

## 2 | GETTING TO ZERO

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### 2.1 | Introduction

This chapter considers the actions that must be taken to attain the required level of coverage of a range of essential interventions that are needed to interrupt malaria transmission. Goals that may seem straightforward in the abstract often involve immense logistical and operational challenges when attempted among the complex realities of an elimination program. As such, this chapter is fundamentally about the backbone of successful elimination programs—sound management and strong systems. The experience of the Global Malaria Eradication Program (GMEP) underscores the central role of management and systems in getting to zero. Emilio Pampana, one of the architects of the 1955-1978 eradication program, recognized this need in the principal manual of that era: “In malaria eradication we must prevent the very last case of malaria. There is no such thing as a partial success. . . . Consequently no other public health program needs such a careful and complete planning and such an efficient and smooth running administration.”<sup>1</sup>

An examination of the GMEP reveals that it was the inability to meet the onerous management criteria that hindered many programs and was the main

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### BOX 2.1 | Main Messages

- Malaria elimination initiatives should be planned and executed in a spatially progressive manner, considering goals at the subnational, national, regional, and supranational levels where appropriate.
- Countries should assess and plan activities and a sound strategy for interrupting transmission and preventing reintroduction prior to embarking on an elimination program.
- Transitions between phases of the malaria program continuum from control to elimination should be based on a range of factors, including political, economic, and epidemiological, not just on epidemiological measures.
- Interventions in malaria elimination programs should be carefully targeted based on identification and analysis of transmission foci.
- Universal diagnosis is critical to elimination and can be effectively achieved through appropriate use of rapid diagnostic tests (RDTs) and microscopy as well as DNA PCR.
- Robust passive case detection is essential to elimination. This should be incorporated into the basic health system as soon as appropriately possible.
- Elimination initiatives should only employ large-scale active case detection interventions after careful analysis of feasibility and cost-effectiveness.
- Cross-border collaboration and regional initiatives should be vigorously pursued. Where cross-border initiatives are developed, there should be clearly defined funding and coordinated implementation.
- Countries should develop a comprehensive strategy for ensuring the sustained commitment and engagement of key stakeholders prior to transitioning to an elimination program.
- Elimination can and should be pursued even if the public health system is not capable of conducting all interventions, if there are other entities able and willing to fulfill those responsibilities.
- Central malaria units should be incorporated into the broader health structure gradually, as opposed to rapid dissolution, after the achievement of elimination, in order to prevent reintroduction.

reason that the program failed to reach its ultimate goal of eradication. In Latin America, for example, stalled progress in the early 1970s was most frequently attributed to “serious administrative and/or operational problems,” the code at the time for poor leadership and management, in addition to weak systems and logistics.<sup>2</sup>

While Chapter 1 explores the necessary forethought that contributes to the decision of whether or not it is reasonable to set the goal of eliminating malaria, this chapter evaluates the transition that is required for a program to achieve that goal. We explore a number of essential components and considerations to ensure successful implementation, including the interface with the basic health system and robust surveillance. Last, we discuss the imperative of cross-border collaboration and regional initiatives for both achieving and sustaining malaria elimination in mainland countries.

It is important to keep in mind that the recommendations in this chapter are not fixed or static. What works for one country may not work for another; there is no “one size fits all” approach that will work universally. The GMEP’s greatest flaw was attempting to apply a single approach—extensive DDT spraying—across immensely diverse eco-epidemiological, socioeconomic, cultural, and political settings. While lessons can and should be learned from other countries, each program must be designed to fit the unique characteristics of the local environment, tailoring available tools to the specific epidemiological and systems settings. Recommendations in this chapter are intended to guide an elimination program’s decision-making process and contribute to their strategy to interrupt transmission.

