

WORLD HEALTH ORGANIZATION
GLOBAL PROGRAMME TO ELIMINATE
LYMPHATIC FILARIASIS

PROGRESS REPORT **2000–2009** AND
STRATEGIC PLAN **2010–2020**

LYMPHATIC **FILARIASIS**

WHO GPELF PROGRESS REPORT 2000–2009 AND STRATEGIC PLAN 2010–2020

Lymphatic filariasis is one of the oldest and most debilitating neglected tropical diseases. An estimated 120 million people in 81 countries are infected currently, and an estimated 1.34 billion live in areas where filariasis is endemic and are at risk of infection. Approximately 40 million people suffer from the stigmatizing and disabling clinical manifestations of the disease, including 15 million who have lymphoedema (elephantiasis) and 25 million men who have urogenital swelling, principally scrotal hydrocele.

The year 2010 marks the halfway point towards the projected goal of eliminating the disease by 2020; this is thus an appropriate time to reflect on the progress made, lessons learnt and the challenges ahead. Global health has changed dramatically since 2000. The Global Programme to Eliminate Lymphatic Filariasis is now part of a comprehensive programme of efforts to control neglected tropical diseases, in which preventive chemotherapy, vector control and morbidity management are increasingly integrated and delivered as multi-intervention packages at the global, national and local levels.

The first 10 years of the Global Programme have seen extraordinary growth. The partnerships that made this growth possible will sustain the programme during the coming decade. The goal of eliminating lymphatic filariasis will be realized within an integrated programme of control; this approach holds the promise of developing greater synergies among programmes to eliminate the disease and other health programmes, and of further extending the benefits of the Global Programme to neglected populations.

*“halfway towards eliminating
lymphatic filariasis ...”*

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**World Health
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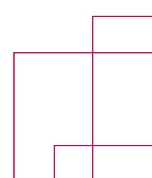
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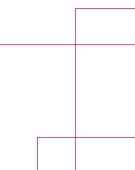
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Abbreviations

DEC	diethylcarbamazine
GAELF	Global Alliance to Eliminate Lymphatic Filariasis
GPELF	Global Programme to Eliminate Lymphatic Filariasis
LF	lymphatic filariasis
MDA	mass drug administration
MDG	Millennium Development Goal
NGO	nongovernmental organization
NTD	neglected tropical disease
PacELF	Pacific Programme to Eliminate Lymphatic Filariasis
WHO	World Health Organization





Executive summary

Lymphatic filariasis (LF) is one of the oldest and most debilitating neglected tropical diseases (NTDs). LF is caused by parasitic worms that are transmitted to humans by mosquitoes. An estimated 120 million people in 81 countries are infected currently, and an estimated 1.34 billion live in areas where filariasis is endemic and are at risk of infection. Approximately 40 million people suffer from the stigmatizing and disabling clinical manifestations of the disease, including 15 million who have lymphoedema (elephantiasis) and 25 million men who have urogenital swelling, principally scrotal hydrocele.

In 1997, the World Health Assembly called upon Member States to develop national plans that would lead to the elimination of LF. In 2000, the World Health Organization (WHO) established the Global Programme to Eliminate Lymphatic Filariasis (GPELF), which has the goal of eliminating lymphatic filariasis as a public-health problem by the year 2020. The strategy aiming to achieve this goal is twofold. First, interrupt transmission using combinations of two medicines delivered to entire populations at risk, a strategy known as mass drug administration (MDA). Second, alleviate suffering and disability by introducing basic measures, such as improved hygiene and skin care, to people with lymphoedema and by providing surgery for men with hydrocele.

The World Health Assembly's 1997 resolution had a cascading effect on national governments, donors and aid agencies. In January 1998, SmithKline Beecham (now GlaxoSmithKline) announced it would donate albendazole for as long as needed to eliminate the disease. Merck & Co., Inc., pledged to provide ivermectin for elimination in all countries where LF and onchocerciasis are co-endemic. An outpouring of interest and support led to the formation of the Global Alliance to Eliminate Lymphatic Filariasis (GAELF) in 2000, a public-private partnership that assists GPELF with advocacy, coordinating partners and mobilizing resources.

The year 2010 marks the halfway point towards the projected goal of eliminating the disease by 2020; this is thus an appropriate time to reflect on the progress made, lessons learnt and the challenges ahead. Global health has changed dramatically since 2000. GPELF is now part of a comprehensive programme of NTD control efforts, in which preventive chemotherapy, vector control and morbidity management are increasingly integrated and delivered as multi-intervention packages at the global, national and local levels.

Section 1 of this document provides background information. Section 2 reports on progress made towards eliminating the disease worldwide and highlights the major challenges remaining. Section 3 outlines a strategic plan for the next decade of GPELF, and Section 4 summarizes the highlights and priorities for each WHO region where the disease is endemic.

Progress report 2000–2009

GPELF has been one of the most rapidly expanding global health programmes in the history of public health. Of the 81 countries where LF is currently considered endemic, 53 have started implementing MDA to stop transmission. During 2000–2009, more than 2.8 billion doses of medicine were delivered to a cumulative targeted population of 845 million people. Of the 53 countries that have implemented MDA, 37 (70%) have completed 5 or more rounds of MDA in at least some of their endemic areas: this is the number of rounds thought to be adequate in most settings to interrupt transmission. The overall economic benefit of the programme during 2000–2007 is conservatively estimated at US\$ 24 billion.

During its first decade, GPELF focused on beginning, which involved developing guidelines based on existing knowledge, initiating programmes in every WHO region where the disease was endemic, and scaling up the programme as rapidly as possible. These efforts must continue. In particular:

- *implementing MDA* is a priority in the remaining 18 countries that require it. Many have fragile infrastructures, are experiencing active conflict, or are in post-conflict situations. In Africa, at least 10 of these countries are co-endemic for Loa loa infection, which presents safety challenges when delivering MDA using currently recommended regimens;
- *scaling up* programmes to achieve full geographical coverage is essential, especially in the countries that account for approximately 70% of the global burden – Bangladesh, the Democratic Republic of the Congo, India, Indonesia, and Nigeria. Delivering MDA in urban environments will require innovative strategies to ensure adequate participation.

While these efforts must continue, the focus for the second decade will broaden to ensure a successful ending. Thus, attention must be given to applying effective tools and strategies to accurately determine when transmission has been

interrupted, implementing effective post-intervention surveillance, and providing official verification when transmission has been successfully interrupted. The programme also must focus more broadly on managing chronic morbidity, which typically persists even after transmission has been interrupted. Of the 81 endemic countries, only 27 (33%) have active morbidity-management programmes.

The 2000–2009 progress report highlights the essential contributions made by operational research, advocacy and partnership, governance, and health systems in making the achievements of GPELF's first decade possible. It concludes with an analysis of the health and economic benefits of the programme.

Strategic plan 2010–2020

Strategic objectives have been established for interrupting transmission by 2020. They address the specific challenges of initiating MDA, other interventions, or both, in all endemic areas, scaling up these interventions to full geographical coverage, stopping interventions when transmission has been interrupted, establishing effective surveillance after MDA has stopped, and verifying success.

Strategic objectives also have been established for providing basic care to all people suffering from LF-related morbidity. They address the specific challenges of initiating morbidity-management programmes in all endemic countries, developing guidelines, developing metrics for monitoring and reporting on programmes, and scaling up interventions to provide access to care for all who need it. The strategic plan suggests future directions to be taken by operational research, advocacy and partnership, governance, and health systems.

The first 10 years of GPELF have seen extraordinary growth. The partnerships that made this growth possible will sustain the programme during the coming decade. The goal of eliminating LF will be realized within an integrated programme of NTD control, an approach that holds the promise of developing even greater synergy among programmes to eliminate LF and other health programmes, and of further extending the benefits of GPELF to neglected populations.

McINTOSH STEREOPTICON
COMPANY, CHICAGO.



Elephantiasis 157

Section 1

Introduction and rationale

1.1 Lymphatic filariasis

Lymphatic filariasis (LF) is one of the oldest and most debilitating neglected tropical diseases (NTDs). LF is caused by three species of parasitic worms, *Wuchereria bancrofti*, *Brugia malayi* and *B. timori*, which are transmitted to humans by mosquitoes. An estimated 120 million people in 81 countries are infected with at least one of these parasite species, and an estimated 1.34 billion live in areas where filariasis is endemic and are therefore at risk of infection. Approximately 65% of those at risk reside in WHO's South-East Asia Region, 30% in the African Region and the remainder in other parts of the tropical world (*Annex*).

Box 1. Lymphatic filariasis

Lymphatic filariasis is caused by infection with nematodes of the Filariodidea family. Some 90% of infections are caused by *Wuchereria bancrofti*, and most of the remainder are caused by *Brugia malayi*.

Humans are the exclusive host of infection with *W. bancrofti*. Certain strains of *B. malayi* can also infect some animal species (felines and monkeys), but the life-cycles in humans and those in animals generally remain epidemiologically distinct.

The major vectors of *W. bancrofti* are mosquitoes of the genus *Culex* (mainly in urban and semi-urban areas), *Anopheles* (mainly in rural areas) and *Aedes* (mainly in endemic islands of the Pacific). *B. malayi* is transmitted by various species of the genus *Mansonia*, although in some areas anopheline mosquitoes transmit *B. malayi*.

W. bancrofti is transmitted throughout the tropics in Asia, Africa, the Pacific and the Americas. Brugian parasites are confined to areas in east and south Asia.

The most common clinical manifestations of LF include lymphoedema, affecting some 15 million people, and scrotal hydrocele, affecting some 25 million men. Lymphoedema and hydrocele adversely affect personal and social life, and limit occupational activities, making LF the second leading cause of chronic disability worldwide (1). The economic costs of the disease are enormous, estimated at more than US\$1 billion per year in India alone (2). LF is a disease of poverty (3).

1.2 LF elimination and the origins of GPELF

During the last quarter of the twentieth century, major advances were made in diagnosing and testing for LF infection, and in understanding the epidemiology and treatment of chronic LF-related disease. These advances, made possible largely through research funded by the Special Programme for Research and Training in Tropical Diseases, significantly changed the dimensions of LF control and paved the way for the development of a global strategy to eliminate the disease. In 1993, the International Task Force for Disease Eradication listed LF as one of only six “eradicable or potentially eradicable” diseases (4). In 1997, the World Health Assembly called upon Member States “to take advantage of recent advances in the understanding of lymphatic filariasis and the new opportunities for its elimination by developing national plans leading to its elimination, as well as for the monitoring and evaluation of programme activities” (World Health Assembly resolution 50.29, 13 May 1997).

In 2000, WHO established the Global Programme to Eliminate Lymphatic Filariasis (GPELF), which has the goal of eliminating the disease as a public-health problem by 2020. The strategy aimed at achieving this goal is twofold. First, interrupt transmission of the LF parasite by delivering single annual doses of diethylcarbamazine (DEC) or ivermectin plus albendazole to the entire eligible population living in areas where the disease is endemic (defined as areas where the prevalence of microfilaraemia or antigenaemia is $\geq 1\%$). In addition to interrupting transmission, mass drug administration (MDA) provides significant collateral health benefits, such as reduced morbidity from intestinal worms and ectoparasites (for example, lice). Second, alleviate suffering and disability by introducing basic measures, such as improved hygiene and skin care, for those with lymphoedema and by providing surgery for men with hydrocele.

The 1997 World Health Assembly resolution had a cascading effect on national governments, donors and aid agencies. In January 1998, the pharmaceutical company SmithKline Beecham (now GlaxoSmithKline), announced its commitment to collaborating with WHO by providing albendazole free of charge for as long as needed to eliminate the disease. Soon after, Merck & Co., Inc., pledged to expand its Mectizan® Donation Program for onchocerciasis (river blindness) to provide ivermectin for LF elimination in all countries where LF and onchocerciasis are co-endemic. By the end of 1999, 27 international partners had come forward to support

GPELF. This outpouring of interest and support led to the formation of the Global Alliance to Eliminate Lymphatic Filariasis (GAELF) in 2000. GAELF is a public–private partnership, with membership open to all interested parties; it assists GPELF by engaging in advocacy, coordinating partners and mobilizing resources.

1.3 GPELF 2000–2009

GPELF has been one of the most rapidly expanding global health programmes in the history of public health (5). During the first 10 years of the programme (2000–2009) more than 2.8 billion doses of medicine were delivered to a cumulative targeted population of 845 million individuals (Section 2.1.2.2.1). GPELF's success is based on strong global partnerships, commitment and political will at the national level, pharmaceutical donations, rapid scaling up of MDA and an appreciation of the broader health impacts of delivering MDA annually. In the wider context, the programme has helped strengthen health systems, and in-country operational research and robust monitoring and evaluation have enabled programmes to adapt as needed.

Since 2000, the dramatic growth of GPELF has occurred within a rapidly changing global health landscape. The Commission on Macroeconomics and Health released its report in 2001 (6); the Millennium Development Goals (MDGs), with their emphasis on alleviating poverty, were adopted; the Global Fund for AIDS, Tuberculosis, and Malaria was established in 2002; numerous worldwide public–private partnerships have emerged; and significant funding has been allocated to improve global health by the Bill and Melinda Gates Foundation as well as bilateral aid agencies. The fact that LF is a disease of the poor as well as a significant contributor to poverty has focused attention on the potential for GPELF to contribute to achieving the MDGs, particularly number 6, which aims to combat HIV, malaria and other diseases.

The first strategic plan for GPELF was published in 1999 (7). Considerable progress has been made towards the goal of eliminating LF as a public-health problem worldwide since then, yet important challenges remain. Conducting operational research, collecting scientific evidence and evaluating programmes have been central to GPELF's work since its inception. Under the auspices of WHO, a Strategic and Technical Advisory Group for Neglected Tropical Diseases also has been formed to guide the programme. Support centres have been established in Australia, Ghana, the United Kingdom and the United States to provide support for research and programme implementation. Regional programme review groups have been formed to decentralize the governance of the elimination programme and to address specific regional issues in elimination. There is one programme review group in each of the five WHO regions where the disease is endemic, with the exception of the Western Pacific Region, in which there is one for the Pacific island countries (the Pacific Programme to Eliminate Lymphatic Filariasis, known as PacELF) and another

for countries of the Mekong and the surrounding region (known as Mekong-Plus). Through these institutions and organizational structures, much has been learnt about eliminating the disease and what is required to achieve success.

1.4 Neglected tropical diseases

Since 2005, one of the most significant changes in global health has been the bundling of LF with other NTDs for the purposes of improving advocacy, programme efficiency, integration and health impacts. The diseases in the NTD basket are those that can be controlled or eliminated through WHO's strategy of preventive chemotherapy.

In 2006, to provide access to treatment for poor and marginalized populations, WHO developed a set of comprehensive guidelines for the integrated use of anthelmintic medicines for large-scale preventive chemotherapy (8). In 2007, WHO published the *Global plan to combat neglected tropical diseases 2008–2015* with its vision of “a world free of neglected tropical diseases and zoonoses” (9). This global plan is formulated according to the principles of everyone's right to health; using existing health systems as a setting for interventions; having health systems coordinate the response to NTDs; integrating disease-specific programmes and ensuring equity in delivery of care; and intensifying control of diseases alongside policies that help people who are poor or marginalized.

The priorities for advancing the strategic control of NTDs include: (i) integrating approaches and packages to deliver multiple interventions; (ii) ensuring that all people have free and timely access to high-quality medicines, diagnostic and preventive tools, and services; (iii) strengthening and building capacity for integrated vector management; (iv) developing partnerships and mobilizing resources; and (v) promoting an intersectoral, interprogrammatic approach.

Because of its rapid success in scaling up interventions, conducting operational research, and implementing programmes, efforts to control LF provide a programmatic platform for the control of other NTDs.

1.5 Rationale: halfway to 2020

As GPELF reaches the halfway point in its projected goal of eliminating LF by 2020, it is an opportune time to assess progress, review lessons learnt, identify major challenges, highlight future opportunities, and update the strategic plan for the next 10 years. Such a review is especially necessary in view of emerging opportunities arising from the findings of operational research that may enhance elimination strategies, as well as the new emphasis on integrating control of all NTDs.

This report and strategic plan represent the culmination of at least one year of meetings and deliberations. Informal meetings were initially held in January and March 2010 at the Task Force for Global Health in Decatur, Georgia, USA. Further discussions were held at WHO's Headquarters in Geneva in May 2010. The report of this latter meeting was endorsed at the sixth meeting of GAELE, held in Seoul, Republic of Korea, in June 2010.

The purpose of this document is to guide governments of countries where LF is endemic in their efforts to eliminate the disease, and to encourage international donors, health professionals, nongovernmental organizations (NGOs) and academic institutions to enhance their support of global and national programmes to eliminate LF.



Lymphatic filariasis patient in Panasabasta village, Baghamari granpanchayat, Begunia Block, Khurda, Orissa.

Section 2

Progress report 2000–2009

GPELF bases its efforts to eliminate LF as a public health problem on two major components: (i) interrupting transmission and (ii) managing morbidity and preventing disability. Progress made in these areas is addressed in the first and second parts of this section, respectively.

Other elements of the programme, which support and make possible these two components, include conducting operational research, developing partnerships and engaging in advocacy, improving governance, and strengthening health systems. Part 3 reviews the progress made and developments in these areas; the overall impact of the programme is highlighted in part 4.

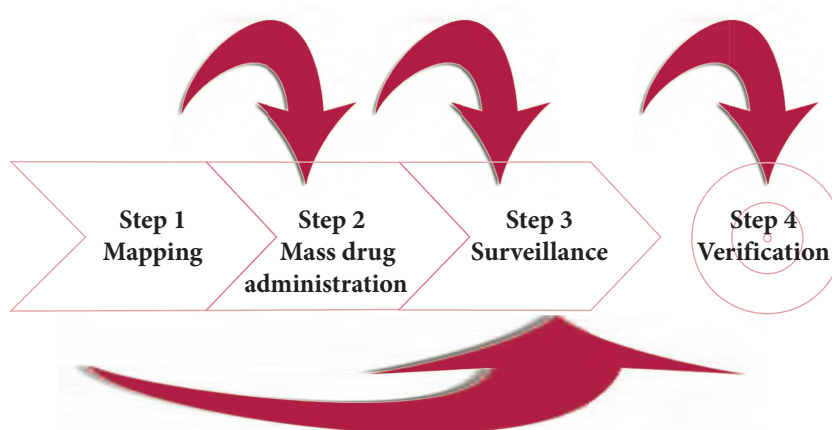
2.1. Interrupting transmission

2.1.1 Strategies and steps to interrupt transmission

Four sequential programmatic steps are recommended by WHO to interrupt transmission (*Figure 1*).

