/2010.6).

The expected outcomes of the meeting were:

a global strategy (provisional) for interrupting transmission of lymphatic filariasis in loiasis-endemic countries;

a draft action plan for the national programme to eliminate lymphatic filariasis, specifying next steps and key partners providing support to the programme; a draft "Manual on practical entomology in lymphatic filariasis"; and

success stories of integrated vector management in the African Region, in collaboration with RTI International/United States Agency for International Development.

Annex 2 provides the programme of work for the meeting.

3. Provisional strategy for eliminating lymphatic filariasis transmission in loiasis-endemic countries

3.1 Current situation: globally and in the WHO African Region

Mapping of the distribution of lymphatic filariasis is a prerequisite to starting national elimination programmes. In WHO's African Region, some countries have yet to initiate mapping (Chad and Eritrea) and 10 countries are in the process of mapping (Angola, Cameroon, the Central African Republic, Côte d'Ivoire, the Democratic Republic of the Congo, Ethiopia, Liberia, Nigeria, Zambia and Zimbabwe).

In 2010, mass drug administration had not yet been implemented in 15 countries of the African Region with lymphatic filariasis (Angola, Central African Republic, Chad, the Congo, Democratic Republic of the Congo, Equatorial Guinea, Eritrea, Gabon, Gambia, Guinea, Guinea-Bissau, Liberia, Sao Tome and Principe, Zambia and Zimbabwe), and South Sudan and Sudan (in WHO's Eastern Mediterranean Region).

Of the 34 countries in the African Region where lymphatic filariasis is endemic or suspected to be endemic, 9 countries (Angola, Cameroon, the Central African Republic, Chad, the Congo, the Democratic Republic of the Congo, Equatorial Guinea, Gabon and Nigeria) are co-endemic for both lymphatic filariasis and loiasis. In WHO's Eastern Mediterranean Region, South Sudan is co-endemic for lymphatic filariasis and loiasis. Hence, most countries with co-endemicity for both diseases have neither completed mapping nor implemented mass drug administration for lymphatic filariasis.

During 2006–2011, the WHO Global Malaria Programme reported major advances in the African Region in increasing the percentage of households owning at least one long-lasting insecticidal net or covered by indoor residual spraying, in providing personal protection and in interrupting malaria transmission. This success, combined with improved diagnosis and treatment of cases, has significantly reduced morbidity from malaria and malaria-specific mortality. Nevertheless, the development of insecticide resistance, the use and maintenance of distributed nets and the decline in funding are growing challenges for the programme.

Integrated vector management, defined as a rational decision-making process to optimize the use of resources for vector control, aims to increase the efficacy, cost effectiveness, ecological soundness and sustainability of vector control. As a result of recent WHO consultations, three guidance documents have been published to assist countries in implementing integrated vector management: a handbook, a core curriculum and guidance on policy-making. Although national policy on integrated vector management is available in half of African countries, the mandate to implement policy remains weak.

A key intervention for elimination of onchocerciasis is community-directed treatment with ivermectin. To interrupt transmission, annual treatment with ivermectin should be continued for as many years as the prevalence of nodules reaches the breakpoint.

Loiasis is a vector-borne disease caused by *Loa loa* worms transmitted through the painful bite of deer flies, *Chrysops* spp., which inhabit tropical forested environments. Treatment with ivermectin commonly administered in programmes to eliminate lymphatic filariasis and control onchocerciasis has the potential to cause serious adverse events (e.g. encephalopathy) in patients with heavy *Loa loa* infection, particularly where *Loa loa* eye worm prevalence exceeds 40%. It is therefore essential to map the distribution of *Loa loa* to assist in benefit–risk assessments for decision-making. WHO's rapid assessment procedure for *Loa loa* (RAPLOA) is based on the collection of information from the community on the presence of the eye worm. The African Programme for Onchocerciasis Control has completed RAPLOA mapping of the level of prevalence and identified 10 countries at high risk of loiasis: Angola, the Congo, the Central African Republic, Cameroon, Chad, the Democratic Republic of the Congo, Equatorial Guinea, Gabon, Nigeria and South Sudan.

The Mectizan Expert Committee scientific working group on *Loa loa* has published guidelines on mass drug administration with ivermectin in co-endemic areas, based on benefit–risk assessments. Because mass drug administration for lymphatic filariasis elimination has no direct benefit to the patient, it is not worth the risk of organizing any ivermectin-based mass treatment for lymphatic filariasis elimination in areas of loiasis that are associated with a high risk of serious adverse events. In areas where ivermectin can be used in mass drug administration, capacity-building on preparedness for serious adverse events for prompt case detection and adequate management is required. To date, of serious adverse events have been reported mainly from two countries: Cameroon and the Democratic Republic of the Congo.

Research has demonstrated that a single annual dose of albendazole (400 mg) resulted in acceptable reductions in levels of lymphatic filariasis microfilariae[3] and the efficacy is greater at higher doses,[4] suggesting that albendazole alone can be used to interrupt transmission of lymphatic filariasis. More robust community trials are under way to confirm the effectiveness of albendazole alone on lymphatic filariasis (the DOLF – death to onchocerciasis and lymphatic filariasis – project).