## 2.2 | From Control to Elimination

Once a decision to pursue elimination has been made, the program must begin to plan and execute appropriate changes to its strategies and interventions. There is no defined moment when a malaria effort ceases to be a control program and becomes an elimination program. The program continues to pursue many of the same activities, including vector control, case management, and monitoring and evaluation (M&E), and the changes in interventions are subtle, with shifts in the emphasis, intensity, and targeting of certain key interventions.

WHO has provided a guideline (Figure 2.1) to assist countries in defining and planning the sequence of changes in the transition from control to elimination.<sup>3</sup> As shown, it recommends that countries engage first in a “pre-elimination” phase, in which initial shifts in emphasis and capacity are made, before pursuing complete interruption of transmission. The decision to engage

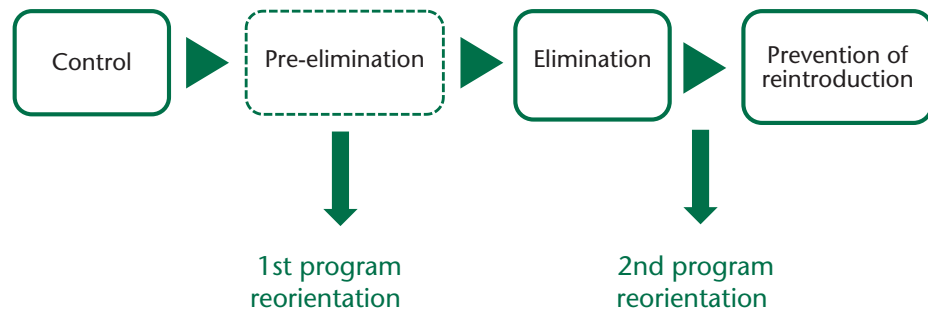


FIGURE 2.1 | Major intervention transitions by program phase

in the first two transitions (the last occurs automatically when elimination is achieved) should be based on a range of political, economic, and epidemiological factors (Chapter 1).

For some countries, the prevention of reintroduction will be the most challenging phase (Chapter 3). Substantial interventions may have to be sustained for decades in the face of constant reintroduction of parasites and public fatigue, and significant advance planning for this phase is an integral component of the elimination program. The MEG therefore strongly recommends that when preparing to interrupt transmission, all countries carefully assess and plan the measures that will be used to prevent resurgence before making the decision to embark on an elimination program.

All core malaria interventions must be adapted in some way in the transition from control to elimination. For some interventions, these changes will be relatively minor. For example, some countries may decide to initiate limited larviciding as part of their vector control strategies for an elimination program.<sup>4</sup> For other interventions, a fundamental shift in the approach or intensity of implementation is required. Table 2.1 summarizes those interventions and/or program components that must undergo the most significant change and the general approach required in each program phase. This list is not exhaustive and does not include all interventions that can be used for elimination.

### SPATIAL TARGETING OF PROGRAMS

Malaria, like most health issues, is typically financed and controlled at the national level. In many areas, however, there is a strong rationale for sub-national (e.g., a low-endemic province), supranational, or regional (e.g., an epidemiological zone shared among several countries) malaria elimination targets and programs. While WHO will only certify an entire country as malaria free, this should not deter countries from pursuing elimination in more-limited