- Areas suspected of being endemic are mapped to determine the geographical distribution of the disease and identify areas in need of MDA.
- MDA is implemented and continued for a period of five years or more to reduce the number of parasites in the blood to levels that will prevent mosquito vectors from transmitting infection.
- Surveillance is implemented after MDA is discontinued to identify areas of ongoing transmission or recrudescence.
- If criteria are met, the elimination of transmission is verified.

Figure 1. Programmatic steps taken by the Global Programme to Eliminate Lymphatic Filariasis to interrupt transmission



Mapping. Mapping is the fundamental platform from which elimination programmes are launched; it provides essential information on the geographical distribution of LF and on where the prevalence is high enough to warrant intervention.

MDA. MDA is recognized as the main strategy that will enable GPELF to achieve elimination by 2020. The intent of MDA is to target *every eligible individual*, including children, living in all endemic areas. Its effectiveness in reducing microfilarial prevalence and density in the blood is directly related to the proportion of the population that takes the medicines every year (known as epidemiological drug coverage). The minimum effective coverage of the total population is considered to be 65% (10).

The recommended regimens for MDA are:

- once-yearly treatment with a single dose of two medicines given together – albendazole (400 mg) plus either ivermectin (150–200 mcg/kg) or DEC (6mg/kg) for 4–6 years; or
- exclusive use of table and cooking salt fortified with DEC for 1–2 years. This regimen, which formed the basis for much of the successful elimination programme in China, has proven challenging to implement and expand in other settings (11).

Various strategies are used to reach target populations with medicine including door-to-door distribution or delivery through fixed posts, schools, workplaces and other central points. The use of directly observed treatment is strongly encouraged. Medicines may be administered by a range of personnel,

including non-health personnel who have been properly trained. Many countries utilize vast networks of community-level volunteers, including teachers. Others make use of community health workers, social workers or other health personnel.

Strong social mobilization at all levels before and during MDA is essential for achieving adequate coverage and compliance. Successful delivery of MDA also depends on establishing and maintaining an effective, high-quality supply chain for donated and nondonated medicines, as well as the capacity to monitor and report administration and safety issues.

Routine monitoring of coverage helps to ensure a programme's effectiveness and to identify areas in need of attention: for example, perhaps a particular high-risk group would benefit from more specifically targeted social mobilization. Microfilaraemia is assessed at baseline and, originally, before the fifth round of MDA in sentinel sites. WHO, in collaboration with research groups, is developing sampling strategies and guidelines for conducting surveys to decide if transmission has been interrupted; these guidelines should be available in 2011.

Post-MDA surveillance. When the criteria for interruption of transmission have been met in a given evaluation unit, and programmes decide to stop MDA, infection levels are monitored for at least five years, and routinely thereafter to evaluate whether recrudescence occurs. The strategies, methods and tools for post-MDA surveillance are being developed using findings from operational research and experience in several countries.

Verification of the absence of transmission. Official verification that a country has succeeded in interrupting transmission is the final step in the process. Specific criteria for verification are included in WHO's guidelines, which will be published in 2011.

2.1.2. Achievements

In 1996, epidemiological evidence suggested that 120 million people were infected with LF worldwide (12). Official estimates published by WHO in 2004 indicated that 1.34 billion people were at risk of infection in 83 countries (13). Of these 83 countries, two – China and the Republic of Korea – have been officially recognized as having eliminated LF as a public-health problem, making the current total 81 endemic countries.

2.1.2.1 Mapping

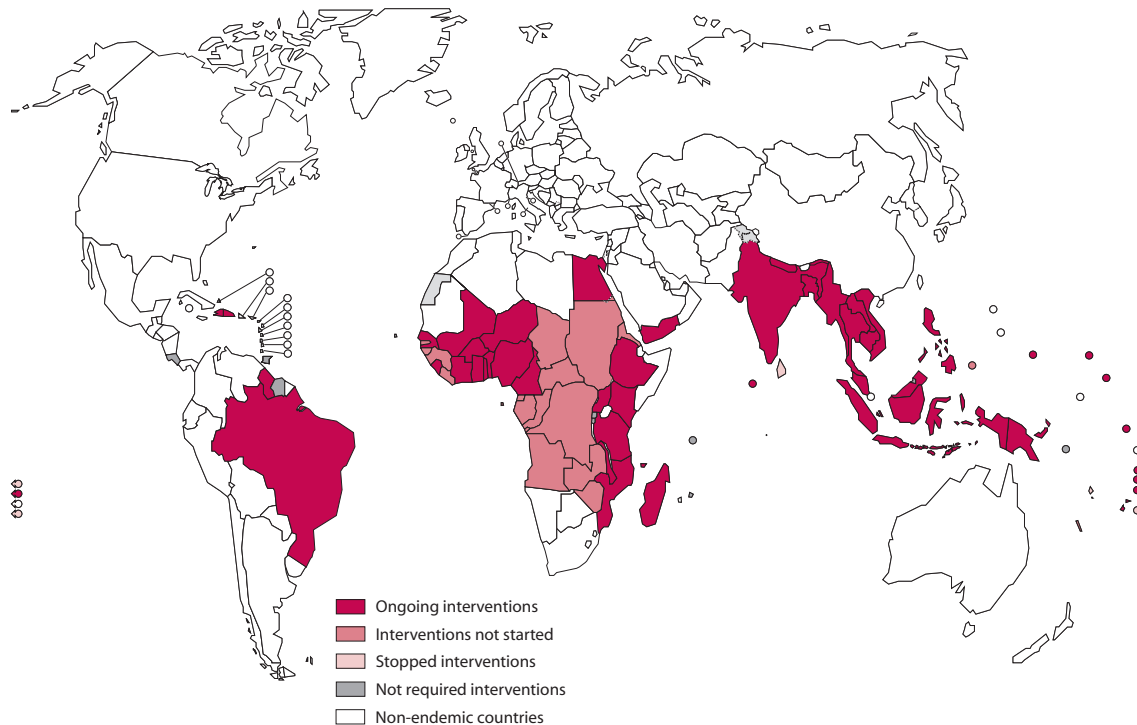
Of the 81 countries listed by WHO as being endemic, 68 had completed mapping their endemic foci by 2009 (Table 1). Of these, the results for 10 countries indicate that transmission exists at extremely low levels, if at all. Thus, MDA is not considered necessary in these countries. Mapping is in progress in 11 other countries, and 2 have yet to start the process. These maps have been pivotal in advocacy efforts, the determination of affected populations, and the effective planning of MDA programmes. Figure 2 shows the geographical distribution of the disease as well as the status of programme implementation.

Table 1. Mapping of lymphatic filariasis in 81 endemic countries, by WHO region or regional programme review group, 2009

Status of mapping	WHO region or regional programme review group						Total
	African	Americas	South-East Asia	Eastern Mediterranean	Mekong-Plus	PacELF	
Completed	27	7	9	2	6	17	68
In progress	10	0	0	1	0	0	11
Not started	2	0	0	0	0	0	2
Total	39	7	9	3	6	17	81

PacELF, Pacific Programme to Eliminate Lymphatic Filariasis.

Figure 2. Global distribution of lymphatic filariasis and status of mass drug administration (MDA), 2009

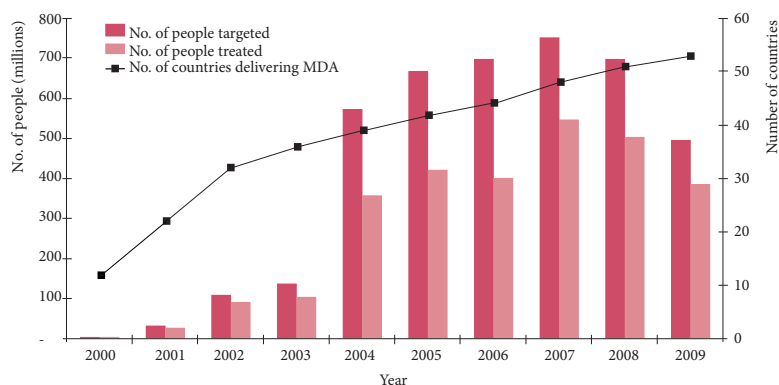


2.1.2.2 Mass drug administration

2.1.2.2.1 Number of countries implementing MDA

Since the launch of the programme, there has been a consistent and steady increase in the number of countries implementing MDA, from 12 in 2000 to 53 in 2009 (Figure 3). The status of MDA implementation by region is shown in Table 2. Of the 18 countries that are likely to require MDA but have not yet implemented it, 15 are in WHO's African Region.

Figure 3. Number of countries delivering mass drug administration (MDA) in one or more implementation units and number of people targeted and treated, 2000–2009^a



^a Data for 2009 do not include information on the number of people targeted and treated in four states in India.
Source: WHO preventive chemotherapy and transmission control databank (available at http://www.who.int/neglected_diseases/preventive_chemotherapy/databank/en/).

Table 2. Status of mass drug administration (MDA) in countries where lymphatic filariasis is endemic, by WHO region or regional programme review group, 2009

WHO region or regional programme review group	No. of endemic countries	Estimated population at risk	No. of countries unlikely to require MDA	No. of countries unlikely to initiate MDA	No. of countries yet to implement MDA ^a	No. of countries completing 5 or more rounds nationwide or in some implementation units	Cumulative number of people targeted for MDA (2000–2009)	Cumulative number of treatments (2000–2009)
African	39	405 938 634	5	15	19	10	106 396 818	281 247 743
Americas	7	11 349 793	3	0	4	3	5 922 193	12 532 495
South-East Asia	9	873 264 167	0	0	9	7	700 215 763	2 421 781 443
Eastern Mediterranean	3	12 565 325	0	1	2	2	2 908 890	14 125 270
Mekong-Plus	6	32 115 887	1	0	5	4	26 939 180	96 170 186
PacELF	17	5 813 842	1	2	14	11	2 991 746	8 575 528
Total	81	1 341 047 648	10	18	53	37	845 374 590	2 834 432 665

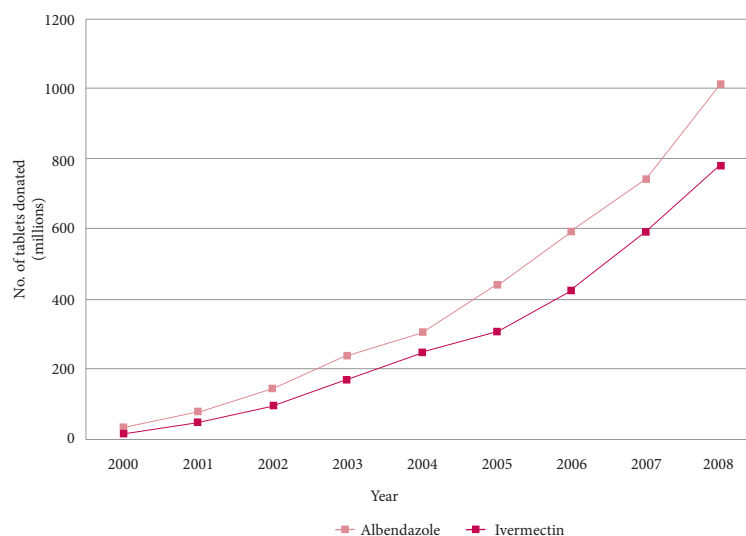
^a Includes countries implementing post-MDA surveillance

2.1.2.2.2 Total population treated

The total population treated through MDA has increased dramatically since GPELF began, from 2.9 million in 2000 to more than 500 million in 2008; the preliminary total for 2009 is 385 million people, which does not include confirmatory information on the number of people targeted and treated from four states in India (14). The cumulative number of treatments delivered by GPELF is more than 2.8 billion, the vast majority (2.4 billion) of these delivered in WHO's South-East Asia Region.

This massive scaling up has been made possible by donations from GlaxoSmithKline and Merck & Co., Inc. By 2008, GlaxoSmithKline had donated 1 billion tablets of albendazole, and Merck & Co., Inc. had donated 781 million ivermectin tablets (*Figure 4*). In addition, billions of tablets of DEC have been purchased by national governments, WHO and donor agencies.

Figure 4. Cumulative number of albendazole and ivermectin tablets donated to the Global Programme to Eliminate Lymphatic Filariasis, 2000–2008^a



^a Source: E. Ottesen, Task Force for Global Health, personal communication, 2010.

2.1.2.2.3. MDA coverage

In 2009, preliminary estimates, not including 4 states in India, showed that 496 million people were offered treatment through MDA, a number that represents 37% of the at-risk population. Of these, an estimated 385 million people participated, for overall coverage of 77.7%. Overall coverage increased consistently from 2004–2007 (*Figure 3*). In 2008, 91 million people in Bihar, India were expected to have been covered with MDA, but were not.

2.1.2.2.4 Number of rounds of MDA

Of the 53 countries that have implemented MDA, 37 (70%) have completed five or more rounds in at least some of their endemic areas (*Table 2*).

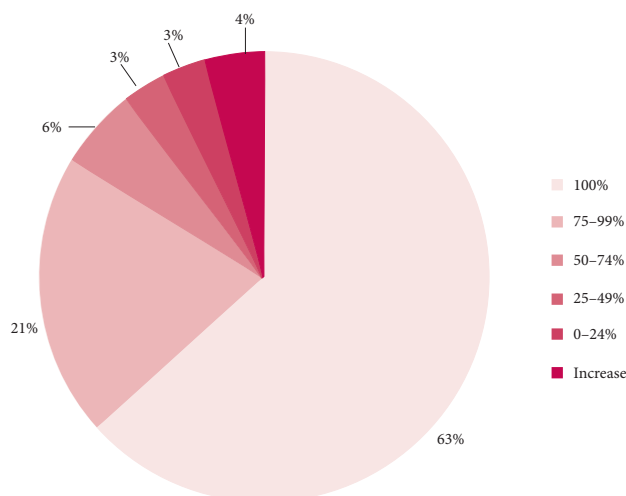
2.1.2.2.5 Geographical coverage

Of the 53 countries that have implemented MDA, 29 (55%) have achieved full geographical coverage (that is, all endemic areas have been covered by MDA). Twenty (38%) of these have already completed five or more rounds in all endemic areas.

2.1.2.2.6 Effect of MDA on microfilaraemia and transmission

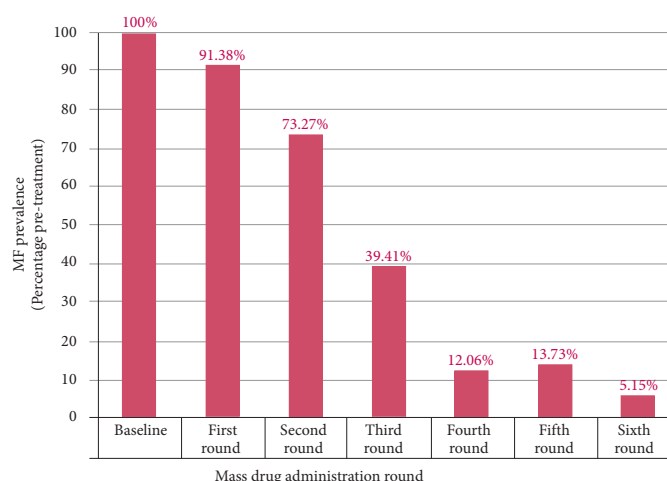
Declines in the prevalence of microfilaraemia have been reported from 68 sentinel sites (communities in which longitudinal data are collected on microfilaraemia) after five rounds of MDA; 43 (63%) had a 100% reduction in prevalence and another 14 (21%) had reductions of 75–99% (*Figure 5*). *Figure 6* shows similarly progressive declines in the prevalence of microfilaraemia after successive rounds of MDA at sentinel sites (15).

Figure 5. Percentage reduction in prevalence of microfilaraemia compared with baseline prevalence in 68 sentinel sites after five rounds of mass drug administration for lymphatic filariasis



The number of rounds required to reduce the prevalence of microfilaraemia to less than 1% appears to depend on three key factors: baseline prevalence of microfilaraemia, the population's compliance with MDA, and the efficiency of the vector (as well as the presence of vector-control measures). In areas with intense transmission and less compliance, a longer duration of MDA may be required.

Figure 6. Effect of mass drug administration for lymphatic filariasis on prevalence of microfilaraemia^a



^a In the first round there were 131 sentinel sites; in the second round there were 124; in the third round there were 139; in the fourth round there were 148; in the fifth round there were 68; and in the sixth round there were 12.

Epidemiological modelling, which takes into account the reduction in potential transmission after sequential rounds of MDA, suggests that the transmission of filariasis in at-risk populations has been reduced by 43% since the beginning of the global programme (Mark Bradley, GlaxoSmithKline, personal communication, 2010).

2.1.2.3 Post-MDA surveillance

As of the end of 2009, 37 countries had completed 5 or more rounds of MDA in at least some endemic areas; of these, 22 had one or more implementation units that met preliminary criteria for the interruption of transmission. These criteria are being revised; the new criteria are expected, along with guidelines for post-MDA surveillance, in early 2011.

2.1.2.4 Verification

In 2007, the People's Republic of China was the first country to be recognized for its success in eliminating LF as a public-health problem. The following year, after an investigative team travelled to the Republic of Korea, WHO concluded that the Republic of Korea also had successfully eliminated the disease as a public-health problem.

2.1.3. Challenges

Progress has been substantial. Since the programme began, 63% of the 1.34 billion people at risk of LF have been targeted for treatment. Nonetheless, several major challenges must be faced to eliminate the disease as a public-health problem by 2020.