Some of the recommendations of the scientific working group were: (i) to establish an integrated database for mapping of lymphatic filariasis, onchocerciasis and loiasis in order to assess the mapping gaps and the risks; (ii) to use single-dose albendazole (400 mg) twice a year in areas where ivermectin cannot be administered as an alternative strategy for eliminating lymphatic filariasis; (iii) to reinforce in these areas the coverage and use of bednets through malaria control programmes; and (iv) to initiate studies to validate this strategy.

The results of a systematic review of the evidence available on the impact of integrated vector management on lymphatic filariasis and malaria show that interventions to control malaria, in particular untreated and treated bednets and indoor residual spraying, convincingly reduced the prevalence of lymphatic filariasis where it is transmitted by anophelines, as is the case in most African countries. In several instances, the impact was greater on lymphatic filariasis than on malaria, probably because transmission is less efficient for lymphatic filariasis than for malaria. A proposal was made to integrate the global programmes on lymphatic filariasis and malaria in Africa to achieve more efficient use of resources, more accurate attribution of complementary effects and an increased impact on transmission of both diseases.

In particular, integrating mass drug administration with distribution of long-lasting insecticidal nets would exploit obvious synergies between both programmes: net distribution programmes in Africa should prioritize areas where the diseases are co-endemic to maximize the benefits

[3] Gyapong JO et al. Treatment strategies underpinning the global programme to eliminate lymphatic filariasis. *Expert Opinion on Pharmacotherapy*, 2005, 6:179–200.
[4] Jayakody RL, De Silva CSS, Weerasinghe WMT. Treatment of bancroftian filariasis with albendazole: evaluation of efficacy and adverse reactions. *Tropical Biomedicine*, 1993, 10:19–24.

of nets in public health. An acknowledged shortcoming in malaria control programmes is the lack of support for proper use and maintenance of bednets at the community level; hence, integration with the infrastructure of mass drug administration through community drug distributors could benefit both programmes.

Experience in Nigeria has demonstrated the role of long-lasting insecticidal nets in eliminating lymphatic filariasis: the integrated use of mass drug administration and long-lasting insecticidal nets reduced the vector infection rate to 0%; the use of these nets alone reduced that rate from 2% to 0.3%. Community-based behavior change interventions emphasized the importance of long-lasting insecticidal nets to protect against both lymphatic filariasis and malaria and included community-directed interventions on net hanging, mending, washing and net use; these interventions resulted in significant improvements in hanging and use of nets.

Innovative studies are under way at partner research centres on the durability of nets, durable wall lining, long-lasting insecticidal net curtains, new repellents, spectroscopy as a potential tool for age grading or for lymphatic filariasis-infectivity of mosquitoes, determination of lymphatic filariasis vectors, biting pattern, insecticide susceptibility, urban transmission, environmental determinants and impact of vector control on lymphatic filariasis.

3.2 Provisional strategy for eliminating lymphatic filariasis in areas where loiasis is co-endemic

Working group sessions were held to develop recommendations on preventive chemotherapy and integrated vector management for the specific settings for which no recommendation currently exists: a situation in which lymphatic filariasis and loiasis are co-endemic and onchocerciasis is non-endemic or hypo-endemic (nodule prevalence <20%); in these settings, malaria is also endemic (lymphatic filariasis+, onchocerciasis–, loiasis+, malaria+).

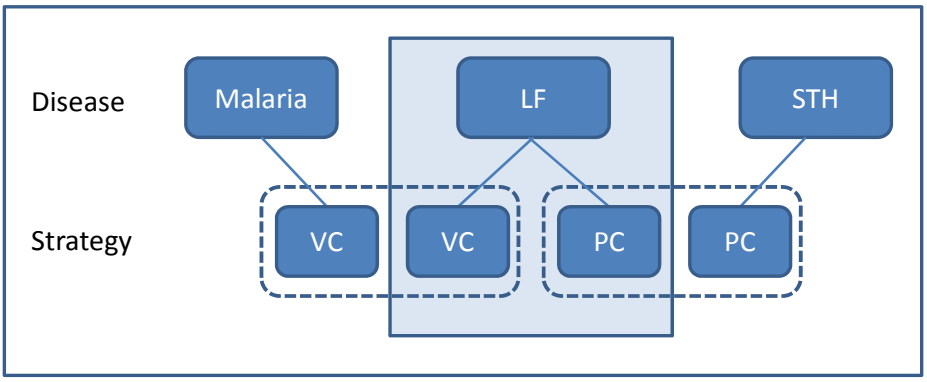
In this setting, and based on the available evidence, the group recommended preventive chemotherapy with albendazole (400 mg) twice per year in combination with vector control (Annex 3). The addition of vector control was deemed necessary to accelerate the interruption of lymphatic filariasis transmission. The operational period needed to achieve elimination in loiasis-endemic settings with this new strategy was estimated at 5 years. Monitoring and evaluation should be conducted through sentinel surveys of microfilariae or antigenaemia rates. The surveys should include a baseline, an obligatory mid-term assessment after the third year of mass drug administration and an end-term assessment after five years of the intervention following the guidelines for transmission assessment surveys.[5]

As a mechanism for integrating preventive chemotherapy, the group recommended integration with existing programmes on soil-transmitted helminthiases. Most countries use a school-based system for such programmes, but may need to switch to a community-based strategy to achieve effective coverage (*Fig. 1*).