**TABLE 2.1 | Major interventions needed as program phases change**

Activity	Control	Elimination	Prevention of reintroduction
<b>Intervention target</b>	Entire or broad areas of country	Residual and potential transmission foci	Potential transmission foci and individual imported cases
<b>Diagnosis</b>	High reliance on clinical diagnosis*; limited quality assurance	All cases confirmed with microscopy and/or RDTs; robust quality assurance	All cases confirmed with microscopy and/or RDTs; robust quality assurance
<b>Private sector</b>	Diagnosis and treatment provided in private sector (with support from public sector in some settings)	No diagnosis or treatment in informal private sector; formal private facilities fully integrated into surveillance system	No diagnosis or treatment in informal private sector; formal private facilities fully integrated into surveillance system
<b>Program management and legislation</b>	Often limited central capacity, including M&E; limited or no cross-sectoral collaboration and enabling legislation	Strong central capacity with extensive analytical and technical capacity; substantial cross-sectoral collaboration and relevant legislation	Reduced or reoriented, targeted central capacity; potential additional legislation (e.g., border screening)
<b>Surveillance</b>	Limited reporting and analysis of cases through passive system	All new cases rapidly reported and analyzed through both passive and active systems	Sustained, comprehensive, and rapid detection of new cases through passive system
<b>Border measures</b>	Limited or no cross-border initiatives	Initiatives pursued to dramatically reduce transmission in key neighboring areas; prophylaxis for travelers to endemic areas	Cross-border initiatives and provision of prophylaxis maintained; potential border screening of travelers from endemic areas; potential screening and treatment of migrant workers and refugees

\*Clinical diagnosis should also be phased out as soon as possible in order to improve control programs.

national areas or regionally. The MEG recommends that national, subnational, and supranational elimination targets be established as appropriate given the epidemiological, political, and economic realities.

One of the greatest distinctions between control and elimination efforts is the geographical focus of key interventions. While there may be some variation between epidemiological zones, most interventions are uniformly applied to the target areas during the control phase. As the caseload approaches zero, however, remaining transmission is increasingly restricted to specific areas, and more precision in the application of interventions is needed. These “foci” are the primary targets of the elimination program, as continued heavy investment in areas where transmission has been interrupted is not cost-effective, nor always necessary.<sup>5</sup>

## BOX 2.2 | Attacking Remaining Malaria Foci in Morocco<sup>4</sup>

In the decade between 1963 and 1973, Morocco reduced the number of annual new indigenous malaria cases from more than 30,000 to several dozen. Local transmission of *Plasmodium falciparum* was eliminated, and continuing *P. vivax* transmission was contained to limited areas of the country. While *P. vivax* resurged modestly in some areas in the ensuing decades, the government of Morocco committed in 1999 to fully eliminating malaria from the country by 2002. To do so, it developed a new strategy to target and interrupt the remaining sources of transmission and limit the introduction of new cases from abroad.

The heart of the new strategy is the classification of different transmission foci throughout the country and the tailoring of interventions to effectively address each. Two foci with continuing transmission were targeted with indoor residual spraying (IRS) and larval control, robust surveillance, and case management. Areas where transmission had been interrupted recently were targeted with a slightly less-aggressive approach to vector control (larval control only) and surveillance (once-instead of twice-monthly home visits). The areas where transmission has been historically present but where indigenous cases have not been detected in more than 15 years receive limited vector control and surveillance targeted only at locations with high importation risk. In this way, Morocco has prioritized its resources to achieve elimination. No locally transmitted case of malaria has been recorded in Morocco since 2004. In 2008, after more than 3 years of zero transmission, the country applied to WHO for certification of malaria-free status.<sup>6</sup>

Interventions should be appropriately targeted based on the characteristics of the foci identified. To be able to determine and target the most effective interventions, a program must be capable of identifying foci, which requires the following:

- accurate universal diagnosis
- prompt reporting of new cases
- active case investigation
- entomological surveillance
- detailed spatial analysis

### TRAINING AND RETRAINING

The transition from control to elimination is crucially dependent on countries giving a high priority to a full range of malaria program and allied-staff training. These will be required for different categories, including senior and junior

health care professionals and other program-related staff. Many countries have far too few people trained in the essential skills as the capacity required for successful elimination is developed.

Program planning from inception through to prevention of reintroduction requires detailed training, retraining, and supervision. The extent of this training will reflect the requirements of the whole elimination strategy and thus needs to be comprehensive. For training, each country would use a standard operational manual that would be updated as evidence and experience accrued. Training must be locally relevant but should be based on a model elimination syllabus that is then adapted by each country or region.

