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**Regional framework for  
prevention of malaria  
reintroduction and  
certification of malaria  
elimination  
2014–2020**



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# Regional framework for prevention of malaria reintroduction and certification of malaria elimination

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Mikhail Ejov, Vladimir Davidyants, Andrei Zvantsov

## ABSTRACT

This framework for prevention of the reintroduction of malaria and certification of countries as free from malaria is intended for health policy-makers, heads of national malaria control programmes, heads of epidemiological, parasitological and entomological departments of the epidemiological services under ministries of health, and specialists from other ministries and agencies involved in the implementation of programmes for malaria elimination and prevention of malaria reintroduction in central Asia, the south Caucasus, Turkey and some European countries.

The document outlines the key issues related to possible resurgence of malaria in the post-elimination period, the goals and objectives of the programme and key approaches and measures to prevent malaria reintroduction, as well as scientific, operational, organizational and methodological aspects of the process of certifying countries free from malaria. The guidelines described in the document are intended to help health policy-makers and managers of malaria control programmes to plan, organize and implement measures aimed at preventing malaria reintroduction and the certification of malaria elimination.

## Keywords

CERTIFICATION  
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## Summary

The period from 2005 to 2013 witnessed not only a reduction in malaria incidence in all affected countries, and prevention of malaria resurgence in countries and areas where it had been eliminated earlier, but also the complete interruption of malaria transmission in most countries with certification of malaria elimination in some of them. By 2013, local malaria transmission was interrupted in eight of the 10 countries that signed the Tashkent Declaration (Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, the Russian Federation, Turkmenistan and Uzbekistan). Tajikistan and Turkey have also made significant progress in reducing the number of malaria cases. Interruption of local malaria transmission can be expected in these countries in the coming years. Armenia, Kazakhstan and Turkmenistan were certified as malaria-free in, respectively, 2010, 2011 and 2012.

Countries that have become malaria-free face a new task, namely, the development of a national programme for prevention of malaria reintroduction. Malaria reintroduction, also known as malaria resurgence, is the occurrence of introduced case(s) (that is, case(s) of first-generation local transmission which are epidemiologically linked to a confirmed imported case) in a country or area where malaria had been eliminated. The transition from elimination of malaria to prevention of malaria reintroduction is possible only when effective countrywide surveillance has shown that malaria transmission has been interrupted, that there are no locally acquired cases of malaria throughout the country and that all reported cases of malaria have been imported.

Continuous importation of malaria from endemic countries and, as a result, the recent resumption of local malaria transmission in limited areas in Georgia, Greece and Turkey require constant vigilance and assessment of the current and potential epidemiological situation as well as prompt and appropriate interventions, when necessary. National programmes for prevention of malaria reintroduction should be carried out until the goal of malaria eradication has been reached, that is, complete interruption of all forms of malaria in all countries of the world.

The risk of malaria resurgence in a country depends on the combined effect of multiple factors, most important of which are susceptibility and vulnerability. Susceptibility is a question of the presence of local vectors and the existence of favourable ecological and climatic conditions to support malaria the transmission of malaria. Vulnerability depends on the level of probability of the importation of malaria parasites into the country. The development of strategic plans and practical approaches to prevent malaria resurgence in a country should be based on the assessment and differentiation of these risks.

The purpose of this programme is to maintain a country's malaria-free status by preventing the re-establishment of local transmission of malaria and the occurrence of introduced case(s) from imported ones and indigenous case(s) secondary to introduced ones. The main objectives of the programme are: early detection, notification, diagnosis and treatment of all cases of malaria; determination of the probable causes of re-establishment of malaria transmission; an urgent response in the event of renewed malaria transmission; and determination of the level of risk of malaria reintroduction, taking into account such factors as susceptibility and vulnerability of the country.

The programme should include not only goals, objectives and key strategic approaches, but also a set of specific activities for implementation. The choice of activities should be based on the assessment of the local situation and the susceptibility and vulnerability of the area.

If the levels of both susceptibility and vulnerability of the area are low, the main emphasis should be placed on improving the skills of general physicians and other general health workers to diagnose malaria as soon as possible. Quite often epidemiological investigation of each confirmed imported case of malaria, along with adequate and prompt prevention and treatment, can be sufficient to prevent resumption of local transmission of malaria. In circumstances characterized by increased levels of receptivity and vulnerability, the above measures must be supplemented by active detection of malaria cases. In areas with a high level of vulnerability, malaria vector control activities aimed at reducing the level of susceptibility are advisable, possible and perhaps even necessary. The vulnerability of an area may be reduced by providing access to diagnosis and treatment of malaria for the entire population, including immigrants and refugees.

## Introduction

In 2002, all Member States endorsed WHO Regional Committee for Europe resolution EUR/RC52/R10 on scaling up the response to malaria in the WHO European Region (1). This resolution urged countries in the Region facing the resurgence of malaria to continue to reduce the burden from the disease. As a consequence, malaria control activities have been strengthened through the Roll Back Malaria regional strategy, which was launched in 1999.

By 2005, it became clear that the malaria epidemic had been contained and that the incidence of the disease had been reduced to a level such that the goal of interruption of malaria transmission had become feasible throughout the Region. This progress made it possible for the ministers of health of Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, the Russian Federation, Tajikistan, Turkey, Turkmenistan and Uzbekistan to sign a policy document entitled The Move from Malaria Control to Elimination in the WHO European Region, better known as the Tashkent Declaration, where they expressed a political commitment to begin the process of malaria elimination in their countries (2).