2.1.3.1 Getting started

Implementing MDA in all endemic countries is a priority. Eighteen countries that require MDA have not yet implemented it. Of these, 15 are in the African Region. If the global goal of eliminating the disease by 2020 is to be reached then initiating MDA in these countries must be a priority. The barriers to implementation, which often are interrelated, include:

- *incomplete mapping.* Eleven endemic countries have not yet completed mapping, and two of these have not yet begun. For the most part, these countries have significant logistical challenges, instability, conflict, or co-endemicity with *Loa loa*;
- *co-endemic *Loa loa* infection.* *Loa loa* is endemic in at least 10 countries in Africa that also have LF. The density of *Loa loa* microfilaria in the blood can reach high concentrations; people with these infections are at risk for serious adverse events if they receive ivermectin. Thus, *Loa loa* co-endemicity has prevented the initiation of LF elimination programmes in some countries. Research is under way to find and test alternative or provisional strategies to the standard annual delivery of MDA with two medicines. Detailed mapping of *Loa loa* infection in the co-endemic areas of Central Africa is urgently needed;
- *conflict.* Of the 18 countries with active LF transmission that have not yet begun MDA, 13 have fragile infrastructures, are experiencing active conflict, or are in post-conflict situations. It is difficult to establish and maintain LF elimination programmes in areas of conflict, but experience shows that it is possible to conduct MDA in such settings if special precautions and principles are adhered to (16,17).

2.1.3.2 Scaling up

Another critical priority for the programme is to reach full geographical coverage of MDA. Not only must MDA campaigns be implemented in all endemic areas, but they must be supported by appropriate social mobilization to achieve necessary coverage rates. Two specific challenges to effectively scaling up are:

- *countries with the heaviest burden.* In the countries where MDA has already begun, it is critical to scale it up to full geographical coverage. Altogether 70% of the total targeted at-risk population – 919.5 million people – live in the countries with the heaviest burden: Bangladesh, the Democratic Republic of the Congo, India, Indonesia and Nigeria. Full geographical coverage, which has been achieved by India, must be a high priority for these other four countries.
- *urban populations.* Strategies must be developed to effectively treat urban populations, where MDA coverage is typically low. Contributing to low coverage is the fact that people who live in cities tend to be busier, making social mobilization more difficult; populations are heterogeneous, with complex social, economic, and religious structures; and urban dwellers place a higher priority on privacy.

2.1.3.3 Stopping MDA

Country programmes have been hampered in transitioning from MDA to surveillance by a lack of global guiding principles for the following two issues:

- *criteria and methods for assessing the interruption of transmission.* Clear criteria and guidelines are needed to assess whether MDA has been successful in interrupting transmission.
- *post-MDA surveillance.* Guidelines and methods are needed for at least five years of surveillance of filarial infection and recrudescence of transmission after MDA is halted. Such surveillance will likely eventually involve techniques that are currently being evaluated for this purpose, such as antibody assays and molecular xenomonitoring (that is, monitoring LF infection in mosquitoes using molecular methods), and integration with other NTDs.

2.1.3.4 Verifying absence of transmission

Guidelines and procedures for verifying the absence of transmission are needed so that formerly endemic countries can have their achievements verified.

Box 2. Bottlenecks to implementation of MDA

DEC procurement – While two of the three medicines that can be used for MDA are donated, DEC is not. This has resulted in financial challenges to national programmes, which sometimes struggle to include the purchase of DEC in their annual budgets. Furthermore, there is no global quality control of the various DEC manufacturers, and no mechanism for reviewing the programmatic use of DEC.

Immunochromatographic card test kits – These kits measure antigenaemia and are used to map the disease and monitor and evaluate elimination programmes. A kit for one person costs US\$ 2.00–4.00, a great expense for national programmes. As more programmes move into assessing interruption of transmission, the global need for these kits will grow, and it will be critical to ensure their availability and affordability.

2.2. Alleviating suffering by managing morbidity and preventing disability

Filarial infections often occur in childhood, yet typically they remain clinically silent until after puberty. Approximately 25 million men suffer from LF-associated genital disease (most commonly hydrocele), and almost 15 million people, the majority of whom are women, have lymphoedema, primarily of a lower limb. These chronic manifestations of LF cause major disability, loss of productivity and social stigmatization.

Because the overall goal of GPELF is to eliminate the disease as a *public-health problem*, managing morbidity and preventing disability are considered integral to elimination programmes. Although scientific studies have documented that providing access to lymphoedema management may increase community cooperation with MDA (18), the primary motivation within GPELF for managing morbidity is to relieve suffering. Thus, this component of the programme is rooted in compassion.

While MDA has been scaling up rapidly at the global level, efforts to address LF-related morbidity have yet to gather the same momentum. Of 81 endemic countries, only 27 (33%) have active morbidity-management programmes. Hydrocele is readily treated with surgery (19), and evidence has accumulated that simple measures, including improving hygiene and care of the skin on the affected foot and leg, can reduce the frequency of acute, painful inflammatory episodes of adenolymphangitis, and help arrest the progression of lymphoedema (20). Thus, controlling morbidity consists primarily of providing basic lymphoedema management and, in areas where there is bancroftian filariasis, urogenital surgery for affected males. GPELF aims to provide access to this basic care for all affected people in endemic areas.

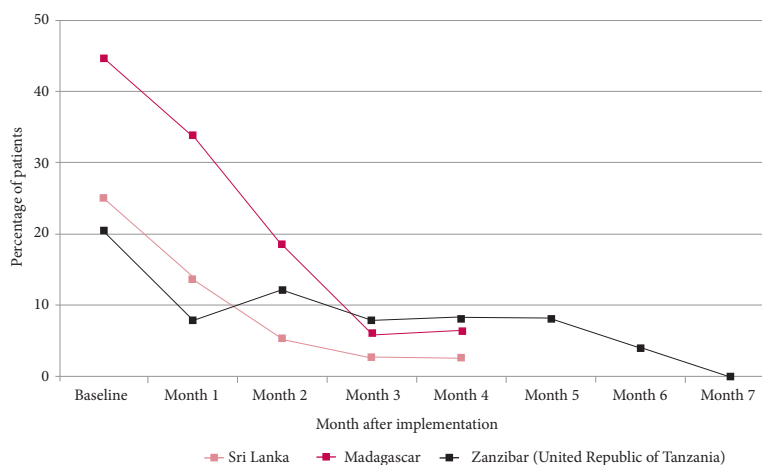
2.2.1 Achievements

2.2.1.1 Research

During the first 10 years of GPELF, a series of research studies have vastly improved our understanding of filarial morbidity and its management. Areas studied include:

- using ultrasound and lymphoscintigraphy to assess subclinical effects of infection and its treatment; these techniques have demonstrated the reversibility of early clinical and subclinical disease in children with the disease who are treated with DEC and albendazole (21–24);
- the positive impact of basic lymphoedema management, principally hygiene and skin care, on the frequency of episodes of adenolymphangitis, chronic inflammation, the severity of clinical lymphoedema, quality of life, and productivity among lymphoedema patients (18, 20); these studies were conducted by research centres and through evaluations of elimination programmes;
- the positive impact of MDA on the frequency of adenolymphangitis and the severity of lymphoedema and hydrocele (25, 26);
- in India, how managing morbidity is associated with increased acceptance and compliance with MDA programmes (18);
- the economic and psychosocial burden of lymphoedema and hydrocele among patients in endemic countries (27);
- making improvements in diagnostic and surgical techniques for managing hydrocele in endemic areas (18, 28).

Figure 7. Percentage of patients with episodes of adenolymphangitis before and after introduction of basic lymphoedema management (foot care), by month after implementation, self-reported data, Madagascar, Sri Lanka and Zanzibar (United Republic of Tanzania), 2004



2.2.1.2 Programmatic achievements

In addition to the scientific advances made in understanding the biology of filarial disease and its management, there have been important developments in implementing programmes to manage morbidity.

- Elimination programmes in 27 countries have active morbidity-control components. Some of these programmes are national in scope, others are subnational; some focus primarily on managing lymphoedema, others on providing hydrocele surgery.
- Reductions in the frequency of debilitating episodes of adenolymphangitis have been observed in countries where lymphoedema management has been implemented (29). Representative data from three countries' programmes are illustrated in *Figure 7*.
- Key partnerships have developed, such as that with the World Alliance for Wound and Lymphedema Care, to advance sustainable programmes for the prevention and care of wounds and lymphoedema in settings with limited resources. NGOs are increasingly involved in managing LF morbidity, as evidenced by renewed activity and leadership in this area among members of the NTD–Non-Governmental Development Organization Network.
- A training module on community and home-based prevention of LF-related disability has been developed by WHO in collaboration with external partners.
- Numerous health workers have received training in lymphoedema management or surgery for urogenital disease. For example, in 2002 the

number of people trained worldwide was estimated at 15 731; in 2003, the number was 24 278 (29).

- Pilot programmes are under way to integrate LF morbidity management with management for other chronic diseases such as leprosy, Buruli ulcer, HIV/AIDS and foot care for people with diabetes.

2.2.2. Challenges

The movement to integrate LF morbidity management with the management of other NTDs, while posing certain challenges, offers the promise of new partnerships and the even broader inclusion of LF morbidity management within existing health services. As with interrupting transmission, challenges to managing morbidity include both the implementation of activities in all endemic countries and achievement of full geographical coverage, that is, providing access to basic care for all people with LF-related disease.

2.2.1.1 Getting started

Of the 53 national programmes currently active, 26 (49%) report that they offer no activities to manage morbidity. Implementing morbidity management in all endemic countries is a priority, and it will be facilitated by:

- *developing guidelines* that incorporate the results of recent and ongoing research into standardized guidelines and training modules, and by disseminating these to all endemic countries;
- *developing simple, standardized metrics* for morbidity management to allow systematic reporting by programme managers. These metrics may include, for example, the number of people trained in lymphoedema management and hydrocelectomy, the number of patients treated, and the number of surgeries performed;
- *improving the integration of lymphoedema care into health systems.* The management of lymphoedema must be integrated into the management of morbidity for other chronic diseases (for example, leprosy, Buruli ulcer, diabetes, HIV/AIDS) within health systems. Access to hydrocelectomy must be provided through existing health services as well as innovative arrangements (for example, the hydrocele camps organized in the United Republic of Tanzania with a special fund from the President).

2.2.1.2 Scaling up

Scaling up may be considered both geographically and in terms of the scope of care delivered. First, the intent is to provide access to basic care for all affected people throughout the endemic area (geographical coverage). Second, scaling up also indicates broadening the scope of care to include both the prevention and treatment of acute morbidity (episodes of adenolymphangitis) as well as basic care for chronic lymphoedema and, in areas endemic for bancroftian filariasis, surgery for hydrocele. Issues associated with, and barriers to, scaling up are similar to those for getting started, as noted in 2.2.1.1.

2.2.1.3 Stopping

Once the backlog of existing hydroceles is addressed through surgery, the number of new hydroceles requiring surgery should decline considerably, particularly if transmission is interrupted. In contrast, management of lymphoedema, particularly in its advanced form of elephantiasis, is likely to require lifelong attention. Thus, the challenge will be to sustain programmes for lymphoedema care.

2.2.1.4 Verification

The guidelines being prepared to verify a country programme's success address only the absence of transmission. For the near future, criteria for verification are unlikely to require specific reductions in morbidity, although the ultimate goal of GPELF, as expressed in the World Health Assembly's resolution, is the elimination of the disease as a public-health problem.

2.3. Enhancing the programme's impact and performance

The two major components of GPELF – interrupting transmission through delivery of MDA and managing morbidity – are supported and extended by other aspects of the programme that enhance its performance and impact. These include conducting operational research, promoting advocacy and partnerships, improving programme governance, and strengthening health systems.

2.3.1. Operational research

2.3.2.1. Scientific foundations

The Special Programme for Research and Training in Tropical Diseases, based at WHO, stimulated basic and applied research about LF during the 1980s and 1990s. This research helped to identify effective interventions and provided new tools for detecting infection in individuals and monitoring the programme's effectiveness at the population level.

- In the 1990s a series of studies funded by the special programme established that treatment with single, once-yearly doses of albendazole in combination with either DEC or ivermectin was highly effective in clearing microfilaraemia and could likely interrupt transmission.
- In many areas, microfilaraemia can be detected in the blood primarily at night, making it difficult to identify and monitor infection levels in endemic populations. The special programme sponsored research on antigen-based and antibody-based diagnostic tests that could be used in surveys conducted during the day. This research led to the development of the immunochromatographic card test, which detects circulating antigen to adult *W. bancrofti*, and to several antibody-based assays, including the BmR1 cassette test for *B. malayi* infection.

Research sponsored by the special programme also provided evidence that intensive hygiene and skin care can reduce episodes of adenolymphangitis in people with lymphoedema and halt progression of the disease. This research established the scientific foundation and rationale for a single programme with two major approaches: interrupting transmission through MDA and managing morbidity.

2.3.2.2 Research achievements 2000–2009

During the first 10 years of GPELF, support from the Special Programme for Research and Training in Tropical Diseases was supplemented by funding from other institutions for operational research that focused on creating and optimizing effective strategies for mapping, delivering MDA, managing morbidity and monitoring programmes. These studies led to:

- the development of guidelines for MDA;
- refinements in approaches to monitoring and evaluating programmes;
- improvements in understanding transmission dynamics and thresholds, which will inform criteria for post-MDA surveillance and verification;
- improvements in assessing the economic and health impacts of the programme;
- refinements in approaches to addressing specific challenges to elimination (for example, *Loa loa* co-endemicity and mobilization of urban population);
- assessment of supplemental and alternative strategies to stopping transmission;
- development of additional tools for monitoring infection (for example, molecular-based xenomonitoring).

2.3.2 Partnerships and advocacy

2.3.2.1 Partnerships

Partnerships have been critical to the success of GPELF since the programme's inception. The strong support from ministries of health in endemic countries has been crucial. GlaxoSmithKline donates albendazole and Merck & Co., Inc. donates ivermectin. These donations, as well as generous financial contributions, have made the programme possible. A wide range of private, bilateral and multilateral donors support the programme financially, including the Bill and Melinda Gates Foundation, the United Kingdom's Department for International Development, the Japan International Cooperation Agency, and the United States Agency for International Development. Technical support comes from several academic institutions, WHO Collaborating Centres, LF support centres, and the United States Centers for Disease Control and Prevention.

To support GPELF and to enhance its advocacy strategies, GAELF was created as an open and inclusive partnership with a light but representative governance structure. GAELF held its first meeting in 2000 in Spain, and has held meetings

every other year since then. Members of GAELF include the LF elimination programmes of all endemic countries as well as 43 NGOs, donor organizations, advocacy groups, international organizations and representatives from the private and academic sectors. The governing body, the representative contact group, elects a small executive group and oversees its work, which focuses on providing advocacy and mobilizing resources for GPELF.

2.3.2.2 Advocacy

The involvement of other partners in advocating for GPELF is critical to ensure the programme's ability to work towards elimination. Engaging in advocacy with political leaders in endemic countries facilitated the early and exponential growth of GPELF, which was fuelled by financial support from the World Bank and donors such as the Arab Fund for Economic and Social Development, the Bill and Melinda Gates Foundation, the United Kingdom Department for International Development, the government of Japan and the Japan International Cooperation Agency. Advocacy efforts also were instrumental in stimulating an initial commitment from the United States of US\$ 100 million for NTDs. This set the stage for the rapid growth in bilateral commitments to integrated NTD programmes, including United States President Barack Obama's Global Health Initiative, which is funded through the United States Agency for International Development.

At the global level, advocacy includes collecting and disseminating timely, accurate information about the programme and its impact. This information is published as progress reports in the *Weekly Epidemiological Record*; as articles in peer-reviewed publications about findings from national, regional and global programmes; and in public service announcements and through media coverage coordinated by GAELF. Advocacy at the global level will continue to be important in an increasingly complex global health environment.

2.3.3 Governance

GPELF had its origins in World Health Assembly resolution 50.29, passed in 1997, which urged Member States to eliminate LF as a public-health problem. In September 1999, WHO published the first strategic plan for GPELF (7), which was followed by the establishment of a Technical Advisory Group. The Technical Advisory Group, comprising international experts in the disease, has been convened annually by WHO to debate, review and make recommendations on GPELF's policies, guidelines and technical issues. The Technical Advisory Group's recommendations have been disseminated through the *Weekly Epidemiological Record*.

In view of the regional variations in parasite species and transmission dynamics, the need for two different medicine regimens (depending on whether onchocerciasis is co-endemic), and the different challenges and opportunities posed by other co-endemic diseases, such as malaria or loiasis, GPELF created regional program review groups to address specific regional issues and guide national programmes. They work closely with WHO's regional offices. The regional

programme review groups, which utilize the expertise of regional experts and public-health officials, review the progress of national elimination programmes, approve national requests for donated medicines, promote regional decision-making and problem-solving, and provide a framework for sharing programmatic experiences across countries.

2.3.4 Health systems – a two-way street

GPELF is unique in that it targets entire populations, rather than specific groups defined by age, sex, employment or health condition. Through a vast network of community volunteers and health workers, and with solid support from national and district health systems, the programme mobilizes entire populations once a year around a single health issue. As such, interactions with the health system are extensive, bidirectional, not thoroughly documented, and probably underappreciated.

WHO recognizes the critical importance of situating specific programmes within health systems and strengthening the overall health system while achieving the specific objectives of the programme. A major focus for GPELF has been to rapidly scale up its programmes, as such it has worked with ministries of health to identify constraints to developing a large workforce of community members to distribute medicine and to facilitate the contribution of system-wide benefits made by this workforce. Community members who distribute medicine have increased awareness of health issues in affected communities and, through MDA, contributed to benefits that extend beyond LF to include the treatment of soil-transmitted helminthiases, onchocerciasis and ectoparasitic infections, such as scabies. Tens of thousands of health workers have been trained to manage LF morbidity; this includes training in the surgical management of hydrocele. Additional evidence for the bidirectional relationship between GPELF and national health systems includes the creation of specific budget lines for LF elimination within budgets for ministries of health in several countries, including Burkina Faso, Ghana, India and the United Republic of Tanzania. In addition, planning and executing MDAs may provide opportunities to improve the data on populations and health that are available to the primary health-care system, as has been documented in the Dominican Republic (30).