## DIAGNOSIS

Effective diagnosis of all cases will require some of the most challenging changes for many programs. While pursuing control, most countries, even those with low transmission, confirm only a minority of suspected malaria cases; clinical diagnosis is still prevalent among health workers.<sup>7</sup> This is not acceptable in an elimination program: as transmission approaches zero, all new cases must be confirmed and treated so that remaining transmission may be monitored. Achieving this will require a comprehensive set of measures across the health system, most of which are not in place in many countries. They include the following:

- education and communication campaigns to increase the awareness of signs and symptoms of malaria, the prompt seeking of treatment at formal health facilities, and the acceptance of diagnosis results by patients and health care workers
- provision of diagnosis and treatment free of all charges (including consultation fees) to all malaria patients, including those attending the formal private sector
- sufficiently trained and motivated staff in primary health facilities to conduct diagnostic tests (either RDT or blood slide)
- consistent supply of high-quality diagnostics and treatment at all levels of the health system
- well-equipped laboratories with trained and motivated staff and adequate transport for efficient transfer of tests and results between facilities and labs
- a strong central reference laboratory and a robust quality control system for diagnosis conducted at all levels of the system

### BOX 2.3 | Selecting Diagnosis Tools and Strategies

Full coverage with microscopy is not feasible in some settings,<sup>8</sup> and other approaches, such as use of RDTs with appropriate quality control, should be adopted instead. Moreover, replacement of clinical diagnosis is important, particularly as endemicity goes down, to avoid overestimation of malaria cases and wastage of drugs.

Each country should carefully tailor its diagnosis strategy to the local context, taking into account operational realities within the health system and malaria epidemiology. Potential alternative strategies to the traditional exclusive focus on microscopy might include the following:

- microscopy used at health facilities to diagnose and confirm cases with a robust quality control system based on DNA PCR at national or regional reference laboratories
  - RDTs used at health facilities for primary diagnosis and case management with microscopy at regional and national level for verification and quality control
  - RDTs used at health facilities for primary diagnosis and case management with DNA PCR at national reference laboratories used for verification and quality control
- 
- a solid reporting structure in place to ensure that all positive diagnoses are reported to the central level with requisite speed

### PRIVATE SECTOR

In many countries, a significant proportion of malaria patients seek treatment outside the public sector.<sup>9</sup> In a control program, the priority is to endeavor to ensure that such patients will be given access to effective treatment. Some countries are actively supporting this through subsidies and/or other interventions. In an elimination program, only the public sector and the accredited premium private hospitals and clinics can provide the high-quality diagnostic facilities required as the basis of treatment. In most cases, the often-prevalent informal and unaccredited sources of treatment, including small drug shops, cannot be expected to provide quality diagnosis and treatment or appropriately report new cases to the central level.

## BOX 2.4 | The Legal Framework for Elimination

Some of the key activities of an elimination program may require changes in national legislation. Some countries have adopted a number of legislative measures to facilitate elimination, including mandatory acceptance of IRS.<sup>1</sup> The recommended specific measures that countries should consider fall into four broad categories, including the following:

1. mandatory implementation of certain activities by health workers and authorities, for example, prompt notification of cases
2. mandatory acceptance by households and private businesses of elimination measures, for example, vector control
3. increased regulation of private sector health providers, including potential removal of over-the-counter antimalarial medicines
4. border control measures such as mandatory screening at ports of entry and case follow-up

Given the personal privacy and human rights implications of some of these measures, the appropriate legislation will have to be carefully designed and adapted to each country, taking into account international conventions and local legal code. In some countries, enforcing these legislative measures will be challenging. However, even if they are not fully enforceable, adopting these measures establishes societal norms, creates awareness, and contributes to behavior changes that will benefit elimination programs.

Countries that are ready to pursue elimination and that have a strong informal network of providers will need to implement a comprehensive and innovative approach to incorporate these facilities into the elimination program. Strategies should include incentives, training, and patient-behavior change approaches, as well as increased regulation, accreditation, and a reliable reporting system to ensure that informal private activity enables the elimination effort rather than undermining it.