The period between 2005 and 2013 witnessed not only the reduction of malaria incidence in the affected countries and prevention of malaria resurgence in countries and areas where it was eliminated earlier, but also the complete interruption of malaria transmission in most countries, plus certification of malaria elimination in some of them. By 2013, local malaria transmission had been interrupted in eight of the 10 countries that had signed the Tashkent Declaration: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, the Russian Federation, Turkmenistan and Uzbekistan. This document created a political base that helped the WHO Regional Office for Europe to launch, in 2006, a new regional strategy to eliminate malaria in the Region by 2015, which is being successfully implemented. Tajikistan and Turkey have also made significant progress in reducing the incidence of malaria. Interruption of local malaria transmission in these countries can, therefore, be expected in the near future. Malaria-free status was granted to Armenia, Kazakhstan and Turkmenistan in, respectively, 2010, 2011 and 2012.

However, 2011 and 2012 saw both renewed malaria transmission – in Georgia (isolated cases) and in Greece and Turkey (localized outbreaks) as a result of malaria importation from endemic countries (Afghanistan, India and Pakistan) – and the subsequent resumption of local malaria transmission in limited areas of these countries.

## Prevention of malaria reintroduction in the post-elimination period

### Transition from elimination to prevention of reintroduction of malaria

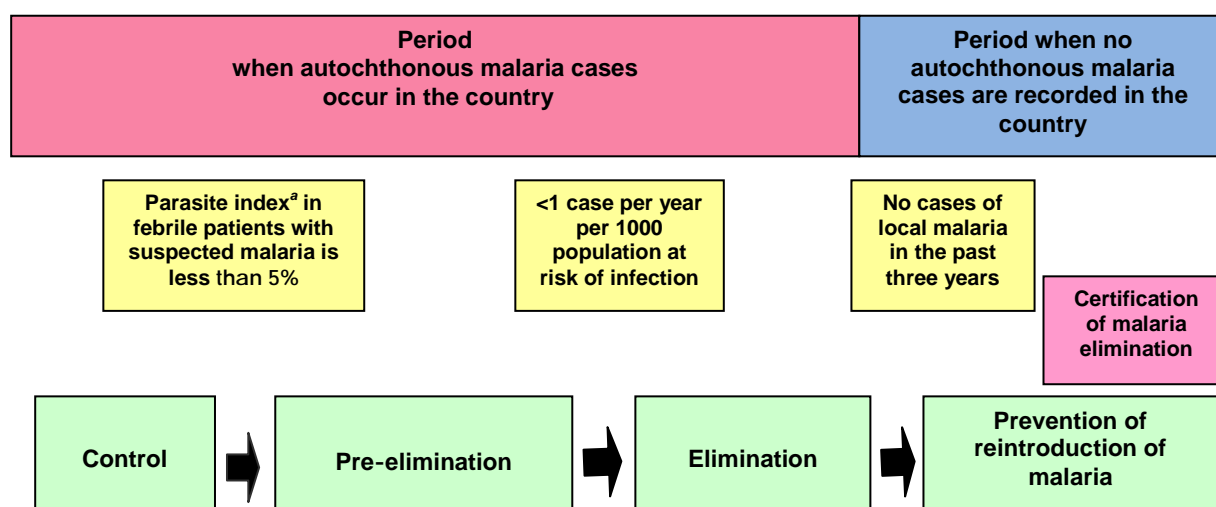
Malaria elimination is defined as interruption of local malaria transmission with the total absence of locally acquired malaria cases due to targeted anti-malaria activities in the country or a specific geographical area. Malaria reintroduction (also known as malaria resurgence) is the occurrence of introduced cases (cases of the first-generation local transmission which are epidemiologically linked to a confirmed imported case) in a country or area where it had previously been eliminated. Countries that have eliminated malaria are entering a new period with the need to prevent malaria reintroduction, when efforts should be made to prevent the resurgence of malaria in conditions when local malaria cases are no longer registered but imported cases may continue to be reported.

The following aims of the malaria elimination programme must be achieved during this period:

- complete interruption of malaria transmission in the country and the absence of locally acquired malaria cases in the presence of adequate and effective malaria surveillance activities throughout the entire country; and
- ability of the national health and surveillance systems, in cases of renewed transmission of malaria, to detect all malaria cases, determine their causes and respond to them rapidly and effectively.

Fig. 1 shows the phases of the malaria programme and the thresholds for each new stage in the continuum control – pre-elimination – elimination – prevention of the reintroduction of malaria.

**Fig. 1. Phases of the malaria programme**



<sup>a</sup> Parasite index – the percentage of people infected with the parasite from the total number of examined people.



Countries that have become malaria-free face a new task, namely the development of a national programme to prevent the reintroduction of malaria transmission. The transition from malaria elimination to prevention of malaria reintroduction is possible only when adequate and effective surveillance of the disease in the country has proved that malaria transmission has been interrupted, that there are no cases of malaria due to local transmission throughout the entire country, and that all reported cases of malaria are imported.

The programme to prevent the reintroduction of malaria in the country should be carried out until the goal of malaria eradication is achieved. This goal is defined as complete interruption of transmission of all forms of malaria throughout the world. The fact that such a terrible disease as smallpox was eradicated by the efforts of all countries under the auspices of WHO indicates that the eradication of malaria is also possible.

## **Importation of malaria and its consequences**

The arrival in the country or area of persons infected with malaria parasites is defined as malaria importation. In recent decades, it has become a common phenomenon as a result of the easier and more frequent movement of people between countries and continents. The role of immigrants and refugees in malaria importation has also increased.