Box 3. Budget lines specific to lymphatic filariasis, Burkina Faso

In 2001, the Government of Burkina Faso launched the National Programme for the Elimination of Lymphatic Filariasis with the support of WHO and the Liverpool School of Tropical Medicine. To secure the funds needed to scale up the programme to the national level, a fundraising consultant helped develop an action plan to mobilize internal resources. As a result of the success of the first four years of the programme as well as data documenting a cost of less than US\$ 0.10 per person treated, in 2005 the Ministry of Health created a permanent budget line of US\$ 400 000 for the LF programme. Following the lead of Burkina Faso's programme, ministries of health in other countries have since created budget lines for MDA to eliminate LF. While global support remains crucial, creating such budgetary lines builds long-term sustainability into the programmes and strengthens the health system's role and capacity for programme coordination.

Box 4. Benefits of collaborating with the primary health-care system, Dominican Republic

In 2003 at the same time that the Programme for the Elimination of LF was planning to expand its activities in the south-west of the Dominican Republic, the government's health-care reform plan created a new system of primary health-care clinics known as Unidades de Atención Primaria. These clinics, which focus on prevention as well as treatment, serve 500–700 families and are staffed by a doctor, a nurse and four or five community-based health promotion workers who do not receive a salary but are paid a small monthly incentive by the government.

The elimination programme decided to work within this new structure to deliver the next round of MDA. Clinic staff organized the round, using the clinics' geographical boundaries to plan house-to-house delivery of medicine. They used the clinics' family health-record information system to gather data on the population and to register those who were given the medicines.

As a result, the geographical coverage of the elimination programme was increased from 13 municipalities to 32, and high coverage was maintained. At the same time, the functions of the clinics were strengthened because the quality of data on the population and the use of these data for health planning by the clinics were improved; community health promotion workers became more involved with the clinics; relationships among the clinics and the community were strengthened; and health workers used the opportunity provided by MDA delivery to include other health-promotion messages during their house-to-house visits (30).

2.4. Global impact and benefits

Numerous studies have shown the beneficial impact of MDA on microfilaraemia and transmission, and many also have documented the negative impact of LF-related lymphoedema and urogenital disease on productivity, social well-being, and health costs. The first comprehensive study to estimate the overall impact of the programme at the global level was conducted by the Task Force for Global Health in Atlanta, Georgia, United States.

2.4.1. Costs of MDA

Compared with many other public-health interventions, using MDA to interrupt transmission is inexpensive. A multicentre study undertaken in 2003–2004 found that the cost-per-person-treated by country programme ranged from US\$ 0.06 to US\$ 2.24 (*Table 3*). National governments were generally found to contribute 60–90% of a programme's operational costs, not including the costs of donated medicines (31).

Table 3. Cost of mass drug administration (MDA) per person treated^a

Country and region ^c	Year(s) ^b	MDA round(s) costed	% of population covered	Financial cost ^c per person treated (US\$)	Economic cost ^d per person treated (US\$)
Albendazole and ivermectin					
Burkina Faso	2001–2002	1, 2	69–77	0.06–0.11	4.55–4.82
Ghana	2002	2	69	0.17	4.88
United Republic of Tanzania	2000–2004	1, 2, 3, 4	65–91	0.26–0.54	4.53–5.82
Albendazole and DEC					
Dominican Republic	2002–2003	1, 2	75–83	0.87–1.87	1.56–3.10
Egypt	2000–2001	1, 2	86–87	1.00–1.37	1.34–1.80
Haiti	2000–2002	1, 2, 3	53–81	1.30–2.23	NA
Philippines	2003	3	81	0.19	0.40

DEC, diethylcarbamazine; NA, not applicable.

^a Table adapted from data published by Goldman A et al. (31).

^b In some countries, cost data were collected over several years for multiple rounds of MDA.

^c Financial costs include all cash expenditures made by a programme including those of the national government and local communities.

^d Economic costs include all cash expenditures plus the value of all resources used by a programme, including donated medicines.

2.4.2 Health benefits

Although the clinical and subclinical manifestations of LF differ by age and sex, GPELF reduces the burden of disease across the spectrum of those affected. A detailed analysis of the programme's activities between 2000 and 2007 (15) indicated that 31.4 million individuals have gained and will continue to gain health benefits; these also result in economic benefits from averting direct costs for treatment and the indirect income loss associated with LF-associated disease (that is, acute adenolymphangitis, hydrocele and lymphoedema).

Those benefiting include:

- **6.6 million newborns** protected from becoming infected with the disease;
- **2.2 million newborns** protected from developing clinical disease;
- **an additional 0.5 million individuals not directly receiving treatment** but who are protected from infection and disease by virtue of living in areas where transmission has been interrupted;

- **9.4 million individuals with subclinical disease** whose disease has been prevented from progressing to overt clinical disease;
- **19.3 million individuals with clinical disease** whose disease has been prevented from worsening as a result of MDA.

2.4.3 Economic impact

The total economic benefit resulting from the first eight years of GPELF has been calculated at US\$ 24 billion, discounted to 2008 net present value (32). A total of US\$ 21.8 billion in direct economic benefits will be saved over the lifetime of the 31.4 million individuals described in 2.4.2.

- 94% of these benefits result from preventing the loss of labour and income.
- US\$ 2.2 billion will be saved by national health systems as a result of fewer LF infections resulting in reductions in the cost of providing services to patients.
- More than 75% of the economic benefit will be derived in south-east Asia: the largest percentage of people receiving treatment live in India.
- The full potential economic benefit could be in excess of US\$ 55 billion when GPELF is extended to all endemic populations.

The economic impact of GPELF by WHO region is summarized in *Table 4*.

Table 4. The economic impact of the Global Programme to Eliminate Lymphatic Filariasis, 2000–2007^a

WHO region	Total population benefit (millions of people)	Total lifetime benefit (millions of US\$) ^b	Average lifetime benefit per patient	Average no. lost workdays prevented annually	Total lifetime health-system costs averted (millions of US\$)
African	2.9	1 288	439	23	53.5
Americas	0.1	183	1 446	20	4.3
South-East Asia	27.2	18 070	665	19	2 085.7
Eastern Mediterranean	0.2	146	922	20	3.8
Western Pacific	1.0	2 128	2 186	18	39.8
All regions	31.4	21 815 ^c	695 ^c	19 ^c	2 187.1

^a Table adapted from data in Chu B et al (32).

^b This category does not include benefits to the health system.

^c Number is the weighted average over all WHO regions.

2.4.3.1. Benefit-cost analyses

GPELF's low financial costs are due in large part to the sustained commitment of donations offered by GlaxoSmithKline (albendazole) and Merck & Co., Inc., (ivermectin). Using the programme costs cited above (30) and health benefits (15), one-year benefit–cost ratios for various countries range from 1.64 to 18.07 (32). After the recommended five years of MDA, costs will decrease dramatically, but benefits will continue; therefore, the lifetime benefit–cost ratio for GPELF will be even higher. Under the conservative assumption that annual economic costs, which include the cost of donated medicines, will continue for 10–15 additional years, the economic rate of return per person treated is estimated at US\$ 20–30 for every US\$ 1.00 spent (32).

2.4.3.2 Additional economic benefits

Preventing LF infection and clinical disease has led to additional benefits that are difficult or impossible to quantify in monetary terms. These include:

- quality-of-life benefits, such as reduced social stigma, increased school attendance, improved psychological well-being, greater learning capacity, and improved sexual function;
- reduced costs from other manifestations of LF disease, such as chyluria and renal and lung disease; and
- prevention of co-endemic diseases including river blindness, scabies and soil-transmitted helminthiases, which are also treated with the medicines used to eliminate LF (15).



Section 3

Strategic plan 2010–2020

3.1 Background

As Section 2 demonstrates, the first 10 years of GPELF have been characterized by widespread programme implementation, rapid scaling up of activities, measurable impact, and broad health and economic benefits. These successes were achieved using strategies developed during the late 1990s. Reaching the 2020 goal for global elimination will require continuing these strategies, as well as incorporating new findings from operational research and adopting strategic innovations that address the remaining challenges.

For example, annual MDA regimens with two medicines will remain the standard intervention to interrupt transmission. However, these regimens cannot be used in areas where loiasis is also endemic. Operational research that is under way may lead to alternative or supplemental strategies for these areas or for other situations in which the two-medicine regimens are not feasible. Two innovations are of particular interest: enhanced drug regimens and integrated vector management.

Although the strategic plan for 2010–2020 continues to refer to MDA as the primary intervention for interrupting transmission, it should be understood that other interventions may also be used in some areas. Therefore, for example, “post-MDA surveillance” should be understood more broadly as “post-intervention surveillance”.

The current emphasis on taking an integrated approach to controlling NTDs will also influence GPELF’s strategy during the next decade. MDA targeted specifically at LF will be increasingly integrated into a broader vision of preventive chemotherapy for all NTDs. In addition, increased attention will be paid to the use of integrated vector management to eliminate LF.

Box 5. Integrated approaches to controlling NTDs

WHO's global plan to combat NTDs during 2008–2015 will deliver integrated multi-intervention packages of preventive chemotherapy and vector management.

Integrated preventive chemotherapy

As with the elimination of LF, the control of several other NTDs – including schistosomiasis, soil-transmitted helminthiasis, onchocerciasis and trachoma – is based on providing large-scale periodic treatment with medicines. For some of these diseases, the medicines are the same as for LF; for example, albendazole is given for soil-transmitted helminthiasis, and ivermectin for the control of onchocerciasis.

Interventions to control these diseases include not only distributing medicine but also training staff, collecting data and developing materials for advocacy and community mobilization. Integrating and coordinating these activities can result in a significant reduction in costs and can maximize the benefits for affected populations.

Integrated vector management

Integrated vector management is a rational decision-making process used to optimize resources for vector control. Its goal is to contribute to the prevention and control of vector-borne diseases. Vector control is well suited to an integrated approach because some vectors, such as *Anopheles* mosquitoes, are responsible for more than one disease (for example, malaria and LF in parts of Africa). In addition, some interventions are effective against more than one vector. WHO is actively promoting integrated vector management in a variety of settings, among them the integrated control of NTDs.

During 2010–2020 the overall goal of GPELF remains the same: global elimination of LF as a public-health problem by 2020. Likewise, the two major components of the programme will be the same: interrupting transmission, and reducing and preventing morbidity and disability. To interrupt transmission, MDA and other interventions will target all eligible residents in endemic areas. Similarly, to reduce morbidity, the target is to give all people with LF-related disease access to basic treatment. The overall vision is one of a world in which the risk of acquiring LF has been eliminated.

The structure of the strategic plan (Section 3) is similar to that of the progress report (Section 2). Parts 1 and 2 cover the programme's two major components: interrupting transmission and managing morbidity. Part 3 addresses future directions for other components of the programme: operational research, advocacy and partnerships, governance, and health systems. Part 4 summarizes the milestones for the next decade, and ends with a final note on the way forward.

3.2 Interrupting transmission

Strategic aim

The strategic aim of this component is to provide access to MDA and other measures to interrupt transmission to every person in every endemic area.

Strategic goal

The strategic goal is to interrupt transmission and reduce the at-risk population to zero.

The major challenges to interrupting transmission were reviewed in Section 2, and can be considered in four general categories:

- starting interventions in all endemic areas;
- scaling up interventions to full geographical coverage;
- stopping interventions when transmission has been interrupted and establishing post-intervention surveillance; and
- verifying the absence of transmission.

The overall and specific objectives for each of these categories are presented as well as proposed indicators for programme monitoring. Interim targets for these objectives are summarized in Table 5.

3.2.1 Starting

Objective 1: By 2012, all endemic countries without co-endemic loiasis that require MDA will have begun implementing it.

Objective 2: By 2013, all endemic countries requiring MDA will have begun implementing MDA or other recommended interventions, or both, to interrupt transmission.

Indicator: The proportion of endemic countries requiring MDA that have begun implementing MDA or other recommended interventions, or both, to interrupt transmission.

3.2.1.1 Mapping

Objective 1: By 2012, mapping of all endemic areas in all endemic countries will be completed.

3.2.1.2 Countries where *Loa loa* is endemic

Objective 1: By 2012, WHO and its partners will develop and circulate recommendations and a provisional strategy for interrupting LF transmission in *Loa loa*-endemic countries.

Objective 2: By 2013, all countries where loiasis is co-endemic will develop LF elimination programmes and begin implementing strategies for interrupting LF transmission.

3.2.2 Scaling up interventions

Objective 1: By 2015, full geographical coverage with MDA or other recommended interventions, or both, will be achieved in all countries without co-endemic loiasis.

Objective 2: By 2016, full geographical coverage with MDA or other recommended interventions, or both, will be achieved in all countries with co-endemic loiasis.

Indicator: The proportion of endemic countries requiring MDA that have achieved full geographical coverage with MDA or other recommended interventions, or both.

3.2.2.1 Countries with the heaviest burden

Objective 1: By 2016, full geographical coverage with MDA, targeting the entire at-risk population, will be reached in the countries with the highest burden of LF (Bangladesh, Democratic Republic of the Congo, India, Indonesia and Nigeria).

3.2.2.2 Urban populations

Objective 1: By 2015, all major urban areas with evidence of LF transmission will be under treatment to reduce and eliminate transmission.

3.2.3 Stopping interventions and establishing surveillance

Objective 1: By 2012, 25% of endemic countries requiring MDA will have met the revised criteria for stopping MDA or other interventions, or both, and entered post-intervention surveillance.

Objective 2: By 2016, 70% of endemic countries requiring MDA will have met the criteria for stopping MDA or other interventions, or both, and entered post-intervention surveillance.

Objective 3: By 2020, all endemic countries will have met the criteria for stopping MDA or other interventions, or both, and entered or completed post-intervention surveillance.

Indicator: The proportion of endemic countries requiring MDA that have met the criteria for stopping MDA or other interventions, or both, and established post-intervention surveillance.

3.2.3.1 Guidelines

Objective 1: By 2011, guidelines for (i) assessing interruption of transmission following MDA or other interventions and (ii) post-intervention surveillance will be published by WHO.

3.2.4 Verifying absence of transmission

Objective 1: By 2014, 20% of all endemic countries will have been verified as free of transmission.

Objective 2: By 2020, 70% of all endemic countries will have been verified as free of transmission.

Objective 3: By 2020, the remaining 30% of endemic countries will be conducting post-intervention surveillance and will be on track for verification by 2025.

Indicator: *The proportion of endemic countries that have had absence of transmission verified by WHO.*

3.2.4.1 Guidelines

Objective 1: By 2011, guidelines and recommended procedures for officially verifying absence of transmission will be published by WHO.

The targets in *Table 5* have been estimated based on the status of countries in 2009 (see Section 4), assuming that five rounds of MDA with full geographical coverage are necessary before MDA can be stopped and that verification would occur at least five years after MDA was stopped.

Table 5. Targets for interrupting transmission for 81 countries in the Global Programme to Eliminate Lymphatic Filariasis, by year

Year	Category (objective) ^a			
	Starting (implementation begun)	Scaling up MDA (full geographical coverage achieved)	Stopping interventions and starting surveillance (MDA stopped and post-MDA surveillance established)	Verifying absence of transmission (countries verified as free of lymphatic filariasis)
2012	85	70	25	20
2014	100	75	40	20
2016	100	100	70	40
2018	100	100	75	45
2020	100	100	100	70

MDA, mass drug administration.

^a Values are the proportion of country-based programmes that should achieve specified indicators for interrupting transmission.

3.2.5 Strategic action

To achieve the objectives described above, concerted action will be required from a wide variety of partners. *Table 6* summarizes the strategic actions and contributions required from some key partners for the four major categories of challenges facing GPELF.

Table 6. Roles and strategic actions to be taken by partners to help the Global Programme to Eliminate Lymphatic Filariasis address the four key challenges to interrupting transmission, 2010–2020

Challenge	Issue	Partner	Role and strategic actions
Starting MDA in all endemic countries	Need to complete mapping; Co-endemic loiasis; areas of conflict	WHO	Develop and disseminate guidelines; establish global strategy; provide technical assistance for developing and implementing national plans and for monitoring and evaluation; develop GPELF policy
		GAELF	Engage in advocacy and fundraising; develop partnerships
		Ministries of health	Coordinate national and subnational activities; develop national plans that include integrated strategies to address NTDs and vector management
		NGOs	Assist ministries of health with mapping foci and implementing MDA; mobilize populations; engage in advocacy and fundraising; provide MDA in remote and unstable areas
		Academic and research institutions	Conduct research on alternative and complementary interventions for areas where loiasis is co-endemic; help develop approaches to mapping in loiasis-endemic areas; assist with training and technical issues
Scaling up MDA	Countries with the heaviest burden; delivering MDA in urban areas	WHO	Develop and coordinate integrated policy for control of NTDs; develop and disseminate guidelines; establish global strategy; provide technical assistance for developing and implementing national plans and for monitoring and evaluating programmes; medicine supply and procurement
		GAELF	Engage in advocacy and fundraising; develop partnerships
		Ministries of health	Coordinate national and subnational activities to achieve full coverage; develop national plans that include integrated strategies to address NTDs and vector management; coordinate logistics; provide operational management
		NGOs	Assist ministries of health in scaling up MDA and achieving full geographical coverage; mobilize populations; engage in advocacy and fundraising
		Academic and research institutions	Conduct operational research on scaling up integrated programmes and programmes' effectiveness

Challenge	Issue	Partner	Role and strategic actions
Stopping MDA Post-MDA surveillance	Need for guidelines; refining strategies and diagnostic tools; sustaining commitment; responding to evidence of resurgence of transmission	WHO	Develop and disseminate guidelines; establish policies; provide technical assistance; procure and supply diagnostic tests and assays.
		GAELF	Engage in advocacy and fundraising; develop partnerships
		Ministries of health	Coordinate national and subnational activities; sustain commitment to rigorous surveillance and intervention if needed; develop national plans that include integrated strategies for NTD surveillance; coordinate logistics; provide operational management; promptly investigate resurgence of transmission
		NGOs	Assist ministries of health with surveillance and decision-making; communicate with local communities; engage in advocacy and fundraising
		Academic and research institutions	Conduct studies and assessments of post-MDA strategies; conduct research on thresholds and conditions for transmission; develop and evaluate new monitoring assays and techniques
Verifying elimination	Developing criteria; need for diagnostic tools; need for operational research	WHO	Develop and coordinate global verification process in context of integrated NTD policies; develop and disseminate guidelines; establish global strategy and processes; provide technical assistance in preparing dossiers for verification; evaluate requests for verification and provide verification documentation; procure and supply diagnostic tests
		GAELF	Engage in advocacy and fundraising
		Ministries of health	Prepare dossiers and collect and present evidence for verification process; coordinate national and subnational activities; develop national plans and processes for verification; make an ongoing commitment to using integrated control measures for NTDs after elimination; provide logistical support
		NGOs	Assist ministries of health with verification process, data collection and dossier preparation
		Academic and research institutions	Conduct intensive targeted studies of transmission thresholds; provide technical assistance and advice in response to requests for verification; develop new tools for verification

MDA, mass drug administration; GAELF, Global Alliance to Eliminate Lymphatic Filariasis; NGOs, nongovernmental organizations.