### PROGRAM CAPACITY

The level and intensity of interventions used in an elimination program require a corresponding increase in the capacity of the national program. New technical staff in areas such as surveillance and data management will need to be added, as well as more general program staff, to closely oversee and support the implementation of key interventions. It will be necessary to enroll

staff at all levels of the elimination program in regular training and retraining programs in order for them to learn new techniques and refresh their skills. Performance throughout the program and the health system will also need to be monitored and enforced to achieve elimination. In Oman, for example, there is a clear performance framework in which members of the program are held accountable for the appropriate management of new cases and other outcomes.<sup>10</sup>

Much more so than in the control phase, there is also a need for the national program to coordinate activities with other units within the government. For example, the ministry of defense must ensure that interventions are appropriately implemented for all military locations and personnel, while the ministry of immigration may need to take measures to limit the introduction of new cases.

## 2.3 | **Knowing the Enemy: Building Strong Surveillance**

Surveillance is perhaps the most important component of an elimination program. As will be further discussed in Chapter 3, a program must be able to detect, investigate, and respond rapidly to every individual case of malaria in order to achieve and sustain zero transmission. This enables it to treat remaining cases appropriately, identify and address transmission foci, and eventually confirm and receive certification for the achievement of elimination.<sup>11</sup> As a program moves to elimination, it must invest heavily in its surveillance system to ensure that it meets a high standard of speed and sensitivity. A surveillance system is composed of three core phases:

1. collection of case data through active and passive detection methods
2. analysis and interpretation of data, including case investigation
3. appropriate response, including radical treatment and targeting of foci

### **PASSIVE CASE DETECTION**

A robust passive case detection system, which includes reporting of cases captured through normal patient visits to health facilities to a central team that carefully analyzes and tracks patterns, is the cornerstone of any approach to surveillance—if new malaria cases identified at health facilities are not being adequately reported and followed up, elimination will not be achieved. In most

elimination programs, the passive case detection system will have to be substantially improved to ensure that all new cases are reported to the central level with the requisite speed (e.g., within 24 hours, once at or near zero local transmission). In addition, many countries will need to strengthen their central units that record, analyze, and mobilize responses to reported cases, which can involve improving skills and obtaining appropriate technology.

Key considerations for elimination programs related to the passive case detection system include the following:

- Strengthening the system will require significant and sustained investment in equipment, personnel, training, and communication.
- In some countries, it may be necessary to create a malaria-specific reporting system that is distinct from the core health management information system. However, parallel reporting systems are not desirable, should be used only if elimination will not be achieved otherwise, and should be incorporated into the basic system as soon as responsibly possible.
- While some countries have extended their passive case detection beyond the formal health system to community health workers, this approach is not recommended for elimination programs.<sup>12</sup>

### ACTIVE CASE DETECTION

Prior to implementing an elimination program, most countries will be unable to identify a sufficient number of new cases through the health system to interrupt transmission and will accordingly need to employ some form of active case detection, or the proactive screening of certain segments of the population for malaria parasites. Active detection provides the distinct benefit of enabling treatment of asymptomatic parasite carriers, who are often a major source of continued transmission. Many different approaches to active detection have been used.<sup>13</sup> Figure 2.2 shows a spectrum of active case detection methods that have been employed from least to most complex and resource intensive.<sup>14</sup> There is currently no evidence to suggest that the approaches on the right end of the spectrum (i.e., mass screening) are more effective and/or cost-effective than the more-limited measures. The MEG therefore recommends that countries only adopt these measures following detailed analysis of feasibility and cost-effectiveness.