The importation of malaria cases should be distinguished from the importation of infected mosquitoes, when malaria parasites are brought into the area by mosquitoes that either fly across the border or are passively transported, usually by aircraft. It is believed that the migration of mosquitoes from Afghanistan played an important role in sustaining the transmission of malaria in southern Tajikistan between the 1960s and the 1980s, when malaria was eliminated in most parts of the country. The importation of infected mosquitoes by aircraft is reported in some European countries and is often referred to as “airport malaria”.

The consequences of malaria importation can be categorized as:

- clinical (morbidity, mortality and disability)
- epidemiological (the occurrence of introduced and indigenous cases)
- economic (factors such as the loss of labour and the cost of malaria control activities).

The importation of falciparum malaria has largely clinical consequences because mosquito vectors in the European Region are rarely or never infected by *P. falciparum* parasites brought from remote regions of the world. However, importation of *P. falciparum* malaria from neighbouring regions (for example, from Afghanistan to the south of central Asia) may have epidemiological consequences, as demonstrated in Tajikistan. Importation of *P. vivax* malaria is primarily associated with epidemiological consequences.

The prevention of malaria importation mainly depends on the prevention of malaria infection and disease among tourists and other people travelling to malaria-affected areas. However, it is not always possible to identify all infected persons crossing the border. On the other hand, prevention of the consequences of imported malaria is quite feasible. The key elements of such prevention are early detection and treatment of malaria among immigrants and travellers.

Based on the foregoing, it is possible to identify the main approaches and activities to prevent malaria importation and its consequences, which are described below.

## **Prevention of malaria importation into the country**

Activities are aimed at preventing infection and disease among tourists and other people travelling to malaria-endemic countries or returning from them. In some cases, surveillance of such groups can be carried out with an adequate degree of efficiency. For example, effective monitoring of organized groups of specialists, students, workers and tourists can be performed through student health centres and health centres providing care to migrant workers as well as by expanding and clarifying the health care obligations of people such as employers or tour operators.

## **Prevention of consequences of malaria importation into the country**

The main activities are: early detection, effective treatment, good laboratory control and detailed epidemiological investigation of malaria cases among immigrants, students, travellers and other groups – both local residents returning home and citizens of malaria-endemic countries arriving in the country.

## **Prevention of malaria importation as a result of active mosquito migration from other countries**

This type of preventive work should be carried out in areas bordering countries where malaria occurs regularly or occasionally. The main activities should be aimed at protecting the local population and ensuring coordination of activities with similar services in the neighbouring countries.

## **Prevention of passive malaria importation into the country**

The term passive malaria importation is used to describe situations when malaria parasites have been brought into the area by infected mosquitoes that were passively transported, usually by aircraft. Key activities in this area should focus on the airports and land border crossing points and should be coordinated with the special services at the borders (such as sanitary and quarantine stations and transport control centres).

## **The risk of malaria reintroduction and associated factors**

The possibility of re-establishment of malaria in the country depends on numerous ecological, climatic, sociodemographic, epidemiological, entomological and other factors. The combined effect of these factors determines the risk of malaria reintroduction in the country. The assessment of the risk, of its components and of their relationships is, therefore, of great practical and scientific importance for the health services.

The development of strategic and practical plans to prevent malaria resurgence in the country should be based on the assessment and differentiation of these risks. The risk of the reintroduction of malaria in the country depends on its susceptibility and vulnerability.

The two factors essential for evaluating and determining the risk of malaria reintroduction are the susceptibility and vulnerability of the area or country.

The susceptibility of an area or country to malaria transmission depends on the presence and ability of local vectors and the existence of environmental and climatic conditions favourable to malaria transmission. The major factors determining the susceptibility of the area are the species

composition, the abundance of local vectors and their ecological requirements, the degree of anthropophily, the life expectancy of mosquitoes, and the duration of the parasite development in the mosquito in the climatic conditions of the area.

The vulnerability of the area is defined as the degree of probability of malaria parasite importation into this area.

The susceptibility and vulnerability of the area are poorly correlated since susceptibility characterizes the possibility and conditions for re-establishment of malaria in the country after its elimination, whereas vulnerability characterizes the risk of introduction of malaria parasites into an area where they do not exist.

The juxtaposition of these two factors makes it possible to estimate the risk of malaria reintroduction and to simulate possible scenarios. It should be remembered that if the value of one of the above factors is zero (even when the value of the other factor is high), the possibility of malaria reintroduction also equals zero. Table 1 shows how to assess the risk of malaria reintroduction.

**Table 1. Assessment of the risk of malaria reintroduction**

Scenario	Risk assessment factors		Level of the risk of malaria reintroduction
	Susceptibility	Vulnerability	
1.	+	+	From high to low, depending on the severity of risk factors
2.	+	–	None (can rise with increasing degree of vulnerability)
3.	–	+	None (can rise with increasing degree of susceptibility)
4.	–	–	None

Thus, the possibility of the re-establishment of local malaria transmission in a malaria-free area can be described as the result of the interaction of such factors as the susceptibility and vulnerability of the area.

In all cases, assessment of the risk of malaria reintroduction should be based on a detailed analysis of the risk factors across the country and stratification of the country according to the results of the assessment.

The onset of a new period, which is characterized by the absence of local malaria cases, requires the development of a national programme for prevention of malaria reintroduction. The experience gained during the malaria elimination period should be used as a basis for the development and implementation of a new programme and a set of activities aimed at preventing the re-establishment of malaria transmission. The goals, aims, objects of intervention, conditions required for the programme implementation and the main elements of the programme are described below.