3.3 Managing morbidity and preventing disability

Strategic aim

The strategic aim of this component is to provide access to basic care for LF-related disease to every affected person in endemic areas

Strategic goals

The strategic goals are:

- *to alleviate suffering* in people with LF-related disease;
- *to promote improvements in the quality of life* of people with chronic LF-related disease;
- *to prevent* debilitating and painful episodes of adenolymphangitis among people with lymphoedema.

Efforts to treat LF-related morbidity have not been scaled up as rapidly as the delivery of MDA. During the next decade, however, implementing morbidity management programmes in all LF-endemic countries will be a priority. The new emphasis on the integrated management of NTDs provides enhanced opportunities and renewed impetus to develop lymphoedema care within a package of care for related disabilities and to further integrate hydrocele surgery with other surgical programmes. GPELF aims to integrate services for the management of LF morbidity and the prevention of disability fully into national health systems by training health staff to care for these patients, building on referral mechanisms from community to health worker to specialist and back, and exploring whether subsidies are available to help with the cost of treatment.

During the coming decade, GPELF will emphasize providing access to care for people with LF-related disease. Major challenges to providing this access include starting programmes and scaling them up to achieve full coverage (both geographically and in terms of the scope of clinical conditions managed). Objectives and proposed indicators for initiating and scaling up morbidity-management programmes are presented in this part. Interim targets for these objectives are summarized in *Table 7*.

3.3.1 Starting

Objective 1: By 2015, all national elimination programmes will have active morbidity management programmes.

Indicator: *The proportion of countries that have implemented morbidity-management programmes.*

The proportion of countries collecting and reporting systematically collected data on morbidity management.

3.3.1.1 Guidelines

Objective 1: By 2011, revised guidelines and training modules for the management of lymphoedema and related urogenital surgery will be disseminated to all endemic countries.

3.3.1.2 Metrics

Objective 1: By 2013, a set of simple metrics on morbidity management, to be used for reporting to WHO by programme managers, will be developed and disseminated to all endemic countries.

Objective 2: By 2014, all endemic countries will collect and report data on morbidity management to WHO.

3.3.2 Scaling up interventions

Objective 1: By 2020, morbidity-management programmes will achieve full geographical coverage of endemic areas and provide full access to basic care.

Indicator: *The proportion of countries where there is full coverage of morbidity-management services and access to basic care.*

Table 7. Targets for morbidity-management services for 81 countries in the Global Programme to Eliminate Lymphatic Filariasis, by year

Year	Objective ^a		
	Morbidity-management programme implemented	Collecting and reporting data to WHO using specified metrics	Full geographical coverage and access to basic care
2012	40	0	20
2014	80	80	40
2016	100	100	60
2018	100	100	80
2020	100	100	100

^a Values are the proportion of country-based programmes that should achieve specified indicators for morbidity-management services.

3.3.3 Strategic action

To achieve the objectives described above, concerted action will be required from a wide variety of partners. *Table 8* summarizes the strategic actions and contributions required from some key partners for the major challenges facing the expansion of morbidity management within GPELF.

Table 8. Roles and strategic actions to be taken by partners to help the Global Programme to Eliminate Lymphatic Filariasis address challenges in morbidity management, 2010–2020

Challenge	Issue	Partner	Role and strategic actions
Starting to provide morbidity-management services in all endemic countries	Need for guidelines; training; human-resource development; need for metrics for monitoring and reporting; financial resources	WHO	Develop and disseminate guidelines, training materials and metrics for monitoring and reporting; establish global strategy; provide technical assistance for developing and implementing national plans; provide training and evaluation; develop GPELF policy
		GAELF	Engage in advocacy and fundraising; develop partnerships
		Ministries of health	Coordinate morbidity-management services within national health systems and ensure they are integrated into cross-disease approaches; develop national plans that include integrated cross-disease strategies for morbidity management; engage in advocacy; provide training
		NGOs	Assist ministries of health with training and implementation of integrated morbidity management; provide access to remote populations; engage in advocacy and fundraising
		Academic and research institutions	Conduct research on the impact of morbidity management and outcomes; conduct research on using integrated approaches to morbidity; conduct clinical studies; provide assistance with training and technical issues
Scale up services to achieve full geographical coverage and full access to lymphoedema management (and hydrocele surgery in areas where there is bancroftian filariasis)	Awareness; commitment; mobilization; financial and human resources; sustainability	WHO	Help scale up training and technical assistance; refine guidelines; develop policies and recommendations for sustaining the integration of LF morbidity-management into other disease-management programmes; document impact of these services
		GAELF	Engage in advocacy and fundraising; develop partnerships
		Ministries of health	Sustain commitment to integrating LF morbidity-management services into national health systems; develop national plans for morbidity management that extend beyond the duration of MDA; engage in advocacy; provide training
		NGOs	Assist ministries of health in scaling up training and implementing integrated morbidity management; provide access to remote populations; engage in advocacy and fundraising
		Academic and research institutions	Conduct research on the impact and outcomes of services; conduct research on using integrated approaches in national health systems; assist with training and technical issues

3.4 Enhancing the programme's impact and performance

As noted in Section 2, the achievements of GPELF – both in interrupting transmission and in managing morbidity – have been made possible by several other components of the programme that provide the necessary technical tools and information, financial and material support, human resources and institutional systems. Among the most important of these are the findings of operational research, the results of advocacy and partnerships, the efficiency of governance, and collaboration with health systems. Progress in all these areas is collaborative, extending beyond WHO and its regional offices. The general strategic direction for continuing to make progress in these areas during the next decade of GPELF is highlighted below.

3.4.1 Operational research

Both financial support to conduct research and research findings to help improve strategies and guidelines continue to be vital to the programme's success. Partners are involved in funding, designing and conducting needed research; partners include academic institutions, LF support centres, WHO and its Collaborating Centres, the Special Programme for Research and Training in Tropical Diseases and the Bill and Melinda Gates Foundation. The research that will guide technical decisions about GPELF into the next decade is focused on three areas:

- 1) developing supplemental tools and approaches for *interrupting* LF transmission, especially those that can be used in areas where loiasis is endemic. Studies are under way to assess the impact of vector control on LF transmission, alternative medicine regimens and dosing, and new macrofilaricidal agents, especially those that target Wolbachia. Research is also being conducted on new approaches to achieving high MDA coverage in urban settings, areas of conflict, and among migrant or nomadic populations;
- 2) developing diagnostic tools and approaches for *assessing* transmission to help refine guidelines and procedures for determining when to withdraw MDA and other interventions, for conducting post-intervention surveillance, and for verifying the absence of transmission. Research is also under way to refine and evaluate a variety of diagnostic tools (for example, immunochromatographic card tests, *BmR1* and *Bm14* antibody assays, and polymerase chain reaction assays for molecular xenodiagnosis) and to systematize and evaluate approaches to surveillance, including using new technologies and methods to manage and report data (for example, smartphones);
- 3) assessing the programme's impact. A thorough assessment should be completed at least once every five years to determine the economic costs, health benefits (both those related and unrelated to LF), societal impact, and health-system impact of GPELF. The results of this assessment will inform advocacy and priority-setting efforts.

Box 6. Examples of new research on eliminating lymphatic filariasis

Example 1. Optimizing preventive chemotherapy to control and eliminate lymphatic filariasis and onchocerciasis

A multifaceted group of studies looking at ways to improve treatment for LF and onchocerciasis is under way, funded by the Bill and Melinda Gates Foundation. The first of these studies focuses on large-scale community trials of twice-annual delivery of “enhanced” MDA, including one trial using twice-yearly doses of albendazole. This study includes epidemiological modelling and cost analyses. Additionally, a group of three randomized clinical trials will assess a variety of combinations of medicines and dosing strategies. The goal is to identify treatments that are safe and effective against both LF and onchocerciasis. Finally, the anti-parasitic medicine flubendazole is being used in pre-clinical studies assessing its potential as a macrofilaricidal agent – that is, against adult worms.

Example 2. Anti-Wolbachia medicines as a potential tool for treating and eliminating lymphatic filariasis

A novel approach to the treatment of filarial worms has been to target Wolbachia, symbiotic bacteria that are essential for the worms' development and survival. A 4–6 week course of the antibiotic doxycycline (200 mg/kg per day) results in the long-term sterility and ultimately the death of the adult parasite. The Anti-Wolbachia Consortium, a five-year research programme funded by the Bill and Melinda Gates Foundation, is seeking new anti-Wolbachia treatments that are compatible with community-treatment programmes for human filariasis. The consortium's activities include refining regimens that use doxycycline, developing assays to rapidly screen and test new medicines that may be more effective than doxycycline, conducting studies to better understand the role of Wolbachia in the life-cycle of filarial worms, and identifying the genes that are essential for Wolbachia's survival.

3.4.2. Partnerships and advocacy

3.4.2.1 Partnerships

Strong, extensive partnerships have been central to the elimination effort. GAELF has created a forum for an open, flexible network, and has fostered and nurtured essential partnerships.

As GPELF moves into its second decade, its critically important partnerships with medicine donors, government aid agencies, private foundations, NGOs and other stakeholders must be maintained and deepened. In the changing global health environment, and as the programme matures, it also will be essential to engage with new partners to create an even broader network, particularly in the area of morbidity management. Another critical area of partnership will be in the area of medicine donations, specifically for DEC, in order to ensure that there is continued access to quality assured medicines for MDA.

Integrating LF elimination within a framework of NTD control presents opportunities for synergies and new partnerships with organizations involved in school-based health programmes, the control of mosquito-borne diseases (especially malaria), morbidity management (for example, for leprosy and foot care for people with diabetes) and surgical care (for example, for trachoma).

3.4.2.2 Advocacy

Enhancing advocacy efforts will be crucial for achieving GPELF's goals during the next decade. WHO will continue to inform partners about the programme's progress through the *Weekly Epidemiological Record*, annual reports on NTDs and briefings at the World Health Assembly.

GAELEF plays a particularly central part in worldwide advocacy, and this remains essential for mobilizing the financial and human resources needed by the programme. GAELEF's advocacy for integrated control of NTDs, to which LF funding is increasingly linked, provides GPELF with an enormous opportunity to scale up MDA in countries that have not achieved full coverage of their at-risk populations. Advocacy by GAELEF, as well as its nurturing of new partnerships, also will be required at the national level, especially in countries where political support may be lacking.

3.4.3 Governance

Through its regional programme review groups and regional offices, WHO has embraced a strong regional approach to GPELF. During the next decade, the role of the regional programme review groups will become even more critical as countries move towards full geographical coverage of MDA, region-specific challenges are addressed (for example, *Loa loa* co-endemicity), decisions are made regarding stopping MDA, and countries request verification of the absence of transmission. Regional programme review groups may also play an important part as preventive chemotherapy programmes expand to cover other NTDs. Thus, strengthening the technical and managerial capacity of the regional programme review groups is a high priority.

3.4.4 Health systems

From the beginning, GPELF has been concerned with strengthening health systems and integrating its activities into existing health structures (7). GPELF – which uniquely mobilizes entire populations in endemic countries once a year and utilizes the services of large numbers of community volunteers to expand the reach of paid health staff – has strengthened both national and subnational health systems and been made possible through them. Because elimination of LF is now part of the integrated approach taken towards controlling NTDs, this two-way street between health systems and GPELF will broaden, deepen and intensify.

One of the most fruitful areas of interaction between GPELF and health systems during the next decade – as well as with other disease-control programmes – will be in morbidity management and disability prevention. Increasingly, the management of lymphoedema in endemic areas is properly viewed as being integrated with care for a variety of other conditions (such as, leprosy, diabetes, Buruli ulcer and venous insufficiency). A range of new partnerships and innovations are being explored as this trend matures.

Another area in which GPELF contributes to the strengthening of health systems is in understanding the roles and potential of community volunteers within national health systems. GPELF utilizes more community volunteers than any other health programme to deliver essential medicines to many of the world's poorest people, many of whom would not be reached without the volunteers. Increasing demands are being placed on volunteers as other programmes recognize their

potential. As support builds for volunteers to deliver chemotherapy for a variety of NTDs and provide other health services, it will be necessary for health systems to create clear job descriptions, standardize incentives across programmes, and coordinate efforts to build capacity.

3.5. Milestones for the next decade

Existing strategies and tools to eliminate LF have been used to set practical milestones to be achieved over the next 10 years. However, new tools and approaches will become available as scientific knowledge advances. Accordingly, flexibility will be required to optimize GPELF's strategy.

A summary of the milestones for the next 10 years (described in more detail in sections 3.2 and 3.3) is shown in *Table 9*.

3.6. The way forward

GPELF is well on its way to the 2020 goal of global eliminating LF as a public-health problem. One of the cornerstones of this programme is providing access to specific health services for some of poorest and most disadvantaged people on earth. To interrupt transmission globally, the programme aims to make preventive chemotherapy and other measures available to 1.34 billion people living in endemic areas. The medicines used in MDA have enormous ancillary health benefits, a result of their broad spectrum of action. To reduce suffering, the programme also aims to provide access to basic care for the estimated 40 million people with LF-related disease.

The first decade of GPELF has been characterized by exponential growth in MDA, which now reaches some 695 million people (14). This success, using standardized approaches developed in the 1990s, has been achieved through the commitment of ministries of health and the strong involvement of regional programmes.

During the next decade, the basic principles of the programme's strategic approach will remain unaltered, and the overall goal and targets of GPELF will remain unchanged. However, the global health environment has changed dramatically since 2000. GPELF is now part of a comprehensive programme of NTD control, in which preventive chemotherapy, vector control and morbidity management are increasingly integrated and delivered as multi-intervention packages at the global, national and local levels. The opportunities presented by such an intersectoral and interprogrammatic approach hold the promise of developing even greater synergy among LF-elimination programmes and other health programmes, and of further extending the benefits of GPELF to neglected populations who nearly always suffer from several overlapping diseases linked to poverty (33).

Table 9. Milestones for the Global Programme to Eliminate Lymphatic Filariasis, 2010–2020

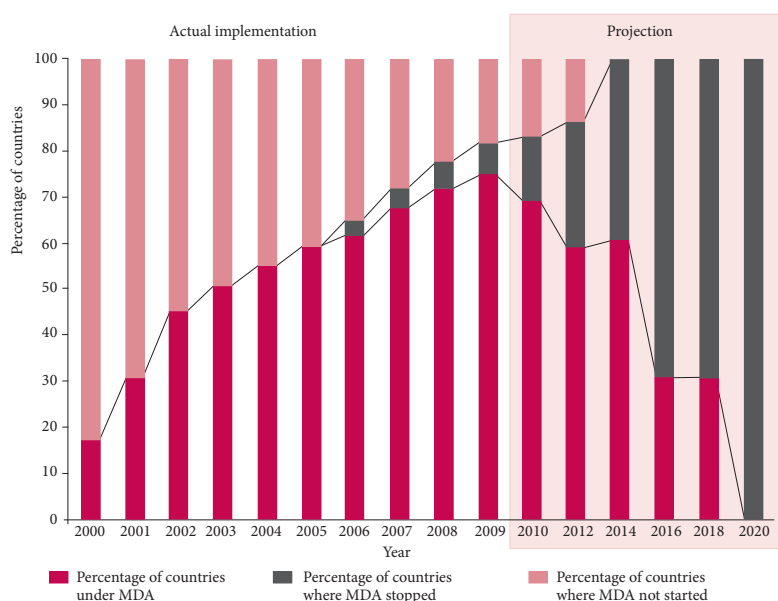
Year	Milestone
2011	<ul style="list-style-type: none"> Revised WHO guidelines on interrupting transmission and conducting post-intervention surveillance completed and available WHO guidelines and criteria for verifying absence of transmission completed and available WHO guidelines and training modules for morbidity management completed and available
2012	<ul style="list-style-type: none"> Mapping completed in all countries MDA started in all countries without co-endemic loiasis Provisional strategy for interrupting transmission in loiasis-endemic countries developed and circulated 25% of endemic countries have met the criteria for stopping interventions and entered post-intervention surveillance phase
2013	<ul style="list-style-type: none"> Revised strategy for interrupting transmission implemented in all loiasis-endemic countries Metrics for annual reporting on morbidity-management programmes developed by WHO and disseminated
2014	<ul style="list-style-type: none"> 20% of endemic countries verified free of transmission All endemic countries collecting and reporting data on morbidity management to WHO
2015	<ul style="list-style-type: none"> Full geographical coverage with MDA or other interventions, or both, achieved in all endemic urban areas Full geographical coverage with MDA or other interventions, or both, achieved in all countries where loiasis is not endemic Progress, global impact and remaining challenges assessed mid-plan
2016	<ul style="list-style-type: none"> Full geographical coverage with MDA or other interventions, or both, achieved in countries with heaviest burden Full geographical coverage with MDA or other interventions, or both, achieved in all countries with co-endemic loiasis 70% of endemic countries have met the criteria for stopping interventions and entered into post-intervention surveillance phase
2020	<ul style="list-style-type: none"> 70% of countries verified as free of LF and 30% under post-intervention surveillance Full geographical coverage and access to basic care for lymphoedema (and hydrocele in areas of bancroftian filariasis) offered in all countries

MDA, mass drug administration.

GPELF's specific challenges and tasks will evolve during its second decade. The first decade focused on *beginning*, which involved developing guidelines using existing knowledge, initiating programmes in every WHO region and scaling up MDA as rapidly as possible. While these efforts must continue so that full coverage of the at-risk population is achieved, the focus for the second decade will broaden to ensure a successful *ending* (Figure 8). Thus, attention will be paid to applying effective tools and strategies to accurately determine when transmission has been interrupted, implementing effective post-intervention surveillance, and providing official verification of the absence of transmission. The programme also will focus more broadly on managing chronic morbidity, which typically persists even after transmission has been interrupted.