As a mechanism for integrating vector control, integrated vector management for LF elimination with malaria vector control was recommended. Since all *Loa loa*-infected areas are also endemic for malaria, and given that lymphatic filariasis and malaria in these areas share the same vector species, human populations should receive universal coverage with malaria vector control interventions (e.g. long-lasting insecticidal nets, indoor residual spraying) (*Fig. 1*).

[5] *Monitoring and epidemiological assessment of mass drug administration in the global programme to eliminate lymphatic filariasis: a manual for national elimination programmes*. Geneva, World Health Organization, 2011 (WHO/HTM/NTD/PCT/2011).

Fig. 1 Mechanisms for integrating preventive chemotherapy (PC) and vector control (VC) with programmes for control or elimination of malaria, lymphatic filariasis (LF) and soil-transmittted helminthises (STH)



The recommended strategy for the elimination of lymphatic filariasis in four possible settings is summarized in Table 1. It is assumed that malaria is endemic in all settings, which is a reality in most of central Africa. Integration of lymphatic filariasis and malaria will facilitate the sharing of resources between the two programmes (e.g. the lymphatic filariasis programme to contribute to maintaining bednet usage), but the benefits of integration need to be assessed. Studies may be required to ascertain whether anophelines are the only vectors of lymphatic filariasis. Moreover, vector control interventions should be selected based on local evidence of vector behavior, few and focal breeding sites (e.g. prospect for larval source management), and insecticide susceptibility, in accordance with available guidelines for malaria control.

Table 1. Recommended strategy for eliminating lymphatic filariasis (LF), by status of co-endemicity

Setting	Co-endemicity				Strategy for LF elimination		
					MDA/preventive chemotherapy		Integrated vector management
	LF	Oncho	Loiasis	Malaria	Medicines	Guideline	
1 (NEW)	**+**	**–**	**+**	**+**	**albendazole**	**400 mg, 2x/year**	**Prioritized for malaria vector control**
2	+	+	+	+	albendazole + ivermectin	MEC/APOC-TCC manual[6]	Malaria vector control
3	+	+	–	+	albendazole + ivermectin	WHO-PC manual[7]	Malaria vector control
4	+	–	–	+	albendazole + ivermectin	WHO-PC manual[5]	Malaria vector control

LF, lymphatic filariasis; MDA, mass drug administration; oncho, onchocerciasis

Advocacy for the importance of integrated vector management to eliminate lymphatic filariasis, particularly in areas where loiasis is co-endemic, will be needed at policy and community levels. Recommendations for vector control outside such areas, including where lymphatic filariasis is transmitted by *Culex* or *Aedes*, were beyond the scope of this meeting but require further development.

3.3 Country situations and national action plans

3.3.1 Angola

The strategic plan on neglected tropical diseases has not yet been completed in Angola. RAPLOA surveys indicate that in the north-west of the country, the high incidence of loiasis overlaps with the distribution of onchocerciasis. Unlike in other countries, Angola has no lack of financial resources to control neglected tropical diseases. Nevertheless, mapping of lymphatic filariasis, which started in 4 out of the country's 18 provinces in 2006, has been completed in only one province due to administrative problems. Hyper-endemic malaria is restricted to the northern provinces, where loiasis is also prevalent. Here, long-lasting insecticidal nets are distributed; coverage is still low but the new malaria control objective is to achieve universal coverage. Indoor residual spraying, with support from the United States President's Malaria Initiative, is implemented in four epidemic-prone provinces in the south of the country bordering Namibia. In several provinces, high vector resistance has been reported to DDT, permethrin and alpha-cypermethrin. A national action plan for elimination of lymphatic filariasis will be drafted within 3 months. The immediate aim is to complete mapping of lymphatic filariasis and to integrate activities between disease-specific programmes.

3.3.2 Cameroon

A strategic plan to control neglected tropical diseases and a malaria control plan are available. Integrated vector management has been adopted for all vector-borne diseases; there is a functional steering committee on integrated vector management, chaired by the Minister of Public Health and led by the malaria programme, to coordinate disease-specific

[6] *Recommendations for the treatment of onchocerciasis with Mectizan® in areas co-endemic for onchocerciasis and Loiasis: the Mectizan® Expert Committee and the Technical Consultative Committee*. Decatur, GA, The Mectizan® Expert Committee/The Mectizan® Donation Program, 2004 (also available at: http://www.mectizan.org/sites/default/files/EnglishMECTCCLoaRecs-June04_1.pdf; accessed April 2012).