## **Regional framework for prevention of malaria reintroduction**

### **Goal of the framework**

The goal of the framework is to maintain the malaria-free status of an area or country by preventing the re-establishment of local transmission of malaria and the occurrence of introduced cases from imported ones and indigenous cases secondary to introduced ones.

### **Objectives of the framework**

The objectives of the framework are the:

- early detection and notification of all malaria cases and prompt diagnosis and treatment;
- determination of the probable causes of the re-establishment of malaria transmission;
- taking of immediate action in the event of renewed malaria transmission;
- determination of the level of risk of malaria reintroduction, including specific factors such as susceptibility and vulnerability of the area, and their regular monitoring.

### **Objects of intervention**

The objects of intervention are imported and introduced cases of malaria, as well as indigenous cases secondary to introduced cases.

### **Main approaches and activities for preventing malaria reintroduction**

The government needs to give priority to the programme based on this framework and allocate adequate funds for its implementation. The government should also assume a number of obligations for the entire duration of the programme. These obligations apply not only to ensuring the presence of the necessary personnel and logistical and financial resources but also to the administration, organization and management of the programme. The programme must be approved by all stakeholders.

In developing this programme, emphasis should be placed on the system of early notification of all cases of imported and locally acquired (introduced and indigenous) malaria. The surveillance system for malaria should be effective, operate throughout the country (regardless of the level of risk) and be able to promptly detect and report all cases of renewed malaria transmission. All malaria cases should be investigated and the information collected should be stored in the national register of malaria cases. The general health care system must be able to detect and treat all reported cases of malaria. Particular attention should be given to the laboratory services and quality control of their work. The entomological surveillance system should be adequate throughout the country and be able to monitor populations of *Anopheles* mosquitoes, conduct entomological surveillance and evaluate the effectiveness and quality of vector control activities. Training and retraining of epidemiologists, parasitologists, entomologists, general physicians, nurses and laboratory personnel on malaria-related issues should also remain a priority. Training in malaria can be included in graduate and postgraduate education. Particular attention should be given to work among the population, such as through various educational programmes. A unified national database on malaria should be created and maintained for the collection, processing, analysis and exchange of information on malaria. Applied research should focus on the

identification of risk factors for malaria reintroduction. The implementation of the programme should be monitored periodically on the basis of national indicators and its performance and results should be assessed annually. The programme should include cross-border and intersectoral cooperation, together with collaboration with WHO and other international organizations, so as to coordinate efforts for the prevention of malaria reintroduction into the country and beyond its borders.

The programme should specify not only the goals, objectives and key strategic approaches, but also a set of specific activities to be implemented.

The choice of activities should be based on an assessment of the local situation and the levels of susceptibility and vulnerability of the area. Two examples of possible situations are provided below for illustration (Tables 2, 3).

**Table 2. Recommended set of curative and preventive measures for different risks of malaria reintroduction**

High risk of susceptibility and vulnerability	Low risk of susceptibility and vulnerability
<ol style="list-style-type: none"> <li>1. Passive case detection.<sup>a</sup></li> <li>2. Active case detection<sup>b</sup> during the transmission season. Normally, active case detection activities are conducted every 14 days. However, in cases of renewed local malaria transmission related to imported cases or to massive importation of malaria by migrant groups, they are performed more often.</li> <li>3. Hospitalization of patients.</li> <li>4. Epidemiological investigation of all cases of malaria.</li> <li>5. Treatment of all confirmed cases of malaria: <ul style="list-style-type: none"> <li>• treatment with blood schizonticidal drugs;</li> <li>• radical treatment of <i>P. vivax</i> malaria, concurrently with administration of blood schizonticidal drugs;</li> <li>• gametocidal treatment of imported cases of <i>P. falciparum</i> malaria during the transmission season;</li> <li>• special attention should be given to suspected <i>P. falciparum</i> malaria cases, especially severe ones.</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Passive case detection.</li> <li>2. Hospitalization of patients.</li> <li>3. Epidemiological investigation and epidemiological classification of all cases and foci of malaria.</li> <li>4. Treatment of all confirmed malaria cases: <ul style="list-style-type: none"> <li>• use of schizonticidal drugs;</li> <li>• radical treatment of <i>P. vivax</i> malaria, concurrently with administration of blood schizonticidal drugs;</li> <li>• special attention should be given to suspected <i>P. falciparum</i> malaria cases, especially severe ones.</li> </ul> </li> </ol>

<sup>a</sup> Detection of malaria cases among patients attending a health facility for diagnosis and treatment, usually for febrile disease.

<sup>b</sup> Detection by health workers of malaria infections at community and household level. Active case detection can be conducted as fever screening followed by parasitological examination of all febrile patients or as parasitological examination of the target population without prior fever screening.

In areas where both indicators are low, the main focus should be on early detection of malaria cases by general health care workers who need to be vigilant for the disease and the possible re-establishment of its local transmission. Quite often, the prevention of malaria reintroduction can be ensured by epidemiological investigation of all confirmed imported cases of malaria, together with immediate and effective health care interventions.