Thus, the way forward builds on the solid foundation of the past 10 years. Success will come only with the continuing efforts of all of the programme's partners, as well as with the development of new partnerships. Operational research will be central to addressing the challenges that remain, especially in areas where *Loa loa* is endemic, and in developing new diagnostic tools and treatment strategies for the end-game. Continued success in advocating for the programme will be critical for securing the necessary financial and human resources. Most importantly, perhaps, the solid sense of collaboration and partnership that has characterized GPELF from its beginning will be key to reaching the global goal of eliminating lymphatic filariasis.

Figure 8. Projected scaling up and later downsizing of the Global Programme to Eliminate Lymphatic Filariasis, 2000–2020^a



^a Figure does not include the 10 endemic countries for which MDA is not required.

Section 4

Regional highlights and priorities

LF is endemic in five of the six WHO regions, and national LF elimination programmes are based on regional strategies. The following parts, organized by WHO region and regional programme review group, describe regional strategies to eliminate LF, highlight countries' progress and discuss the priority issues for the next 10 years.

Due to the tremendous efforts of national programmes, more than 2.8 billion treatments have been delivered worldwide since GPELF was launched in 2000. By the end of 2009, 53 of 81 endemic countries had implemented MDA. Five of those countries have achieved the targets for interrupting transmission and have stopped MDA (*Table 10*). Over the next 10 years, GPELF will change its focus from achieving full geographical coverage of MDA to scaling down its efforts as countries meet criteria for stopping interventions and transition to post-MDA surveillance. The progress that has been made is presented by WHO region and regional programme review group in *Figures 9–21*.

Table 10. Status of the Global Programme to Eliminate Lymphatic Filariasis, by country, 2009

WHO region or regional programme review group	Number of countries						
	With endemic foci	MDA unlikely to be required	MDA not initiated	MDA with less than 100% geographical coverage	MDA with 100% geographical coverage and less than 5 rounds	MDA with 100% geographical coverage and 5 or more rounds	Post-MDA surveillance
African	39	5	15	13	4	2	0
Americas	7	3	0	4	0	0	0
South-East Asia	9	0	0	5	2	1	1
Eastern Mediterranean	3	0	1	0	0	2	0
Mekong-Plus	6	1	0	1	1	3	0
PacELF	17	1	2	1	2	7	4
Total	81	10	18	24	9	15	5
		Burundi Cape Verde Mauritius Rwanda Seychelles Costa Rica Suriname Trinidad and Tobago Brunei Darussalam Solomon Islands	Angola Central African Republic Chad Congo Democratic Republic of the Congo Eritrea Equatorial Guinea Gabon Gambia Guinea Guinea-Bissau Liberia Sao Tome and Principe Zambia Zimbabwe Sudan Palau New Caledonia	Benin Cameroon Côte d'Ivoire Ethiopia Kenya Madagascar Mozambique Niger Nigeria Senegal Sierra Leone United Republic of Tanzania Uganda Brazil Dominican Republic Haiti Guyana Bangladesh Indonesia Myanmar Nepal Timor-Leste Lao People's Democratic Republic Papua New Guinea	Comoros Ghana Malawi Mali India Maldives Philippines Federated States of Micronesia Marshall Islands	Burkina Faso Togo Egypt Yemen Thailand Cambodia Malaysia Viet Nam American Samoa Fiji French Polynesia Kiribati Samoa Tuvalu Wallis and Futuna	Sri Lanka Cook Islands Niue Tonga Vanuatu

African Region
 Region of the Americas
 Eastern Mediterranean Region

South-East Asia Region
 Mekong-Plus (Western Pacific Region)
 PacELF (Western Pacific Region)

African Region

Population at risk: **405.9 million**
Number of endemic countries: **39**

Indicator	No. of countries
Countries stopped MDA	0
Countries completed 5 or more rounds of MDA with 100% geographical coverage	2 countries Togo, Burkina Faso
Countries implementing MDA with 100% geographical coverage	6 countries Burkina Faso, Comoros, Ghana, Mali, Malawi, Togo
Countries implementing MDA	19 countries Benin, Burkina Faso, Cameroon, Comoros, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Senegal, Sierra Leone, Togo, Uganda, United Republic of Tanzania
Countries where MDA not yet started	15 countries Angola, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Eritrea, Gabon, Gambia, Guinea, Guinea-Bissau, Liberia, Sao Tome and Principe, Zambia, Zimbabwe
Countries with mapping in progress	10 countries Angola, Cameroon, Central African Republic, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Liberia, Nigeria, Zambia, Zimbabwe
Countries not started mapping	2 countries Chad, Eritrea
Countries unlikely to require MDA	5 countries Burundi, Cape Verde, Mauritius, Rwanda, Seychelles

Figure 9. Progress in mass drug administration (MDA) for lymphatic filariasis, WHO's African Region, by year, 2000–2009

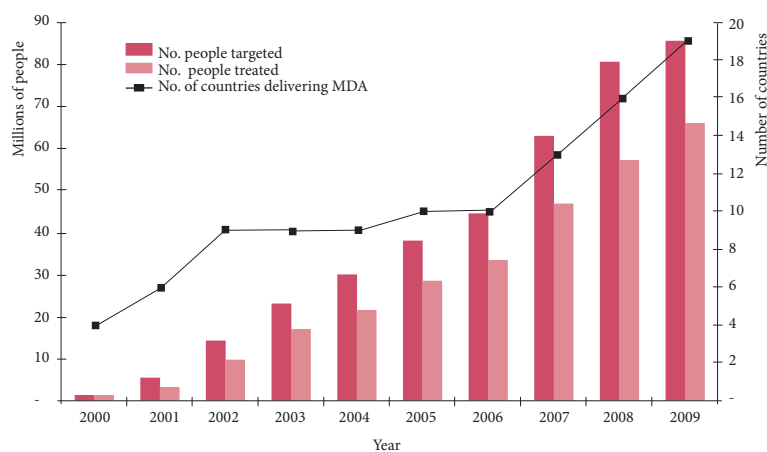
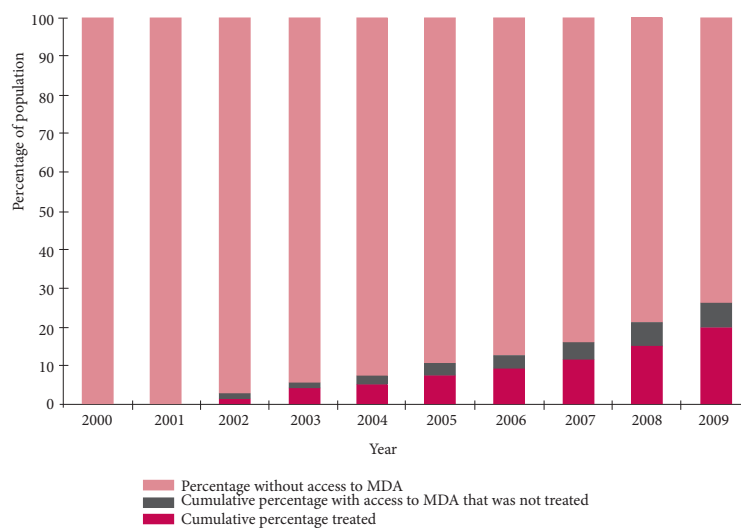


Figure 10. Cumulative percentage of population at-risk for lymphatic filariasis that has been treated by mass drug administration (MDA), that had access to MDA but was not treated and that did not have access to MDA, WHO's African Region, 2000–2009



4.1. African Region

4.1.1 Background

WHO's African Region, which accounts for approximately 30% of the global burden of LF disease, includes 405.9 million people at risk of infection in 39 of its 46 member countries. *W. bancrofti* is the only human filarial parasite found in Africa. In most parts of Africa, the vectors that transmit *W. bancrofti* are the *Anopheles* species of mosquitoes; however, urban transmission with *Culex quinquefasciatus* is known to occur in some parts of East Africa.

In 2000, the African Region launched the Programme for Elimination of Lymphatic Filariasis, and conducted MDA in Ghana, Nigeria, Togo and the United Republic of Tanzania. A regional programme review group was established in 2001 and has met annually to review national plans of action and national applications for antifilarial medicines, and to provide technical advice to programme managers.

4.1.2 Highlights 2000–2009

The first 10 years of activities to eliminate the disease in the African Region saw major progress in mapping and scaling up MDA. As of 2009, 37 of the 39 endemic countries are at various stages of implementing their programmes; only two countries have not started mapping (*Table 11*).

Implementation has accelerated during the past five years as a result of the increased financial resources that have become available through integration with control efforts for other NTDs. This integration has led to the national programmes in six countries – **Burkina Faso, Comoros, Ghana, Malawi, Mali and Togo** – achieving full coverage of their entire at-risk populations.

Comoros and Togo are near to meeting the current criteria for interrupting transmission and stopping MDA, and will soon establish surveillance to assess transmission. In five countries – **Benin, Burkina Faso, Ghana, Nigeria and the United Republic of Tanzania** – some implementation units have met the criteria and have stopped MDA.

Activities to manage disabilities require more resources before they can be scaled up. However, almost all countries conducting MDA have, to varying extents, implemented lymphoedema management activities and surgery for hydrocele.

Table 11. Lymphatic filariasis in WHO's African Region, by country, 2009

Country	Population at risk	Mapping status	MDA status	Onchocerciasis	Loiasis	Type of MDA
Angola	12 090 000	In progress	Not started	Endemic	Endemic	IVM+ALB
Benin	5 282 204	Completed	Started	Endemic		IVM+ALB
Burkina Faso	15 411 849	Completed	Started	Endemic		IVM+ALB
Burundi			MDA not required	Endemic		
Cameroon	14 305 000	In progress	Started	Endemic	Endemic	IVM+ALB
Cape Verde			MDA not required	Non-endemic		
Central African Republic	3 300 000	In progress	Not started	Endemic	Endemic	IVM+ALB
Chad	7 270 000	Not started	Not started	Endemic	Endemic	IVM+ALB
Comoros	514 110	Completed	Started	Non-endemic		DEC+ALB
Congo	2 600 000	Completed	Not started	Endemic	Endemic	IVM+ALB
Côte d'Ivoire	14 000 000	In progress	Started	Endemic		IVM+ALB
Democratic Republic of Congo	49 140 000	In progress	Not started	Endemic	Endemic	IVM+ALB
Equatorial Guinea	420 000	Completed	Not started	Endemic	Endemic	IVM+ALB
Eritrea	3 577 000	Not started	Not started	Non-endemic		DEC+ALB
Ethiopia	30 000 000	In progress	Started	Endemic	Endemic	IVM+ALB
Gabon	1 290 600	Completed	Not started	Hypo-endemic	Endemic	IVM+ALB
Gambia	1 200 000	Completed	Not started	Non-endemic		DEC+ALB
Ghana	11 587 953	Completed	Started	Endemic		IVM+ALB
Guinea	6 067 135	Completed	Not started	Endemic		IVM+ALB
Guinea-Bissau	1 311 741	Completed	Not started	Endemic		IVM+ALB
Kenya	3 031 878	Completed	Started	Hypo-endemic		DEC+ALB
Liberia	3 600 000	In progress	Not started	Endemic		IVM+ALB
Madagascar	17 948 748	Completed	Started	Non-endemic		DEC+ALB
Malawi	12 887 248	Completed	Started	Endemic		IVM+ALB
Mali	13 798 000	Completed	Started	Endemic		IVM+ALB
Mauritius			MDA not required	Non-endemic		
Mozambique	15 538 610	Completed	Started	Hypo-endemic		IVM+ALB
Niger	11 465 194	Completed	Started	Hypo-endemic		IVM+ALB
Nigeria	70 650 902	In progress	Started	Endemic	Endemic	IVM+ALB
Rwanda			MDA not required	Hypo-endemic		
Sao Tome and Principe	410 000	Completed	Not started	Non-endemic		DEC+ALB
Senegal	5 314 600	Completed	Started	Endemic		IVM+ALB
Seychelles			MDA not required	Non-endemic		
Sierra Leone	5 319 758	Completed	Started	Endemic		IVM+ALB
Togo	1 191 720	Completed	Started	Endemic		IVM+ALB
Uganda	13 264 445	Completed	Started	Endemic		IVM+ALB
United Republic of Tanzania	37 369 939	Completed	Started	Endemic		IVM+ALB
Zambia	8 780 000	In progress	Not started	Non-endemic		DEC+ALB
Zimbabwe	6 000 000	In progress	Not started	Non-endemic		DEC+ALB

MDA, mass drug administration; IVM+ALB, ivermectin plus albendazole; DEC+ALB, diethylcarbamazine plus albendazole.

4.1.3 Priorities for the next 10 years

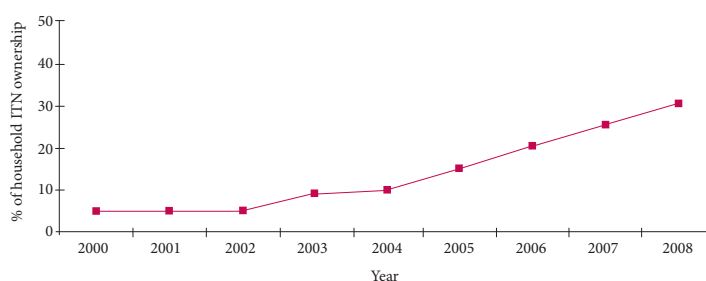
Loiasis co-endemicity. Treatment challenges in areas where *Loa loa* is co-endemic need to be addressed. Owing to concerns about severe adverse reactions, treatment with the combination of ivermectin and albendazole cannot be implemented in these areas, which encompass most of Central Africa. Work is in progress to develop strategies to map communities for the presence of *Loa loa*. Better tools are needed to assess risk as are guidelines on criteria for including or excluding people from treatment programmes.

Vector control. Reducing mosquito populations can support and help sustain interruption of transmission. Improved techniques, such as the use of insecticide-treated bednets and curtains, as well as residual spraying, are available as effective vector-control tools. The African Region will explore how to best utilize vector control as a supplemental intervention for interrupting transmission, particularly in areas of loiasis co-endemicity.

Box 7. Bednet coverage may help eliminate lymphatic filariasis

Insecticide-treated bednets are widely used to prevent and control malaria in many countries in Africa, where both malaria and LF are transmitted by the same anopheline vectors. The proportion of households that use treated bednets has increased dramatically over the past decade. The number of households that possess at least one treated bednet increased from 4.5% in 2000 to 31% in 2008 (Figure 11). In countries where LF is endemic, such as Madagascar, Mali and Ethiopia, 60–80% of households possess at least one treated bednet. The use of these nets will enhance the impact of MDA administered against LF and reduce the probability of LF resurgence in areas where MDA has been stopped.

Figure 11. Model-based estimate of coverage of insecticide-treated bednets in 35 countries with a high burden of malaria, WHO's African Region, 2000–2008 (34)



Integration. In areas where a number of NTDs are present, LF elimination is being implemented within a package of integrated control measures. The major benefit to this approach has been the opportunities for increased funding that have allowed for a rapid scaling up of implementation. In order to fully exploit these opportunities while still focusing on the goal of eliminating LF by 2020, guidelines and training are needed to address the integrated mapping of NTDs, to develop multiyear strategic plans for controlling NTDs and to develop annual national and district-level NTD implementation plans. Building capacity in data management and coordinating partners are also critical to achieving the effective and integrated control of NTDs.

4.1.4 Local partnerships

Regionally, the Programme for the Elimination of Lymphatic Filariasis has benefited from financial support from the Bill and Melinda Gates Foundation, the United Kingdom's Department for International Development (through its various grantees, including the Liverpool School of Tropical Medicine's Centre for Neglected Tropical Diseases, formerly the Liverpool LF Support Centre), Emory University's LF Support Center, and the Neglected Tropical Disease Control Program supported by the United States Agency for International Development and led by Research Triangle Institute International. Over the past 10 years, many NGOs, including Handicap International, IMA World Health, and Health & Development International, have collaborated in morbidity-control activities in various countries.

Region of the Americas

Population at risk: **11.3 million**
Number of endemic countries: **7**

Indicator	No. of countries
Countries stopped MDA	0
Countries completed 5 or more rounds of MDA with 100% geographical coverage	0
Countries implementing MDA with 100% geographical coverage	0
Countries implementing MDA	4 countries Brazil, Dominican Republic, Guyana, Haiti
Countries where MDA not yet started	0
Countries with mapping in progress	0
Countries not started mapping	0
Countries unlikely to require MDA	3 countries Costa Rica, Suriname, Trinidad and Tobago

Figure 12. Progress in mass drug administration (MDA) for lymphatic filariasis, WHO's Region of the Americas, by year, 2000–2009

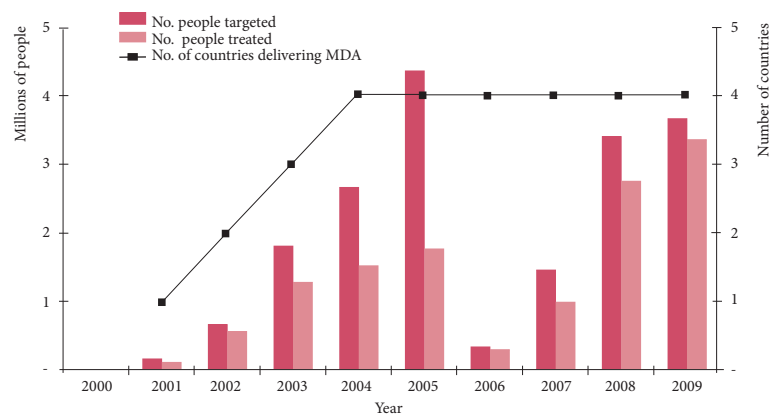


Figure 13. Cumulative percentage of population at-risk for lymphatic filariasis that has been treated by mass drug administration (MDA), that had access to MDA but was not treated and that did not have access to MDA, WHO's Region of the Americas, 2000–2009



4.2. Region of the Americas

4.2.1 Background

It is believed that *Wuchereria bancrofti* was imported to the Americas, along with schistosomiasis and onchocerciasis, during the era of the European colonial transatlantic slave trade. The region accounts for 1% of the global population at risk of LF infection. *W. bancrofti* is the only important human filariasis parasite species found in the Americas; the principal vector is the mosquito *Culex quinquefasciatus*, which breeds mainly in foul water.