[7] *Preventive chemotherapy in human helminthiasis – coordinated use of anthelminthic drugs in control interventions: a manual for health professionals and programme managers*. Geneva, World Health Organization, 2006 (also available at: http://www.who.int/neglected_diseases/preventive_chemotherapy/pct_manual/en/index.html; accessed April 2012).

programmes. Mapping of lymphatic filariasis is almost complete: the results show that of the 179 functional health districts (i.e. implementation units), 158 are known to be endemic for lymphatic filariasis. In 2011, mass drug administration was implemented in 135 health districts, but it could not be done in the 23 health districts where *Loa loa* is prevalent. At present, 11 implementation units, representing a population of 2.4 million, remain to be mapped. Malaria is endemic throughout the country. Interventions for malaria vector control are the distribution of long-lasting insecticidal nets, aiming to achieve universal coverage, and indoor residual spraying in selected health districts. These interventions are selected based on evidence of vector behavior and insecticide susceptibility. A major challenge is elimination of lymphatic filariasis in all health districts where loiasis is endemic, because no recommended strategy is currently available in the country.

In areas where loiasis is endemic, the objective is to eliminate lymphatic filariasis by 2020. Actions planned include mass drug administration with albendazole alone, targeted vector control, collaboration to strengthen and maintain coverage of long-lasting insecticidal nets, awareness raising, monitoring and evaluation, and mapping of lymphatic filariasis in remaining districts.

3.3.3 Central African Republic

Mapping of lymphatic filariasis has been completed in 8 of the country's 16 prefectures, 4 of which are co-endemic for loiasis (in the south-west of the country). Mapping remains to be conducted in 8 prefectures. In total, 5 prefectures have been found endemic with loiasis. Malaria is endemic throughout the country. Malaria vector control is implemented through distribution of long-lasting insecticidal nets, but net usage is not being monitored. A challenge will be the elimination of lymphatic filariasis in areas where loiasis is endemic. There is currently no coordination between disease-specific programmes. Additional resource is needed to complete mapping of lymphatic filariasis and to maintain the commitment of community-based volunteers.

The general objective in the action plan is to reduce morbidity from and transmission of lymphatic filariasis in prefectures where loiasis is endemic. The specific objective is to cover all communities in these prefectures with mass drug administration using the newly recommended rates of albendazole twice per year, and to achieve at least 80% coverage of individuals. The implementation plan includes training (cascade training of health workers, community drug distributors), health promotion, mass drug administration through the community structure, vector control using long-lasting insecticidal nets and indoor residual spraying, monitoring and evaluation (transmission assessment survey), surveys of bednet usage, studies on vector behavior and mapping of lymphatic filariasis in the remaining prefectures. Capacity on entomology is largely lacking in the Central African Republic.

3.3.4 Liberia

Despite political instability in Liberia, there is enthusiasm to improve the public-health situation. A preliminary survey conducted in 2010 indicated that lymphatic filariasis is prevalent in 13 of its 15 counties, whereas loiasis is not prevalent in the country. Control of neglected tropical diseases has been identified as a health priority, emphasizing greater community involvement, and is included in the national health plan. The plan is to initiate mass drug administration in April 2012, and to integrate mass drug administration for lymphatic filariasis with the ongoing treatment programme for onchocerciasis in areas where the distribution of both diseases overlaps. A challenge to implementing mass drug administration is how to motivate community drug distributors to participate. A task force on integrated vector management has been set up and a national policy has been drafted. As a result, there is coordination between the lymphatic filariasis programme and the malaria programme for vector control. This coordination mechanism has potential benefits for the lymphatic filariasis programme.

The objectives in the action plan are to start mass drug administration in 2012, to interrupt lymphatic filariasis transmission by 2016 (i.e. 4 years from initiation of mass drug administration) and to reduce morbidity and disability from lymphatic filariasis by 80% in 2020. The short timeline (4 years) for elimination is considered feasible because of the combination of mass drug administration with high coverage of long-lasting insecticidal nets and indoor residual spraying by the malaria control programme and the history of onchocerciasis control; the timeline for mid-term epidemiological assessment will be adjusted accordingly. The strategy is to use mass drug administration through the existing network of community drug distributors and to integrate malaria control interventions, notably long-lasting insecticidal nets and indoor residual spraying. Health workers and community drug distributors will be trained on the integrated tools for mass drug administration.

3.3.5 Ghana

Historically, neglected tropical disease control programmes have been coordinated with the malaria control programme, which has been much better resourced. New advocacy is needed to ensure that areas endemic for lymphatic filariasis are targeted by malaria vector control interventions. The malaria programme is currently planning the distribution of 12 million long-lasting insecticidal nets and the targeting of indoor residual spraying. The participation of lymphatic filariasis programme managers in malaria meetings could provide a major opportunity for coordinated planning to tackle both diseases. Consequently, information on the distribution of lymphatic filariasis prevalence could reorient the targeting of nets. Moreover, coordinated action would provide good opportunities for demonstrating the effect of long-lasting insecticidal nets on lymphatic filariasis.