**Table 3. Recommended set of vector control measures for different risks of malaria reintroduction**

High risk of susceptibility and vulnerability	Low risk of susceptibility and vulnerability
<ul style="list-style-type: none"> <li>• Environmental management aimed at sustained improvement of areas and rational planning of hydro-engineering and drainage projects.</li> <li>• Introduction of <i>Gambusia</i> fish into all breeding sites where <i>Anopheles</i> mosquitoes breed.</li> <li>• Other activities against <i>Anopheles</i> larvae can also be applied, but only in breeding sites where the effectiveness of introduction of <i>Gambusia</i> is reduced due to overgrown vegetation.</li> <li>• Indoor residual spraying should be carried out only in exceptional cases, such as when there is extensive importation of malaria by refugees or agricultural workers, or when infected mosquitoes invade the border areas.</li> </ul>	<ul style="list-style-type: none"> <li>• Vector control activities are carried out as part of the general mosquito management programme.</li> </ul>

When the levels of susceptibility and vulnerability of the area increase, the above measures must be supplemented by active detection of malaria cases, for example through door-to-door visits. In areas with a high level of vulnerability, it is possible and perhaps even necessary to implement malaria vector control measures to reduce the level of susceptibility of the area. On the other hand, the vulnerability of the area may be reduced by ensuring access to diagnosis and treatment of malaria for the entire population, including immigrants, refugees and other groups. In some areas, especially areas with a high influx of immigrants from malaria-endemic countries, it may be recommended to screen high-risk populations for malaria infection.

The following activities for detection, diagnosis and treatment of malaria cases are recommended.

1. Early and mandatory reporting should be made of all confirmed and suspected malaria cases identified by public and private health care institutions to a special national medical institution under the ministry of health (for example, to the national epidemiological service) responsible for the prevention of malaria reintroduction into the country. The national register of malaria cases should also be notified about all identified malaria cases.
2. Notification can be by telephone, fax or email. It is advisable that a free hotline be established so that everyone can get the necessary information related to the diagnosis, treatment and prevention of malaria. It is advisable to use or develop (if one is not already available) a standard electronic form for notification of all malaria cases, which should be posted on the website of the above health institution and be accessible to all those who are responsible for the detection, diagnosis and treatment of malaria cases in the public and private health sectors.
3. It is essential that the private health sector reports all confirmed and suspected malaria cases identified in this sector to the public health institution responsible for this area of work at the central level. It is also necessary to ensure that all confirmed and suspected malaria cases in the private sector are referred to public health institutions for confirmation of diagnosis and appropriate treatment.
4. Diagnosis and treatment of malaria should be free. Particular attention should be paid to strengthening the parasitological laboratories of public health facilities, which should receive and analyse blood samples from all malaria patients to confirm the final diagnosis.

All forms of malaria should be treated in the public health sector. National policies and recommendations for the treatment of malaria should be updated periodically.

5. At points of entry, immigrants from malaria-endemic countries should be provided with visual materials on malaria, including information about what to do in case of suspected malaria.
6. To prevent malaria it is necessary to raise the awareness of people travelling to malaria-endemic countries about ways to prevent it. If possible, malaria prevention interventions should be free. Every year, ministries of health should provide the epidemiological services and health care services in the country with WHO information about the drug-resistant malaria situation in different geographic areas and countries of the world, as well as with recommendations about antimalarial drugs, which should contain the schemes and doses to be used.
7. When a local malaria case has been identified, the public health agency or institution responsible for the prevention of malaria in the country should conduct an epidemiological investigation of both the case and the malaria focus.

The availability in the country of mechanisms to respond to emergencies (such as earthquakes, floods, social instability and mass migration), which may cause a malaria outbreak, will help in the taking of rapid and adequate measures aimed at detecting cases of malaria and containing outbreaks. It is imperative that malaria-free countries have mechanisms for prevention, forecasting, early detection and rapid response to emergency situations related to malaria. National emergency plans should be prepared based on the most likely scenarios and taking into account all risk factors. Such plans should contain information about resources that can be quickly mobilized and channels that can be employed for the effective provision and use of these resources.

In cases where malaria parasites have been brought into the area by infected mosquitoes that have been passively transported, usually by aircraft, spraying of vehicles with insecticides may be recommended in accordance with the current International Health Regulations.

In countries or areas where there is a risk of the importation and re-establishment of malaria, more emphasis should be placed on the training of national health workers in malaria-related issues. In addition to training, and the retraining of professionals with sufficient experience, special attention should also be paid to improving the knowledge and skills of general medical staff in the diagnosis, treatment and prevention of malaria, malaria surveillance and community-based activities. Another important aspect is the training of laboratory staff, which should include both basic training and refresher courses with regular supervision.

In the prevention of malaria reintroduction phase, more attention should be given to public involvement and partnerships between civil society groups and public health services. Malaria prevention activities should be implemented in close contact with the population. Even the best preventive strategy will fail if the public is not aware of the benefits of disease prevention.

Entomological monitoring of malaria vectors should be continued when a country or area is in the phase of maintaining its malaria-free status and preventing malaria reintroduction. The entomological services should closely monitor the breeding sites of malaria vectors by estimating the abundance of larvae and adult mosquitoes both indoors and outdoors, monitoring resistance to insecticides, and meteorological monitoring of such indicators as the average daily temperature and precipitation.

Vector control can be recommended, particularly in border areas. The choice of vector control activities should be based on local environmental, epidemiological, social and economic conditions, and their implementation should be coordinated with other sectors, local authorities and relevant services in neighbouring countries.

Environmental management activities can also be considered as a set of approaches to prevent the breeding of *Anopheles* mosquitoes and renewed malaria transmission. These activities are the most efficient method of malaria control and prevention aimed at radical improvement of the entire area. Another advantage of such activities is their lasting effect, provided they have been conducted promptly and professionally. These measures do not require the purchase of special equipment since conventional construction equipment can be successfully used for this purpose.