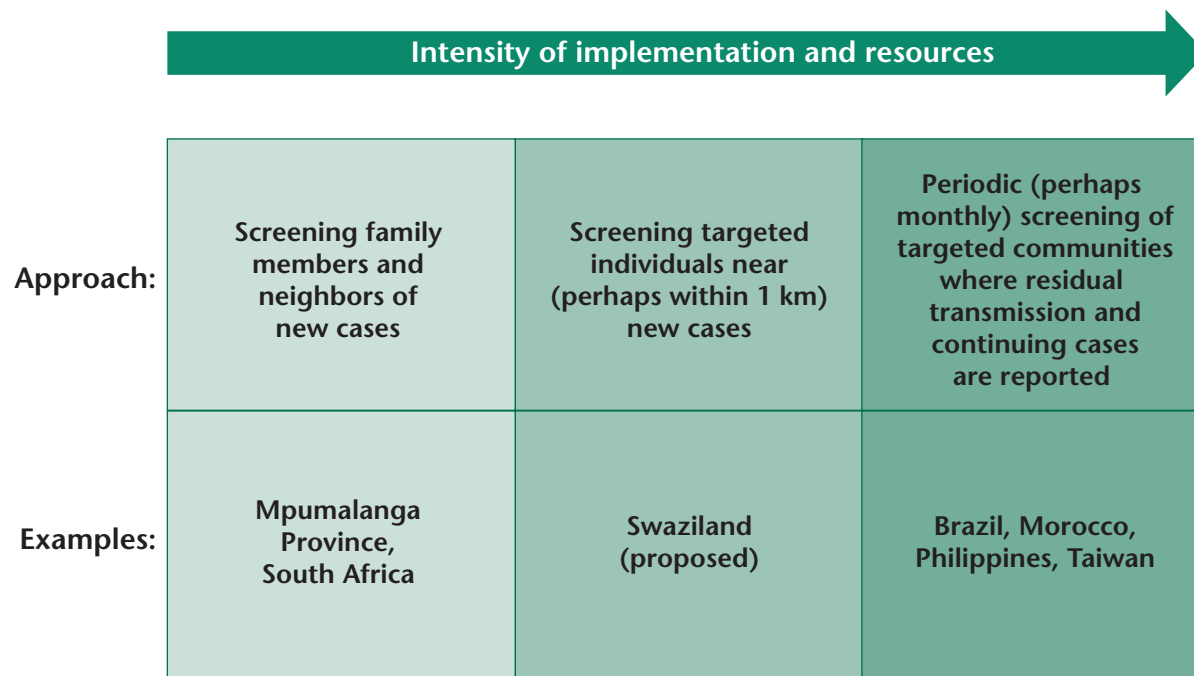


FIGURE 2.2 | Approaches to active case detection

### ANALYSIS AND RESPONSE

The surveillance system is only as useful as the response it elicits. As described above, strong surveillance enables the program to identify and target its interventions at residual and potential foci. To do so, the program must first understand and interpret the often complex data gathered by the system. This is done through the following:

- active investigation of all new cases to determine parasite species, source of infection, and history and duration of illness (e.g., for potential *P. vivax* relapse)
- collection of relevant entomological data in targeted areas (Chapter 9)
- prompt analysis of both epidemiological and entomological data in a central elimination database, ideally with a strong geographic information system component

Given the constant risk of resurgence, countries will need to maintain sufficient emergency stocks of key commodities, such as insecticide and medications, to rapidly respond to emerging epidemics (“epidemic preparedness and response”). In addition, the requisite systems must be in place nationally and at district level to ensure that provision of the commodities can be guaranteed as needed.

## 2.4 | The Imperative of Cross-Border Collaboration

As discussed in Chapter 1, all countries that will pursue national elimination in the coming years will have to face the challenge of continued malaria transmission in neighboring countries. This is particularly the case for countries that share lengthy land borders, but also applies to island countries with multiple entry points or areas pursuing subnational elimination. Borders are typically porous with increasingly high levels of human traffic, not only due to migrant laborers but also as a consequence of social and political unrest. As such, unless eliminating countries can ensure a significant and sustained reduction in transmission in the border areas of neighboring countries, it is unlikely that they will be able to achieve zero local transmission.