In summary, the countries face challenges in capacity building on mapping of lymphatic filariasis, integration of mapping between lymphatic filariasis, onchocerciasis and loiasis, monitoring of serious adverse events, entomological methods, management of insecticide resistance, and motivating community-based volunteers to participate. Establishing functional coordination and collaboration between lymphatic filariasis and malaria programmes is another challenge requiring investment. Advocacy on integrated vector management is needed at all levels, and implementation of integrated vector management is starting in some countries. Countries have prepared their action plans on mapping, training, coordination and implementation, but their timelines may need to be reconsidered at country level. An outline of country situations is given in Table 2.

Table 2. Status of mapping for lymphatic filariasis and co-endemicity with onchocerciasis, *Loa loa* and malaria, by country, WHO African Region, 2012

	Lymphatic filariasis		Onchocerciasis	Loiasis	Malaria		
Country	Prevalence	MDA	Prevalence	Prevalence	Prevalence	LLIN	IRS
Angola	Mapping started	Not started	Endemic	Endemic	Endemic	Yes	Yes
Cameroon	Mapping almost completed	Ongoing since 2008 in 132 IUs	Endemic	Endemic	Endemic	Yes	Yes
Central African Republic	Mapping half-way	Not started	Endemic	Endemic	Endemic	Yes	No
Ghana	Mapping completed	Ongoing	Endemic	Not endemic	Endemic	Yes	Yes
Liberia	Mapping completed in 2010	Planned to start from Apr 2012	Endemic	Not endemic	Endemic	Yes	Yes

IRS, indoor residual spraying; IU, implementation unit; LLIN, long-lasting insecticidal net; MDA, mass drug administration

3.4 Next steps

As an outcome of the meeting, recommended strategies are now available for the elimination of lymphatic filariasis in loiasis areas, and WHO will expedite the preparation of the updated guidelines. The WHO Regional Office for Africa is organizing two meetings in Burkina Faso and Zimbabwe respectively for countries to finalize their strategic plans for neglected tropical diseases. The recommendations of the current meeting will be incorporated in the master plan of countries where Loa loa is co-endemic.

Completion of lymphatic filariasis mapping, including in areas of loiasis, is the priority for countries. In some countries, the selection of implementation units for such mapping lymphatic filariasis should be streamlined with that for the loiasis and onchocerciasis implementation units for. The WHO Regional Office for Africa indicated its plans to expedite completion of lymphatic filariasis mapping in African countries.

To improve coordination among programmes, lymphatic filariasis programme personnel should participate in country coordination meetings on malaria control (e.g. those involving the United States President's Malaria Initiative). Malaria programmes are generally more effective at distributing nets than at ensuring proper use of those nets. Here, lymphatic filariasis programmes could usefully contribute by mobilizing their network of community drug distributors to help improve usage and maintenance of bednets, to reduce transmission of both diseases. A challenge remains, however, in areas endemic for *Loa loa*, especially those where onchocerciasis is non-endemic or hypo-endemic, because the network of community drug distributors still needs to be developed.

Adequate training of health workers and community drug distributors on mass drug administration and training on monitoring and evaluation is critical to successful implementation and evaluation. Also, advocacy on the role of vector control in elimination of lymphatic filariasis is an urgent need in countries because misconceptions about transmission of the disease and the contribution of vector control interventions are common, including at the policy level. In this respect, monitoring and evaluation of the effect of distribution of long-lasting insecticidal nets and their usage on lymphatic filariasis prevalence rates is required to demonstrate benefits of vector control for elimination of the disease. Long-lasting insecticidal nets and indoor residual spraying are the most promising tools for vector control of lymphatic filariasis in most settings in African countries; however, it was suggested that criteria for deciding between the selection of nets or spraying should be developed.

4. User opinions on the "Manual on entomology of lymphatic filariasis"

Vector control has an important complementary role in interrupting transmission of lymphatic filariasis, particularly in areas where *Loa loa* is endemic. Basic vector bionomics and vector transmission dynamics are an integral part of the epidemiological service to eliminate lymphatic filariasis. Therefore, entomologists have an important role to play in planning national elimination programmes.

A manual on entomology of lymphatic filariasis would be needed to guide entomologists on appropriate vector control strategies, and to increase programme managers' understanding of the use and value of entomological procedures and their epidemiological implications for elimination programmes.

A working group considered the outline of chapters for the manual and the content for each chapter (see extract below). The manual will explain the epidemiological significance of vector control in various settings; provide descriptions of vector species, and biology and control options for vector genera; describe entomological techniques (e.g. to assess microfilariae infection rates, annual transmission potential); explain relevant vector control methods and vector surveillance methods; and discuss how vector control programmes for lymphatic filariasis could be managed, organized and implemented particularly in relation to existing vector control programmes (e.g. for malaria control).