Environmental management activities should cover all current and potential places of *Anopheles* breeding, that is, all water reservoirs where *Anopheles* larvae can develop. Thus, the objects of these activities include almost all types of surface water.

For crops to be grown successfully, groundwater should be at a certain level relative to the soil surface. This level is called the rate of subsurface drainage. To maintain this level, it is often necessary to lay a network of drainage channels. Surface drainage is achieved by a system of open ditches or closed drains. Filling unnecessary water reservoirs with soil is the most radical hydro-engineering procedure, as it completely eliminates the mosquitoes' breeding place and will not require any maintenance.

Plants emit considerable amounts of water absorbed from the soil during transpiration. Thus, the planting of rapidly transpiring plants helps to lower the groundwater level and eliminate waterlogged areas. A particularly significant effect is observed with the use of such plants as eucalyptus and sunflower, although the use of eucalyptus can be recommended only for the most southern countries of the Region.

One of the prerequisites for the construction of water reservoirs is the forecast of changes in the malaria situation in the affected area. Only a specialist with excellent knowledge of the ecology and biology of vectors will be able to forecast how the size and location of *Anopheles* breeding places will be changed following the filling of the artificial reservoir. Particular attention should be given to location of the planned dam and to the normal headwater level. Even the most acceptable version of constructing a dam cannot ensure a complete absence of *Anopheles* breeding sites in the reservoir. *Anopheles* breeding sites are eliminated by various methods that include:

- installation of dykes protecting the area from flooding
- drainage by means of open and closed drainage systems
- levelling of the soil surface
- deepening of shallow areas.

The creation of large reservoirs is often associated with the resettlement of people from the flooded area in newly created settlements along the banks of the future reservoir. Rational location of the newly established settlements will help to reduce human contact with malaria vectors and the risk of malaria.



The use of larvivorous fish may be recommended in some cases. The introduction of such fish is a simple procedure involving significant expenditure only in the early stages. Specialists planning to use such fish should assess the possibility and advisability of using this approach in different types of reservoir.

Attention should also be paid to the following approaches:

- monitoring the state of water sources and preventing the creation of stagnant water reservoirs near them (some species of *Anopheles* – *An. claviger*, *An. plumbeus* – can breed in artificial ponds with solid walls such as water wells, water tanks and cisterns, so they should be provided with tightly closing lids);
- controlling the intra-settlement and intra-household water reservoirs (removal of vegetation, deepening of shallow water reservoirs, straightening and strengthening of the banks of ponds and other artificial water reservoirs);
- eliminating small ponds and puddles in areas adjacent to and within human settlements;
- preventing the growing of rice on private plots within the boundaries of settlements or homesteads.

To prevent the return of malaria to malaria-free areas in the period when vector control activities are drastically reduced, more emphasis should be placed on methods of individual and collective protection of the population. To protect people from mosquito bites, the following approaches can be used:

- creating a physical barrier, such as anti-mosquito nets, screening and protective clothing which, if they are impregnated with insecticides, both protect people from mosquito attacks and serve as a method for regulating mosquito populations;
- making people unattractive to mosquitoes as blood-meal hosts by using insect repellents;
- distracting mosquitoes from attacking people by, for example, in livestock areas, reviving such an undeservedly forgotten preventive method as the deployment of livestock to form a zoological barrier distracting mosquitoes and thus protecting people from contracting malaria and other vector-borne diseases.

## **Certification of malaria elimination**

### **Background**

The global malaria eradication programme, coordinated and supported WHO since 1957, has been successful in most countries of the temperate zone but has not achieved its objectives in tropical regions.

In 1959, the Regional Committee urged Member States where indigenous malaria was a public health problem to reach the consolidation phase in their respective eradication programmes within the next three years. By 1963, this objective had been achieved and, over the next decade, most countries in the Region fulfilled the criteria for malaria elimination. By 1975 it became clear that endemic malaria had disappeared from Europe for the first time in history, although the achievement of this goal required much more effort than originally anticipated.

The successful elimination of malaria in Europe has demonstrated that large-scale vector control measures (in particular indoor residual spraying with insecticides), combined with adequate treatment and surveillance, are able to sharply decrease and even completely interrupt the transmission of malaria in areas with a relatively low intensity of transmission. In Europe, the implementation of anti-malaria activities, combined with modern agricultural methods, helped to reduce the risk of malaria reintroduction to very low levels in most countries. However, as described in WHO documents, any deterioration in the public health services in European countries caused by natural or social disasters could bring back a broad range of infectious diseases, including malaria. This happened in the early 1990s, when the incidence of malaria began to rise in some countries of the Region.

It should be noted that since 1956, when the WHO Expert Committee on Malaria first addressed the issue of malaria eradication, the main condition for the completion of the consolidation phase has been the fact that an adequate surveillance system is successfully operating and that it is able to demonstrate convincingly that malaria transmission has been interrupted throughout the country (or specific area) and that the local reservoir of malaria has disappeared.

Thus, the fact of malaria elimination can be defined as a situation when a high-quality surveillance system has revealed no evidence of malaria transmission despite careful search for malaria cases during three consecutive years, in the absence of any measures for malaria vector control at least in the previous two years. This functional definition of malaria elimination was slightly modified and enlarged at later sessions of the WHO Expert Committee on Malaria.

## Requirements and procedures for certification

Certification of malaria elimination is the official recognition of malaria elimination achieved in a specific country. Malaria-free status is granted by WHO when it has been proved beyond reasonable doubt that the chain of local malaria transmission by *Anopheles* mosquitoes has been fully interrupted throughout the country or area for at least three consecutive years. The concept of certification of malaria elimination was first formulated by WHO at the onset of the malaria eradication campaign. Malaria elimination includes four stages: the preparatory phase, attack phase, consolidation phase and maintenance phase.