Endemic countries have been operating programmes under national plans for elimination, basing their work on delivering MDA, managing morbidity and providing health education; these efforts are sometimes accompanied by vector-control measures. A 2009 resolution adopted by the Pan American Health Organization on the elimination of neglected diseases of poverty (Resolution CD49. R19) targets LF as one of several neglected diseases to be eliminated as a public-health problem from the region by 2015 (35).

Before 2000, seven countries were considered to be endemic for LF. As of September 2008, transmission was considered to have been interrupted in Costa Rica, Suriname and Trinidad and Tobago, and these countries are in the process of verifying the absence of transmission. In Brazil, focal transmission in the state of Alagoas was interrupted in 2005, and an older focus in Belém, in the state of Acre has been eliminated. At the end of 2009, there was evidence of active transmission in only four countries in the region: Brazil (state of Pernambuco), the Dominican Republic, Guyana and Haiti.

The largest population at risk is in Haiti. In Haiti and the Dominican Republic the disease affects mostly residents of low-income rural areas, many of whom are of African descent. The Dominican Republic is entering into the scale-down phase of the programme. In Guyana, the zones considered to be at risk are restricted to the coastal area and to the poorer communities of metropolitan Georgetown.

By the end of 2009, 3.36 million people were reported to have received MDA, principally in Haiti. DEC-fortified salt may continue to be used in Port-au-Prince, Haiti, and in Guyana as a complementary strategy to MDA.

4.2.2 Highlights 2000–2009

Before the January 2010 earthquake, Haiti had been scaling up MDA steadily, reaching more than 3 million people at the end of 2009. Morbidity management is limited to a clinic in Leogane, although some 7000 patients with lymphoedema and 700 with hydrocele have been treated. Dramatic reductions in the prevalence of LF and soil-transmitted helminthiasis were observed between 2000 and 2005 in sentinel sites.

Box 8. In Haiti, a unique partnership

A rapid scaling up of MDA has been enabled in Haiti by a unique partnership and collaboration among the national elimination programme, the Haitian Ministry of Education, the United States Centers for Disease Control and Prevention, the University of Notre Dame in Indiana (United States), Sainte Croix Hospital, IMA World Health, Research Triangle Institute International, the United States Agency for International Development, the Congregation of the Holy Cross in Haiti and the United States, the Global Network for Neglected Tropical Diseases, the Pan American Health Organization, and WHO. Partners designed and implemented collaborative operational research projects throughout the MDA phase, making important contributions to the understanding of why some people systematically refuse to take part in MDA and the impact of MDA for LF on soil-transmitted helminthiases. It was the determination of the Ministry of Public Health and Population, as well as this network of national and international partners, that made it possible to continue MDA after the earthquake in January 2010.

The **Dominican Republic** has been evaluating its south-west focus to determine if transmission has been interrupted. Additional epidemiological surveillance is being considered to evaluate whether LF infection exists among Haitians displaced to the Dominican Republic after the January 2010 earthquake.

In the late 1990s, collaboration among researchers, clinicians and surgeons in the **region** led to a new understanding of the role of adenolymphangitis in the pathogenesis of lymphoedema. Based on this research, new strategies for morbidity management, such as limb care and improved hygiene for lymphoedema, and more effective techniques for surgical repair of hydrocele were pioneered and tested. They have since been widely adopted in all of WHO's endemic regions. The concept of "hope clubs" – support groups for patients in the home and workplace – was also developed and implemented in the region.

The entomological technique of xenomonitoring was also developed and tested in the region during the past decade, and has become part of the toolbox used for monitoring *Culex quinquefasciatus*.

4.2.3 Priorities for the next 10 years

Post-earthquake Haiti. Given the burden of disease in Haiti, as well as the fragile infrastructure left after the earthquake, a priority for the region and its partners is to continue to scale up MDA and mobilize resources for Haiti's elimination programme.

Monitoring and evaluation. The region will focus on technical and operational monitoring and evaluation issues. These include re-mapping when needed, and ensuring data are collected from sentinel sites in a timely manner. In addition, it will be critical to develop an evidence-based plan for scaling down and stopping MDA in the Dominican Republic. Finally, there is a need for guidelines and resources to verify the absence of transmission in Costa Rica, Suriname and Trinidad and Tobago.

Integration. LF programmes throughout the Americas are exploring various integration strategies; during the next 10 years they will focus on integrating plans to control of NTDs in countries where LF is endemic. Where feasible, these strategies could integrate MDA with deworming, the immunization of children and mothers,

the Integrated Management of Childhood Illness strategy, or the distribution of vitamin A and micronutrients, or some combination of these. The region also will explore collaborative strategies with programmes targeting other vector-borne diseases, leprosy and other skin infections. Looking towards sustainable, long-term solutions, programmes will advocate for improving basic sanitation and drainage in endemic communities.

4.2.4 Local partnerships

Since 2008, the Pan American Health Organization has worked with the Inter-American Development Bank, the Sabin Vaccine Institute and the Global Network for Neglected Tropical Diseases to establish a trust fund for neglected infectious diseases to support the elimination of LF and other neglected diseases of poverty at the country level. Development of the trust fund is supported, in part, through a grant from the Bill and Melinda Gates Foundation awarded to the Global Network for Neglected Tropical Diseases.

In Brazil, collaboration among municipal health agencies, the federal elimination programme, Centro de Pesquisas Aggeu Magalhães, a branch of the national FIOCRUZ research institute in Recife, and university hospitals has built a strong partnership to support operational research, clinical care and disease prevention. In Guyana, collaboration between two branches of the Ministry of Health has resulted in improved care for patients with LF-related morbidity. Interaction with the region's Onchocerciasis Elimination Programme for the Americas has fostered an awareness that LF elimination programmes share common experiences and challenges, and are part of a larger regional effort to eliminate NTDs.

South-East Asia Region

Population at risk: **873.3 million**
Number of endemic countries: **9**

Indicator	No. of countries
Countries stopped MDA	1 country Sri Lanka
Countries completed 5 or more rounds of MDA with 100% geographical coverage	1 country Thailand
Countries implementing MDA with 100% geographical coverage	3 countries India, Maldives, Thailand
Countries implementing MDA	8 countries Bangladesh, India, Indonesia, Maldives, Myanmar, Nepal, Thailand, Timor-Leste
Countries where MDA not yet started	0
Countries with mapping in progress	0
Countries not started mapping	0
Countries unlikely to require MDA	0

Figure 14. Progress in mass drug administration (MDA) for lymphatic filariasis, WHO's South-East Asia Region, by year, 2000–2009

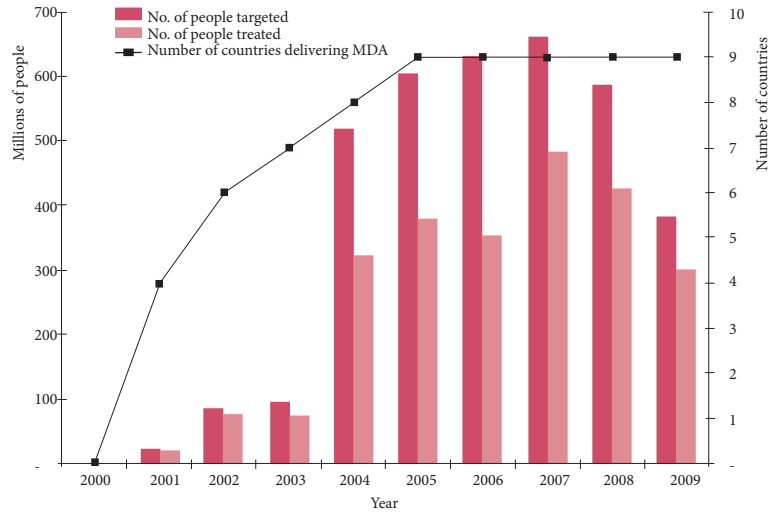
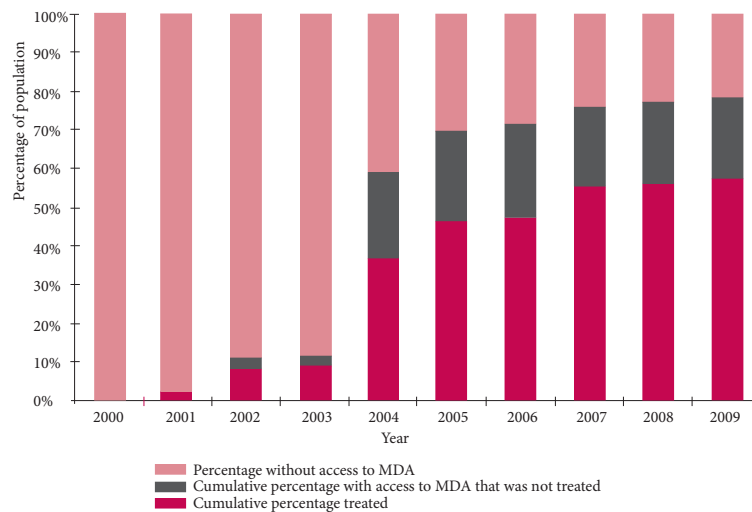


Figure 15. Cumulative percentage of population at-risk for lymphatic filariasis that has been treated by mass drug administration (MDA), that had access to MDA but was not treated and that did not have access to MDA, WHO's South-East Asia Region, 2000–2009



4.3. South-East Asia Region

4.3.1 Background

The South-East Asia Region has the highest burden of LF among the six WHO regions. Sixty-five percent of the global population at risk, or 873.3 million people, reside in this region, of whom 297 million (34%) are children. Of the 120 million people infected globally, 60 million live in the region. The region also accounts for approximately 57% of the total global burden of 5.1 million disability-adjusted life years lost due to LF. Thus, achieving the goal of eliminating LF in the South-East Asia Region will have a significant impact on reducing the global burden.

All three lymphatic filarial parasites – namely *W. bancrofti*, *B. malayi*, and *B. timori* – are present in the region, but *W. bancrofti* causes 95% of infections. *Culex quinquefasciatus* is the major vector of bancroftian filariasis in the region, and *Aedes* and *Anopheles* species mosquitoes are present in a few foci. Several species of *Mansonia* and *Anopheles* are involved in the transmission of brugian filariasis.

Nine countries in the region are endemic: Bangladesh, India, Indonesia, the Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor-Leste. Filariasis elimination programmes and national plans of action are operational in all endemic countries. The region's first strategic plan for eliminating LF was developed in 2000; it has since been updated for the period 2010–2015 (36). The regional programme review group meets regularly to review national and regional progress made towards elimination, and considers countries' applications for donations of medicine.

4.3.2 Highlights 2000–2009

Eight of the endemic countries in the South-East Asia Region are conducting MDA. In 2006, **Sri Lanka** stopped MDA after six rounds in the eight endemic implementation units and started post-MDA surveillance.

Nearly 76 million of **Bangladesh's** population of 147 million is at risk of LF, with 34 of 64 districts being endemic. In 2009, MDA was undertaken in 19 implementation units, targeting approximately 35 million people; reported coverage was 93%. A detailed analysis is being conducted in the seven implementation units that have delivered at least six rounds of MDA to determine whether it can be stopped. Collaboration with LEPROA Health in Action has improved social mobilization efforts in Dhaka, but there is still a need to improve MDA coverage there.

LF is endemic in 250 districts in 20 states in **India**; the at-risk population is 600 million. In 2009, MDA with DEC and albendazole was delivered in all endemic districts. On average, 85% of the eligible population was covered by MDA. Compliance with MDA (the percentage of the population that actually takes the medicine) was lower, but this figure is improving. The overall prevalence of microfilaraemia decreased from 1.24% in 2004 to 0.53% in 2008.

Box 9. Achieving full geographical coverage in India

The response to LF in India has dramatically changed during the past decade. In 2001, India launched an ambitious MDA programme in seven districts. By 2007, the programme was being implemented with either DEC or a combination of DEC and albendazole in all 250 endemic districts, and offered protection to the entire endemic population of 600 million, making it the largest national public-health intervention ever. The expansion of the programme is matched by the government's allocation of sufficient funds. Thus, within a span of 10 years, treatment has been made available to every individual in endemic areas. One of the highlights of the programme is an excellent partnership between the programme and researchers. The positive impact of the programme is evident: monitoring and evaluation suggest that microfilaraemia levels have declined sharply in many implementation units, some of which will be able to stop MDA in the near future. The government envisages achieving elimination by 2015.

Of the 472 districts in **Indonesia**, 337 are endemic, with an at-risk population of more than 124 million. By 2009, the programme had expanded to include 99 endemic districts. Special population groups, called Tenaga Pelaksana Eliminasi, were used to distribute the medicine, either door-to-door or at booths in areas where the community usually congregates. However, MDA was discontinued fully or partially in seven provinces before the criteria for interrupted transmission were met owing to a lack of funds. Health services in a few districts offered hydrocele surgery and support in managing lymphoedema; training programmes have been conducted at the provincial level.

Four rounds of MDA have been completed on the single island in the **Maldives** where LF is endemic.

Myanmar has conducted seven rounds of MDA with uniformly high coverage. During 2007 and 2008, night-time blood surveys in three sentinel sites and spot-check sites revealed no microfilaraemia or antigenaemia among children aged 2–4 years. However, high microfilaraemia rates have persisted at other locations despite several rounds of MDA.

In **Nepal**, seven MDA rounds have been completed, with approximately 8.3 million people covered by the 2009–2010 round. Medicine was distributed through house-to-house visits and also at booths in crowded urban areas. Activities to alleviate disabilities have been conducted according to national guidelines.

By 2009, **Thailand** had completed eight rounds of MDA in its 87 implementation units where the disease is endemic. Only one area, in Narathiwat province, was found to have persistent microfilaraemia; MDA will continue there.

From 2005 to 2007, **Timor-Leste** implemented three rounds of MDA.

4.3.3 Priorities for the next 10 years

Resource constraints. Major challenges for the South-East Asia Region are insufficient funds and a lack of human resources, particularly for social mobilization, transmission-assessment surveys and post-MDA surveillance. Frequent changes in the managers of national programmes and delays in obtaining high-quality medicines also affect implementation.

Monitoring and evaluation. To better understand the programme's progress, the region will need to improve the quality of its data. Problems with data include a lack of baseline assessments made prior to commencement of MDA in some areas, a lack of timely data from sentinel and spot-check sites, and large differences in reported coverage versus survey-assessed coverage.

4.3.4 Local partnerships

National elimination programmes in the different countries in the region collaborate closely with national-level research institutions, academic institutions, NGOs, other disease-control programmes and developmental sectors, such as those engaged in education, social welfare and local governance. The region facilitates the interaction of country-level programmes with various experts, such as LF support centres and funding agencies. Several donors have supported elimination programmes in the region, including pharmaceutical companies, the Australian Agency for International Development, the Damien Foundation in Belgium, the Bill and Melinda Gates Foundation, the Carter Center, the Japan International Cooperation Agency and the World Bank.

Eastern Mediterranean Region

Population at risk: **12.6 million**
Number of endemic countries: **3**

Indicator	No. of countries
Countries stopped MDA	0
Countries completed 5 or more rounds of MDA with 100% geographical coverage	2 countries Egypt, Yemen
Countries implementing MDA with 100% geographical coverage	2 countries Egypt, Yemen
Countries implementing MDA	2 countries Egypt, Yemen
Countries where MDA not yet started	1 country Sudan
Countries with mapping in progress	1 country Sudan
Countries not started mapping	0
Countries unlikely to require MDA	0

Figure 16. Progress in mass drug administration (MDA) for lymphatic filariasis, WHO's Eastern Mediterranean Region, by year, 2000–2009

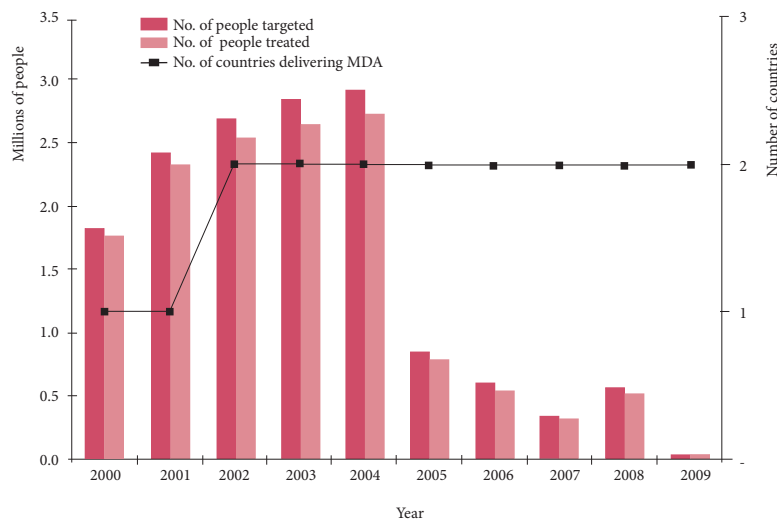
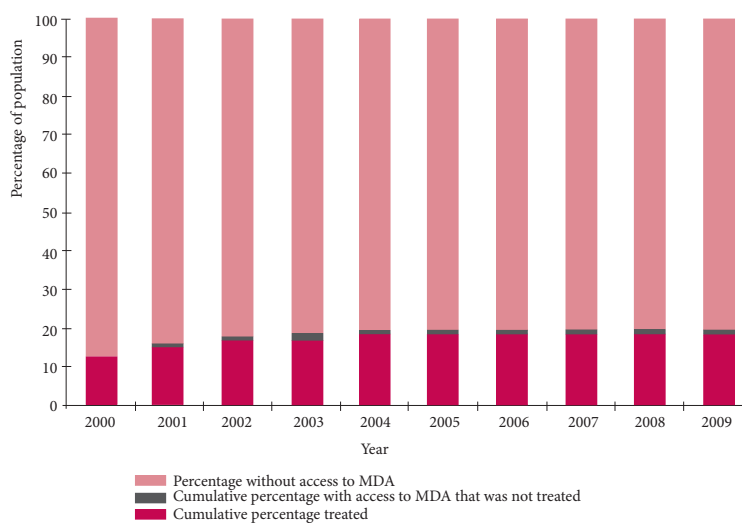


Figure 17. Cumulative percentage of population at-risk for lymphatic filariasis that has been treated by mass drug administration (MDA), that had access to MDA but was not treated and that did not have access to MDA, WHO's Eastern Mediterranean Region, 2000–2009



4.4. Eastern Mediterranean Region

4.4.1 Background

WHO's Eastern Mediterranean region, with an estimated at-risk population of 12.6 million people, accounts for approximately 1% of the global disease burden. LF is caused by *W. bancrofti*, and transmitted primarily by *Culex* species mosquitoes in mostly rural and semi-urban areas.