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The country representatives agreed the need for such a manual. The following provisional timeline for its preparation was proposed:

- First draft completed (second quarter of 2012)
- Editing completed (third quarter of 2012)
- Comments submitted (third quarter of 2012)
- Files submitted to printer (fourth quarter of 2012)
- Printing for the seventh GAELF meeting (fourth quarter of 2012)

5. Integrated vector management: experiences in Africa

Intersectoral coordination on vector control has been established in several countries of Africa, either through a steering committee on integrated vector management, an existing Pesticides Board, or both. In Cameroon, technical working groups have also been established under the auspices of the steering committee to provide guidance on insecticide resistance management and the selection of vector control methods. In other countries, coordination between programmes and sectors is still lacking. The immediate requirement for lymphatic filariasis vector control is to establish coordination within the health sector, especially with the malaria control programme or with the Expanded Programme on Immunization.

Vector control needs assessment is a tool to assist countries in adapting their resource capacity to their needs for vector control. Assessments have been conducted in an estimated half of the countries in Africa, and include the available information on lymphatic filariasis. Consequently, the assessment should be streamlined to incorporate the specific requirements for situational analyses on the management and organization of lymphatic filariasis.

Some countries have noted a problem with competing incentive mechanisms at community level. Hence, community drug distributors are linked to the lymphatic filariasis programme, but a problem may arise when they also become involved in the malaria programme through the distribution or surveillance of long-lasting insecticidal nets. Also, the Expanded Programme on Immunization has its own incentives mechanism. Consequently, coordination is required to harmonize this issue between programmes, for example by having agreed budget lines on incentives, to ensure continued motivation of community-based workers or volunteers to participate in health programmes.

Capacity building is a major challenge for implementation of integrated vector management, and several opportunities for training and networking at country-level and regional-level have been identified. Capacity on entomological monitoring and data management needs to be developed as a routine component of programme operations. Available entomological manuals in relation to malaria may need adaptation for use for lymphatic filariasis. Laboratory facilities and equipment are still lacking in some countries but are being supported by the Global Fund as a requirement to support monitoring and evaluation activities for malaria

control. Hence, countries should ensure that adequate consideration is given to laboratory facilities and equipment in funding proposals and national resource mobilization to support their monitoring and evaluation activities.

Another major challenge in establishing integrated vector management in countries is advocacy of its benefits for elimination of lymphatic filariasis and malaria, at both policy level and community level. Some countries have managed such advocacy to policy makers, for example through meetings with authorities and leaders, but the challenge remains to motivate community health workers and volunteers as well as the community at large.

Research in some countries should engage more closely with implementation programmes to address operational needs. Research involvement in operations is usually through monitoring and evaluation. However, programmes should also be encouraged to develop their internal capacity for monitoring and evaluation. The problem of research being detached from operational needs was highlighted, leaving programmes in some countries without access to an evidence base for decision-making.

5.1 Monitoring and evaluation of integrated vector management

WHO has developed a guidance document on monitoring and evaluation of integrated vector management. Its main purpose is to guide countries in monitoring and evaluation of the implementation of their national integrated vector management strategy, which will help them making improvements where required. The secondary purpose is to propose standard methods that will facilitate monitoring and evaluation at regional and global levels. The document is in line with the operational framework of the *Handbook for integrated vector management*. The target audience is the multidisciplinary technical working groups tasked with the development of procedures for monitoring and evaluation of integrated vector management as well as those involved in carrying out the monitoring and evaluation activities. The challenge for monitoring and evaluation is how to measure the 'transformation of vector control'; how to assess positive change for each of the components of integrated vector management, from policy to capacity building. The expected outcomes should therefore be defined, and indicators that are specific to these expected outcomes and that will be easy to measure should be identified. The proposed outcome indicators of integrated vector management will be discussed in detail in another document. The meeting discussed these indicators and made some suggestions to improve the document further.

6. Conclusions and recommendations

We, the participants of the WHO meeting on lymphatic filariasis, malaria and integrated vector management,

> Acknowledging the significant advances made in global efforts to control and/or eliminate neglected tropical diseases, especially lymphatic filariasis, through the Global Programme to Eliminate Lymphatic Filariasis, which is one of the largest initiatives in global public health;
>
> Cognizant that these efforts have culminated in extensive campaigns of mass drug administration in endemic countries targeting lymphatic filariasis and other priority neglected tropical diseases, resulting in significant reductions in transmission in many areas;
>
> Recognizing that co-endemicity of *Loa loa* in countries of central Africa presents severe constraints to the effective implementation of mass drug administration, primarily due to the potential for serious adverse events associated with ivermectin and diethylcarbamazine in people infected with *Loa loa*;

Aware of the potential effectiveness of albendazole alone on microfilariae of *Wuchereria bancrofti*. Though further efficacy trials are needed and are under way;

Mindful that for a number of countries, the geographical distribution of lymphatic filariasis is still not fully known and that efforts to conduct systematic mapping are constrained by lack of technical capacity and/or financial resources;