The past experience of eradication programmes has shown, however, that during the advanced consolidation phase, and even later during the maintenance phase, isolated malaria cases are sometimes detected which cannot be classified as relapsing, induced, imported, introduced or locally transmitted. If an exhaustive epidemiological investigation fails to reveal the source of malarial infection, such cases are classified as “cryptic” and their presence is not considered as incompatible with malaria elimination or as an obstacle to the completion of the consolidation phase. Two more conditions should, however, be met before a decision is taken on terminating this phase.

- First, it should be proved that the surveillance has been adequate, that is, it has been of high quality, based on active and passive case detection methods and appropriately supervised, and that the laboratory investigations have been reliable, prompt and efficient and their results are accurate.
- Second, it should be proved that the preparation work for initiating the maintenance phase has been completed.

Eliminating malaria, which is defined as interruption of its local transmission throughout the country or area, does not require the elimination of malaria vectors or complete absence of malaria cases, since imported cases related to international travel can and probably will be recorded.

Once an elimination programme has been successfully implemented, the government may be inclined to officially proclaim the elimination of malaria throughout the country. Any government can declare that malaria has been eliminated from its territory, but to obtain international recognition of such a declaration it is expected that WHO will certify it by including the country in an official register of areas where malaria elimination has been achieved. For this to happen, the government of the country must request WHO to undertake an inspection and review the achievements of the malaria programme. Such an inspection is usually carried out by an international certification team acting on behalf of WHO. Upon completion of the inspection, the expert team submits its report and recommendations to the Director-General of WHO. The final decision of the Director-General is communicated to the Member State. The Tenth Report of the WHO Expert Committee on Malaria contains detailed information about the confirmation of malaria elimination, including all the points to be explored and checked by a certification team (3). The process of certifying malaria elimination is based on the following principles:

- certification is done for a country as a whole, and for all four human malaria species;
- inspection of the certification process and evaluation of its implementation will be carried out by an expert team led by WHO; upon completion of the inspection, the expert team submits its report and recommendations to the Director-General of WHO;
- the final decision on certification is taken by the Director-General of WHO, and a Member State is duly informed about this decision;
- registration of malaria elimination certification is published in the WHO Weekly Epidemiological Record as well as in an official register of Member States where malaria elimination has been achieved.

It is the prerogative of a national government to decide whether malaria elimination in a country should be certified. But if such a decision is made, certification is always conducted by WHO.

The process of certification of malaria elimination in a country seeks to find answers to the following two questions.

- Is the indigenous transmission of malaria interrupted throughout the country?
- Can the existing health system in the country (in particular the curative and preventive services and the epidemiological service) prevent the re-establishment of local malaria transmission?

Answers to these questions, which will be provided by the International Certification Commission, are of great importance both for the country and for the international community.

Malaria control, reducing the burden of malaria and its elimination are one of the main priorities of the Millennium Development Goals, which were adopted in 2000 by 193 member states of the United Nations and by 23 international organizations. Certification of malaria elimination is an

international acknowledgment by WHO, acting on behalf of the international community, of the fact that a country is free from malaria and that it has met the commitments made by the countries with regard to malaria control and elimination. Certification also confirms to the international community that the country has created an adequate system for preventing the re-establishment of local malaria. To maintain its malaria-free status, a country must show it has the necessary political will and vision, has created the required legislative and regulatory framework and has adequate financial and administrative resources, personnel and technological capacities. All the above help to improve the political rating of a country that has been able to eliminate this disease which is associated with poverty.

International recognition of the elimination of malaria in a country, based on the decision of the Director-General of WHO, is first reflected in the WHO Weekly Epidemiological Record. In addition, WHO publishes the International Travel and Health Report where it is also reflected.

The status of a malaria-free country provides direct or indirect economic benefits for tourism, business, student exchange programmes and so on. That is why the political, social and economic importance of the elimination of malaria in a country and the certification of this fact is difficult to overestimate.

## **Timeline and criteria for certification**

When interruption of malaria transmission is achieved throughout a country and the absence of local malaria transmission has been maintained for at least three consecutive years, the country may request WHO to begin the process of certifying its territory as malaria-free.

A country asking WHO to certify its malaria-free status must submit the necessary evidence that the local transmission of malaria has been absent for at least three consecutive years and that the country has an efficient system for epidemiological surveillance of malaria which is able to detect any signs of possible malaria transmission. Certification of malaria confirms both that local malaria transmission has been interrupted throughout the country and that the country has an effective system of epidemiological surveillance of malaria.

The International Commission for the Certification of Malaria Elimination can reach a decision about the absence of malaria cases and the interruption of local malaria transmission only when the country has demonstrated that it has:

- a high-quality system of malaria surveillance covering all areas of the country;
- a national register of malaria cases and a system of emergency alert and of prompt notification of all cases of malaria by the public and private health sectors;
- an adequate system of early detection and effective treatment of imported malaria cases and their subsequent clinical and epidemiological monitoring;
- laboratory services providing high-quality and prompt parasitological diagnosis of malaria throughout the country, including the most remote and inaccessible areas;
- a system ensuring prompt and thorough epidemiological investigation of each case of malaria;

- a national plan of action aimed at preventing the re-establishment of local malaria transmission in the country, financed under the national budget and supported by the national government.