The disease is endemic in three of the 22 countries in the Eastern Mediterranean Region: Egypt, Sudan and Yemen. Of these, Sudan and Yemen are co-endemic with onchocerciasis. Egypt and Yemen have successfully implemented five effective rounds of MDA, and northern Sudan has completed epidemiological mapping of the disease. The situation in four other countries remains uncertain (the Republic of Djibouti, the Islamic Republic of Pakistan, the Kingdom of Saudi Arabia and the Somali Democratic Republic). Epidemiological investigation has revealed that the Sultanate of Oman is free of LF transmission.

In 2000, the Regional Committee for the Eastern Mediterranean approved a resolution (EM/RC47/R.11) urging Member States with present transmission or a history of transmission to make national epidemiological assessments of the disease; to strengthen filariasis management, surveillance, information and evaluation systems; and to develop a time-bound national plan for eliminating the disease in line with the strategies adopted by WHO. The resolution also urged that all relevant governmental and nongovernmental bodies take part in these activities (37).

4.4.2 Highlights 2000–2009

Egypt was one of the first countries in the world to initiate a national programme to eliminate LF within the framework of WHO's global strategic plan. By the fifth round of MDA, implemented in 2004, 181 villages had been treated, covering more than 2.5 million inhabitants in seven governorates. The reported overall MDA coverage rate for all rounds was more than 90% of the targeted population. Following WHO's guidelines, MDA was stopped in 149 villages (92.5%) after five rounds.

Box 10. External assessment in Egypt

In 2006, two years after MDA was stopped in certain areas of Egypt, an independent research team conducted post-MDA epidemiological studies in villages that had had the highest infection rates before MDA. The study confirmed the high coverage reported by the Ministry of Health. None of the study participants examined in eight villages had microfilaraemia; the prevalence of microfilaraemia was 0.2% in another village. A slightly larger proportion of participants (0.8%) in the nine villages had residual antigenaemia. Infection rates in mosquitoes in 22 villages examined were below 0.40%, with most at extremely low levels (0.13% or less). Such data suggest that transmission has been interrupted in these settings after delivery of five rounds of MDA.

In 2002, nine districts in **Yemen** were found to be endemic, with antigenaemia prevalences ranging from 2% to 40%. MDA was conducted between 2002 and 2009 in these districts. By 2006, all 7 implementation units had completed five rounds of MDA; all but one had reached the criteria for interrupting transmission. After three more annual rounds of treatment during 2007–2009, supplemented with vector-control measures, the criteria were reached in the remaining implementation unit, and MDA was stopped. Passive laboratory-based surveillance as well as surveys for infection every two years will be conducted among children aged 6–8 years using immunochromatographic card tests. In addition, supportive treatment for the management of disability has been provided to 523 people with possible LF-related disease registered at the programme's clinics.

By the end of 2009, **northern Sudan's** LF elimination programme had completed epidemiological mapping in 12 of 15 states. All 77 northern localities were found to be endemic, with an estimated at-risk population of more than 19 million people. Mapping activities did not include three inaccessible localities as well as three states experiencing conflict. In preparation for MDA activities and to collect baseline data, the elimination programme carried out night-time blood surveys in two sentinel sites in each of two states, finding microfilaraemia prevalence rates ranging from 0% to 8.0%. A total of 90 health workers participated in three training sessions on MDA during 2009.

Mapping of LF in **southern Sudan** has been hampered by conflict and because loiasis is co-endemic in certain areas. Previous epidemiological surveys indicated that LF is hyperendemic in four states, and questionnaire surveys showed that clinical manifestations occur in another three states. However, no information is available from the remaining two states. In 2009, an integrated survey of NTDs conducted in the state of Northern Bahr El Ghazal found the overall prevalence rate was below 1%, which is the threshold for MDA intervention.

4.4.3 Priorities for the next 10 years

Integrated community-based interventions. There is an urgent need for research to develop innovative, sustainable, efficient and cost-effective strategies for implementing community-based interventions in areas with few resources.

Loiasis co-endemicity. There is a need for operational research to determine the best rapid assessment index that can be used in southern Sudan to ascertain the level of endemicity of loiasis and the risk of severe adverse reactions following ivermectin treatment in areas where loiasis is suspected to be endemic.

Verification. With support from LF experts, the Eastern Mediterranean Region will help countries that were endemic in the past or have interrupted transmission through MDA to prepare dossiers for verification of the absence of transmission.

4.4.4 Local partnerships

National elimination programmes have worked in close association with various local and international partners. For example, social mobilization in Egypt was supported through GlaxoSmithKline's local office in Cairo, and post-MDA epidemiological surveys were conducted with the collaboration of researchers at Washington University in St. Louis, Missouri, United States. In Yemen, field activities were implemented using the infrastructure of the Yemen Leprosy and TB Elimination Society, an NGO. The Malaria Consortium and Research Triangle Institute International, with support from the United States Agency for International Development, are helping to map southern Sudan.

Western Pacific Region

Mekong-Plus Regional Programme Review Group

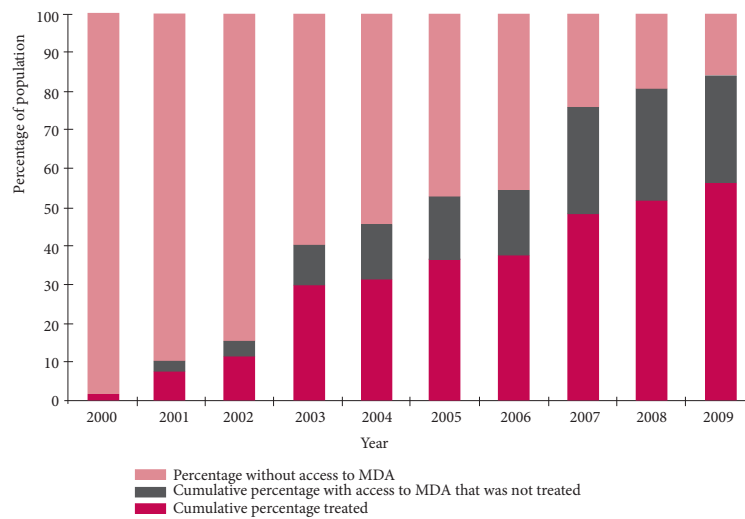
Population at risk: **32.1 million**
Number of endemic countries: **6**

Indicator	No. of countries
Countries stopped MDA	0
Countries completed 5 or more rounds of MDA with 100% geographical coverage	3 countries Cambodia, Malaysia, Viet Nam
Countries implementing MDA with 100% geographical coverage	4 countries Cambodia, Malaysia, Philippines, Viet Nam
Countries implementing MDA	5 countries Cambodia, Lao People's Democratic Republic, Malaysia, Philippines, Viet Nam
Countries where MDA not yet started	0
Countries with mapping in progress	0
Countries not started mapping	0
Countries unlikely to require MDA	1 country Brunei Darussalam

Figure 18. Progress in mass drug administration (MDA) for lymphatic filariasis, Mekong-Plus Regional Programme Review Group, WHO's Western Pacific Region, 2000–2009



Figure 19. Cumulative percentage of population at-risk for lymphatic filariasis that has been treated by mass drug administration (MDA), that had access to MDA but was not treated and that did not have access to MDA, Mekong-Plus Regional Programme Review Group, WHO's Western Pacific Region, 2000–2009



Pacific Programme to Eliminate Lymphatic Filariasis Regional Programme Review Group

Population at risk: **5.8 million**
Number of endemic countries: **17**

Indicator	No. of countries
Countries stopped MDA	4 countries Cook Islands, Niue, Tonga, Vanuatu
Countries completed 5 or more rounds of MDA with 100% geographical coverage	7 countries American Samoa, Fiji, French Polynesia, Kiribati, Samoa, Tuvalu, and Wallis and Futuna
Countries implementing MDA with 100% geographical coverage	7 countries American Samoa, Fiji, French Polynesia, Kiribati, Samoa, Tuvalu, and Wallis and Futuna
Countries implementing MDA	10 countries American Samoa, Fiji, French Polynesia, Kiribati, Marshall Islands, Micronesia, Papua New Guinea, Samoa, Tuvalu, Wallis and Futuna
Countries where MDA not yet started	2 countries Palau, New Caledonia
Countries with mapping in progress	0
Countries not started mapping	0
Countries unlikely to require MDA	1 country Solomon Islands

Figure 20. Progress in mass drug administration (MDA) for lymphatic filariasis, Pacific Programme to Eliminate Lymphatic Filariasis Programme Review Group, WHO's Western Pacific Region, 2000–2009

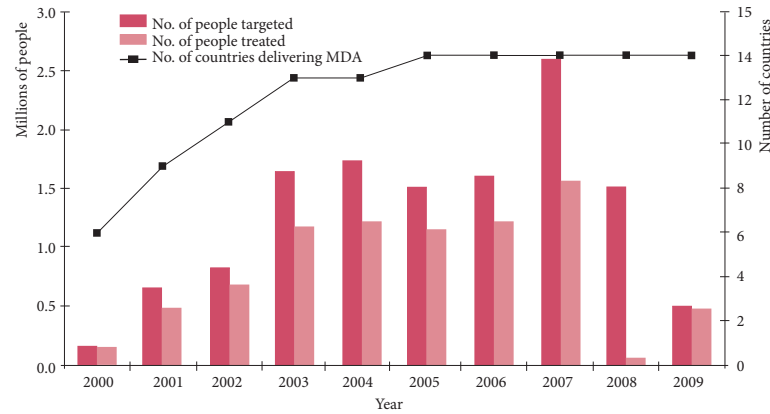


Figure 21. Cumulative percentage of population at-risk for lymphatic filariasis that has been treated by mass drug administration (MDA), that had access to MDA but was not treated and that did not have access to MDA, Pacific Programme to Eliminate Lymphatic Filariasis Programme Review Group, WHO's Western Pacific Region, 2000–2009



4.5. Western Pacific Region

4.5.1 Background

With almost 40 million people at risk of LF infection, the Western Pacific Region accounts for 3% of the global burden. LF is caused by *W. bancrofti* and *B. malayi*, and transmitted by *Anopheles*, *Culex* and *Aedes* mosquitoes. In 2002, the region resolved to eliminate lymphatic filariasis by 2020 by integrating approaches to tackling LF with those of other disease-control programmes, such as helminth control, nutritional supplementation, environmental health and malaria control (38).

For logistical reasons, the programme in the Western Pacific Region is divided into two areas, namely the Mekong-Plus and the Pacific. The programme to eliminate lymphatic filariasis in the Mekong-Plus countries began in 2000. The six endemic countries in the Mekong-Plus subregion – Brunei Darussalam, Cambodia, the Lao People's Democratic Republic, Malaysia, the Philippines and Viet Nam – are at different stages of implementation. All except Brunei Darussalam and Malaysia face resource constraints. Elimination has been verified in two countries in the Mekong-Plus subregion: China and the Republic of Korea.

The Pacific Programme to Eliminate Lymphatic Filariasis (PacELF) started in 1999 and has made good progress towards elimination. Morbidity-control programmes must be scaled up, and active post-MDA surveillance must be implemented, particularly in areas with efficient day-biting vectors and a long history of resurgence of LF.

The Western Pacific Region has a regional plan of action that incorporates principles of integrated vector management, which is a key component of control programmes for malaria and dengue. Integrated vector management will be incorporated into LF elimination strategies in specific settings, such as Papua New Guinea.

4.5.2 Highlights 2000–2009

4.5.2.1 Mekong-Plus subregion

Due to a low overall prevalence of microfilaraemia, MDA was not required in **Brunei Darussalam**. Instead, a strategy of individual case detection and treatment has been implemented.

Cambodia and **Viet Nam** have both completed five annual rounds of MDA; they need to assess whether transmission has been interrupted and begin post-MDA surveillance. **Malaysia**, which has also completed five rounds, will implement a transmission-assessment survey during 2010–2011, under the guidance of the Mekong-Plus Regional Programme Review Group and WHO.

The **Lao People's Democratic Republic** and the **Philippines** are still conducting MDA. In February 2008, the Lao People's Democratic Republic commenced MDA in one endemic district, but mapping in 2009 found that the entire province is endemic. In addition, another province will be remapped in 2010 to determine if MDA is needed there.

The **Philippines** completed mapping by 2008 and was found to have the heaviest burden in the Western Pacific Region, with 29.4 million people in 41 of 79 provinces at risk of infection. MDA commenced in 16 implementation units in 2002. In 2008, three provinces were epidemiologically evaluated to determine whether MDA could be stopped. One of them met the criteria for interruption of transmission, and the other two needed further verification. Plans are under way to integrate services for LF disability alleviation with those of the leprosy elimination programme.

Box 11. Successful elimination efforts in China and the Republic of Korea

The only two countries to have been verified by WHO as having eliminated the disease as a public-health problem – China and the Republic of Korea – are both in the Western Pacific Region. After an extensive programme of MDA, using tablets as well as DEC-fortified salt, and meticulous post-MDA surveillance, China applied to WHO in 2006 for verification of elimination. Many of the strategies used by GPELF originate from the successful approaches implemented in China. In 2008, WHO concluded that the Republic of Korea had eliminated LF as a public-health problem. Social and environmental changes, made possible by economic growth, also contributed to elimination in the Republic of Korea.

4.5.2.2 PacELF subregion

Surveys conducted in 2007 in the Pacific showed that PacELF's strategy has been effective when properly implemented. After five rounds of well conducted MDA, the prevalence in the **Cook Islands**, **Niue**, **Tonga** and **Vanuatu** dropped below 1%, the threshold thought to be needed to interrupt transmission. These countries need to implement post-MDA surveillance.

Specifically-tailored interventions were needed for the **Federated States of Micronesia**, **Marshall Islands**, **New Caledonia**, **Palau**, and **Wallis and Futuna**, which had prevalences below 1% at the national level but as high as 46% on some islands. With the development of more sensitive surveillance methods, it will be possible to conduct detailed mapping of prevalence and to implement targeted interventions.

A further six countries, consisting of **American Samoa**, **Fiji**, **French Polynesia**, **Kiribati**, **Samoa** and **Tuvalu**, present specific challenges: geographical and logistical issues as well as a long history of resurgence despite very low prevalence rates. In June 2008 careful assessments were conducted by a group of international experts. These assessments were analysed during the meeting of a technical working group that followed the experts' mission to the countries; gaps in financial and technical support were identified, and they can now be addressed systematically.

Six other countries (**Guam, Nauru, the Northern Mariana islands, Pitcairn Island, the Solomon Islands and Tokelau**) are considered non-endemic.

Papua New Guinea has faced particular challenges due to population size, geographical and logistic issues, and security problems. Complementary interventions such as the use of DEC-fortified salt, and coverage with insecticide-treated bednets distributed through the malaria programme, might reduce transmission.

Because endemic countries have focused on MDA for the past 10 years, the morbidity-control component of the programme has been delayed.

4.5.3 Priorities for the next 10 years

Scaling up in Papua New Guinea. A sustainable, integrated LF elimination programme should be established by using new opportunities for collaboration with the malaria-control programme, for example by implementing vector-control measures that affect the transmission of both malaria and LF.

Resources. Experience in the region has shown that the closer countries move towards elimination, the more they need strategies tailored to their specific needs, constraints, settings and history of LF control. Technical assistance will be needed to develop these strategies. In addition, to effectively implement the regional programme it will be necessary to ensure a supply of quality-assured DEC, and build capacity in countries to accurately estimate their annual requirements for DEC.

Monitoring and evaluation. There will be a continuing need for both technical and financial support to implement evidence-based approaches as many countries move towards conducting surveys to assess whether transmission has been interrupted and then begin post-MDA surveillance.

Morbidity management. Morbidity management in PacELF began in Fiji in 2009, but much more is needed in the PacELF subregion to implement plans to ensure that people suffering from the disfiguring consequences of the disease are cared for.

4.5.4 Local partnerships

Funding for implementation of LF activities in the Western Pacific Region has come from many donors, including the Asian Development Bank, the Australian Agency for International Development and WHO. The Japanese government has supported PacELF since its inception in 1999. In September 2009 the Japanese government confirmed that it will extend its commitment and will continue to provide the necessary immunochromatographic card tests and DEC until 2015 for the countries in the PacELF subregion.

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Annex

List of endemic countries by WHO region or regional programme review group^a

African (39)

Angola
Benin
Burkina Faso
Burundi
Cameroon
Cape Verde
Central African Republic
Chad
Comoros
Congo
Côte d'Ivoire
Democratic Republic of the Congo
Equatorial Guinea
Eritrea
Ethiopia
Gabon
Gambia
Ghana
Guinea
Guinea-Bissau
Kenya
Liberia
Madagascar
Malawi
Mali
Mauritius
Mozambique
Niger
Nigeria
Rwanda

Sao Tome and Principe

Senegal
Seychelles
Sierra Leone
Togo
Uganda
United Republic of Tanzania
Zambia
Zimbabwe

Americas (7)

Brazil
Costa Rica
Dominican Republic
Guyana
Haiti
Suriname
Trinidad and Tobago

South-East Asia (9)

Bangladesh
India
Indonesia
Maldives
Myanmar
Nepal
Sri Lanka
Thailand
Timor-Leste

Eastern Mediterranean (3)

Egypt
Sudan
Yemen

Mekong-Plus (6)

Brunei Darussalam
Cambodia
Lao People's Democratic Republic
Malaysia
Philippines
Viet Nam

PacELF (17)

American Samoa
Cook Islands
Fiji
French Polynesia
Kiribati
Marshall Islands
Micronesia
New Caledonia
Niue
Palau
Papua New Guinea
Samoa
Solomon Islands
Tonga
Tuvalu
Vanuatu
Wallis and Futuna

^a Countries in italics are countries where MDA is not required.