Noting that the effectiveness of vector control interventions on reducing transmission of lymphatic filariasis has been demonstrated in a number of settings;

Recognizing that, as a mosquito-borne disease, current malaria vector control interventions present significant opportunities to accelerate the interruption of lymphatic filariasis transmission, complementing ongoing mass drug administration initiatives, and that the infrastructure of mass drug administration programmes presents an enormous opportunity to further the goals of malaria vector control, particularly for enhancing net ownership, use and maintenance;

Do hereby recommend that:

Mapping of the distribution and burden of lymphatic filariasis must be undertaken and completed in endemic countries, as a matter of urgency, because this is fundamental to developing national strategies and implementation plans;

Where *Loa loa* infection is present and onchocerciasis is non-endemic or hypo-endemic (<20% of nodule prevalence), mass drug administration for lymphatic filariasis elimination should be done using albendazole alone 400 mg twice per year. This mass drug administration should be supplemented by vector control. The meeting recommends, accordingly, that the WHO guidelines on preventive chemotherapy (section on the lymphatic filariasis elimination programme in areas with *Loa loa*) be updated as a “provisional measure” (Annex 3);

National authorities be encouraged to fully explore and implement vector control using integrated vector management approaches for elimination of lymphatic filariasis;

National programmes should take cognizance of locally-generated evidence in the context of their integrated vector management strategies;

A manual on entomology of lymphatic filariasis is needed to guide entomologists on appropriate vector control strategies for national elimination programmes; and

Under the auspices of WHO, partners should collaborate with national authorities to support elimination of lymphatic filariasis, targeting particularly the creation of conducive strategies and resource allocation to sustain elimination efforts.

Annex 1. List of participants

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Annex 2. Programme of work

Sub-meeting 1: Strategic plan on LF Malaria IVM in endemic countries with Loa loa
Sub-meeting 2: Development of "LF Entomology"
Sub-meeting 3: Advancing IVM in Africa: country experiences

Day 1 – Monday 5 March 2012

09:00– 09:15	**1. Welcome remarks and introduction**	AFRO, WR Ghana
09:15–09:30	**2. Overall meeting objectives and Sub-Meeting No1, No2 and No3 objectives**	K. Ichimori
09:30–10:30	***Sub-meeting 1: strategic planning***	
	3. Current Situations- Global and AFRO	
	3-1. GPELF LF	K. Ichimori
	3-2. GMP Malaria	B. Ameneshewa
	3-3. IVM, vector control	R. Velayudhan
	3-4. AFRO NTD and Malaria	A. Garba
10:30–11:00	**Coffee break**	
11:00–13:00	3-5. Report and recommendations from MDP Loa loa Scientific Working Group meeting	Y. Sodahlon
	3-6. Report and recommendations from RBM Vector Control Working Group meeting	J. Williams
	3-7. LF and Malaria vector control (review)	B. Henk
	3-8. Research findings -	
	- CDC	R. Wirtz
	- The Carter Center	A. Patterson
	- Noguchi Institute	D .Boakye
	- University of Ghana	J. Gyapong
	- CNTD/LSTM	L. Kelly-Hope
13:00–14:00	**Lunch break**	
14:00–16:00	**4. Country situations**	
	4-2. Angola	
	4-3. Cameroon	
	4-4. Central Africa Republic	Country representatives
16:00–16:30	**Coffee break**	
16:30–17:30	4-8. Nigeria	
	4-9. Liberia	Country representatives
	Discussion	
	5. Summary of country challenges	M. Bockarie/T. Thompson

Day 2 – Tuesday 6 March 2012

09:00–09:30	**Summary of day 1**	Rapporteur
	Group work: discussion points and framework	K. Ichimori
09:30–10:30	**6. Group work - "Global strategy on LF Malaria IVM in endemic countries with Loa"**	
	Group 1.Preventive chemotherapy	
	Group 2. Integrated vector management	
10:30–11:00	**Coffee break**	
11:00–12:00	Group work (continued)	
12:00–13:30	**Lunch break**	
13:30–15:30	**7. Group presentations and plenary discussion**	Group chairs
	Integration : programme steps	
15:30–16:00	**Coffee break**	
16:00–17:00	**Conclusion and recommendations**	Chair

Day 3 – Wednesday 7 March 2012

	Sub-meeting 1: strategic planning		*Sub-meeting 2: LF Entomology*	
Time	**Session**	**Facilitator**	**Session**	**Facilitator**
09:00–09: 30	**8. Workshop on development of national LF programme**	R. Velayudhan Y. Sodahlon J. Gyapong R. Thompson B. Ameneshewa	**9. Introduction and objectives**	M. Bockarie
09:30–10:30			**10. Outlines and draft document** 10-1. GPELF and Entomology 10-2. Scope and purpose	K. Ichimori P. Graves
10:30–11:00	**Coffee break**		**Coffee break**	
11:00–12:30	Workshop continued		10-3. II. Vector Profiles 10-4. III Entomological Methods and Techniques	R. Wirtz P. Jamblingam
12:30–14:00	**Lunch break**		**Lunch break**	
14:00–16:00	Workshop continued		10-5. LF Vector control 10-6. Organization and management of vector control in PELF	B. Koudou Henk van den Berg
16:00–16:30	**Coffee break**		**Coffee break**	
16:30–17:30	**Conclusion**		**11. Summary**	