In order to prevent malaria reintroduction and to maintain the favourable epidemiological situation the country should also have:

- an adequate system for early recognition and rapid response to malaria outbreaks;
- a functioning mechanism for coordination of preventive measures in the border areas of neighbouring countries (if necessary);
- a functioning mechanism for intersectoral cooperation of all ministries and agencies involved in the prevention of malaria;
- a high-quality system of entomological surveillance, including monitoring of resistance of malaria vectors to insecticides, especially in areas with high susceptibility;
- a centralized computerized database of malaria cases and malaria outbreaks with the possibility of mapping based on the geographic information system;
- an adequate system of prevention and health education that helps to identify promptly all cases of imported malaria and to eliminate the risk of resumption of local malaria transmission, including the development and distribution of recommendations for the prevention of malaria among travellers, tourists, students, workers and other individuals travelling to or returning from malaria-endemic countries.

Special studies may provide important proofs that malaria transmission is interrupted. Sero-epidemiological surveys to detect malaria antibodies in the population can serve as an additional proof of interruption of malaria transmission. Molecular epidemiological studies using polymerase chain reaction -based techniques may be a powerful argument when deciding whether the country should be granted malaria-free status.

## **Stages of the certification process**

The process of certifying a country as malaria-free, from the moment when the country requests WHO to perform the certification until the publication of the certification decision in the WHO Weekly Epidemiological Record, includes the following steps.

### **Request to start the certification process**

The first step is sending the appropriate request to WHO. On behalf of the government the minister of health must send an official letter to the Director-General and the Regional Director of WHO with a request to begin the process of certification of malaria elimination in his or her country. The Director-General notifies the country that WHO has received this request, agrees to start the certification process and is prepared to give the country the necessary scientific, methodological and consultative assistance in this process through the malaria programme both at WHO headquarters and the Regional Office. The Director-General also informs the country about the certification process, the associated criteria and the required documentation containing clear and convincing evidence that malaria transmission has been interrupted throughout the country.

## **Establishment of the national certification committee and its activities**

The country creates the national certification committee which is responsible for preparations for certification and for subsequent work with the International Certification Commission. The government approves the composition, scope and work plan of the national certification committee, including the timeline of activities.

## **Preparation of documents recommended by WHO for the certification process**

The country prepares documents required for certification, which must be submitted to the WHO Certification Commission for confirmation of the fact that the interruption of local transmission of malaria has been achieved throughout the country. The list of the necessary documents is as follows:

- a national action plan aimed at control, elimination and prevention of re-establishment of malaria;
- an organizational structure of the special malaria control programme and the plan of its activities at all levels, including a detailed budget and the staff involved;
- annual reports on the surveillance of malaria in the previous 10 years;
- a complete database of all malaria foci with detailed maps for the last five years, including the date of registration of the last local malaria case;
- a national register of malaria cases and foci with maps of epidemiological investigations of cases identified in the previous five years;
- reports on the monitoring of the quality of malaria diagnosis;
- existing national policies and recommendations for the treatment of malaria;
- reports on the entomological situation and activities aimed at malaria vector control;
- reports of the national committee for malaria elimination responsible for the overall coordination and monitoring of the activities;
- recent scientific publications on epidemiology, control and elimination of malaria and malaria vectors;
- an existing legal framework and administrative acts related to malaria control;
- reports on community-based activities related to the prevention of malaria;
- reports on intersectoral cooperation for malaria control;
- reports on cross-border cooperation with neighbouring countries related to malaria control and elimination.

## **Preparation of a national report on the elimination of malaria in the country**

The national report on the elimination of malaria is prepared by the country for consideration by the WHO group of independent experts. This document is extremely important and requires careful preparation.

## **Visit by WHO certification team and a group of independent experts**

Typically, WHO sends its specialists to the country to assess whether it meets the certification criteria. Members of the WHO certification team examine the prepared documents, including the national report, collaborate with the national certification committee and visit curative and preventive health institutions and relevant ministries and departments. On the basis of the material collected, the WHO team prepares its comments and suggestions for the country, and decides whether the country is ready for certification and whether sending an independent expert group to the country is advisable.

The group of independent experts carefully studies all documents, including the national report, thoroughly reviews current and past activities, visits endemic and non-endemic malaria areas, reviews the activities of relevant departments and agencies and meets the relevant decision-makers. Finally, the group answers the two main questions, namely, has malaria been eliminated in the country, and does the country have an effective health system that is able to prevent malaria reintroduction? The group then submits its conclusion to the relevant department at WHO headquarters.

## **Final evaluation by the WHO Expert Committee**

The relevant WHO department transmits all the evaluations prepared by the certification team and reviewed by a group of independent experts, including conclusions, recommendations and other necessary documents, to the chairperson and members of the WHO Expert Committee on Malaria. If necessary, the chairperson may directly contact the relevant ministry of health for further information. After receiving opinions from members of the Expert Committee, the chairperson informs the Director-General about the decision of the Committee on the matter.

## **Final decision**

The Director-General of WHO makes the final decision on granting malaria-free status and communicates this decision in an official letter to the national government.

## **Publication of information about the certification**

The WHO secretariat publishes positive decisions on granting malaria-free status in the WHO Weekly Epidemiological Record, and the country is included in the WHO Official Register of areas where malaria elimination has been achieved.

## **Post-certification period**

After the certification of malaria elimination, the country must continue its efforts to prevent the re-establishment of local malaria transmission as well as to collect and provide relevant information on malaria to the relevant Regional Office on an annual basis.

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## The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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## Regional framework for prevention of malaria reintroduction and certification of malaria elimination 2014–2020

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