Day 4 – Thursday 8 March 2012

09:00–09:30	***Sub-meeting 1: strategic planning*** **Summary of day 3**	Chairs/ Rapporteurs
09:30–10:30	**12. Strategic planning:** - Global policy and strategy - National LF programmes: country presentations - Next steps – discussion	R. Thompson
10:30–11:00	**Coffee break**	
11:00–12:00	**Meeting 1: conclusions and recommendations**	
12:00–13:30	**Lunch break**	
13:30–15:30	***Sub-meeting 2: LF entomology*** **Summary of day 3** **13. LF entomology: "users opinion – programme supporting manual "LF entomology"** 13-1. Country participants LF 13-2. Country participants Malaria 13-3. Implementation supporters	P. Graves
15:30–16:00	**Coffee break**	
16:00–17:00	**Meeting 2: next steps and recommendations**	Chair

Day 5 – Friday 9 March 2012

09:00–09:30	***Sub-meeting 3: IVM experiences in Africa*** **14. Introduction and objectives**	J. Williams
09:30–10:30	**15. Three areas of key elements** 15-1. Advocacy 15-2. Capacity building 15-3. Evidence-based Monitoring and evaluation for IVM	R. Velayudhan
10:30–11:00	**Coffee break**	
11:00–12:30	**16. IVM - cost-effective programme** 16-1. Multi -disease approaches 16-2. Multi -Intervention approaches 16-3. Decision making system	Henk van den Berg
12:30–14:00	**Lunch break**	
14:00–16:00	**17. Conclusions and recommendations**	

Annex 3. The Accra Strategy (provisional strategy)

Statement recommended by the meeting on the implementation strategy for lymphatic filariasis elimination programmes in countries where loiasis is co-endemic

The following points are to be added to the WHO preventive chemotherapy manual, section "Co-administration of Mectizan and ALB in areas where *Loa loa* is co-endemic":

> Where *Loa loa* infection is present and onchocerciasis is non-endemic or hypo-endemic (that is, less than 20% of nodule prevalence), mass drug administration could be implemented with albendazole alone (400 mg) twice per year.
>
> In addition to preventive chemotherapy, integrated vector management should be implemented to accelerate interruption of lymphatic filariasis transmission. Since all areas infected with *Loa loa* are also endemic for malaria, and given that lymphatic filariasis and malaria in these areas share the same vector species, human populations should receive universal coverage with malaria vector control interventions targeting the vectors of both lymphatic filariasis and malaria.[1]
>
> [1] For further information on vector control for lymphatic filariasis, see *Manual on practical entomology in lymphatic filariasis* [in preparation].

This newly recommended strategy complements the current WHO guidelines on preventive chemotherapy[7] and guidelines published by the African Programme for Onchocerciasis Control.[6]

The Global Programme to Eliminate Lymphatic Filariasis targets the global elimination of lymphatic filariasis as a public-health problem by 2020. The main strategy is to interrupt transmission through integrated preventive chemotherapy, using mass drug administration to treat entire populations at risk of the disease, with a combination of albendazole plus ivermectin or albendazole plus diethylcarbamazine administered as a single dose once a year for at least 5 years.

Because ivermectin or diethylcarbamazine can cause serious adverse effects in people infected with *Loa loa* causing loiasis (African eye worm), an endemic disease in a large part of central Africa, the current guidelines for preventive chemotherapy contain no recommendation for areas where lymphatic filariasis and loiasis are co-endemic but where onchocerciasis is hypo-endemic or non-endemic. Consequently, mass drug administration to eliminate lymphatic filariasis using the combination of medicines recommended by the World Health Organization could thus far not be implemented in these communities. In order to meet the 2020 goal, it has become urgent to develop an alternative strategy for interrupting transmission of lymphatic filariasis adapted to the specific situation of co-endemicity with *Loa loa*. This strategy could potentially include both medication and vector control.

The milestones for the Global Programme to Eliminate Lymphatic Filariasis 2010–2020 stipulate that by 2012, a provisional strategy for interrupting lymphatic filariasis transmission in loiasis-endemic countries should have been developed; and that by 2013, a revised strategy for interrupting lymphatic filariasis transmission should have been implemented in all loiasis-endemic countries.

In June 2011, a preliminary meeting on *Loa loa* in Lusaka, Zambia, proposed the following provisional strategies for eliminating lymphatic filariasis in areas where *Loa loa* is co-endemic: integrated vector management as the main strategy, and mapping of lymphatic filariasis and *Loa loa* at the lowest possible administrative level to potentially identify small areas that can be treated for lymphatic filariasis.

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