A number of different approaches to cross-border initiatives have been pursued in the past, including the following:

- An eliminating country, which has greater capacity and resources, directly implements or provides detailed support for interventions in the neighboring country. This approach has been followed in the Lubombo Spatial Development Initiative (LSDI), a highly successful collaboration between Mozambique, South Africa, and Swaziland that has reduced malaria prevalence in targeted areas by more than 90%.<sup>15</sup>
- The eliminating country provides limited or remote technical and financial assistance to the targeted areas. An example of this is an intermittent collaboration between Saudi Arabia and Yemen, where the principal activities have included training of Yemeni staff in Saudi facilities.<sup>16</sup>
- Participating countries engage only in targeted coordination of policies and increased communication between their programs.<sup>17</sup> This is the de facto approach used by most regional initiatives.

The MEG recommends that, as much as possible, countries develop regional initiatives that employ the first two of these approaches.

There are substantial challenges to developing and executing successful cross-border initiatives. Many initiatives have been conceived and planned, but few have had notable impact. Drawing on lessons learned from the LSDI, there are a number of apparent success factors for cross-border efforts:

*Political and administrative support* The negotiation of cross-border arrangements typically needs to occur at levels above the respective

malaria program managers, and a clear mandate from ministers of health or other political leaders can greatly facilitate regional or cross-border operational arrangements.

*Technical leadership* Strong alignment of approaches and guidance on technical issues across the participating countries is essential to any cross-border initiative. For example, the LSDI is led by a regional malaria control commission of technical and operational experts from the region, which designed the initiative and guides its ongoing work.<sup>14</sup>

*Significant and independent funding* As will be discussed more in Chapter 4, innovative financing mechanisms are required to facilitate regional or cross-border programs. Cross-border initiatives typically require substantial additional funding, and in most areas, it is unlikely that governments alone will devote adequate national resources to controlling malaria in neighboring countries. The LSDI has been largely financed by private sector donors, South Africa, and the Global Fund to Fight AIDS, Tuberculosis and Malaria.

*Strong centralized management* In the LSDI, the Medical Research Council in South Africa (MRC) has established a robust management structure and closely monitors and manages performance across the initiative in line with the accountability standards and reporting requirements set by its donors.

## 2.5 | Sustaining National Political Will

Although recent experience has reconfirmed that dramatic reductions in malaria incidence can be achieved in a short time, fully eliminating local transmission is a war of attrition in most settings. Finding and clearing the last cases and foci, particularly of *P. vivax*, often requires five or more years of effort, even in relatively conducive settings such as in Europe and the Middle East.<sup>18</sup> As history has consistently shown, attention, resources, and diligence cannot waver during this time or malaria will resurge and the gains of the preceding years will be lost.

Fatigue among key stakeholders, ranging from local communities and implementers to national politicians, is one of the greatest threats to a malaria elimination program. It is challenging to convince individuals to engage in elimination-conducive behavior, such as sleeping under insecticide-treated nets (ITNs), and to convince politicians from endemic countries and donors

to commit funds and attention once malaria is no longer a major threat. The MEG therefore recommends that each country develop a comprehensive strategy for ensuring the sustained engagement of key actors before it launches its full elimination program.

Key components of the strategy to maintain national and political will include the following:

*Secure sustained, high-level political support* The highest levels of the government must view elimination not just as a short-term political benefit but as a long-term investment in the development of the country or region. This can be fostered through incorporation of elimination goals and activities into broad development strategies and medium-term budgets as well as consistent, well-designed advocacy campaigns, ideally supported by high-profile champions from within the government.

*Build community engagement* Programs will greatly benefit if communities fully understand and take ownership of the elimination goal.<sup>19</sup> While there has been increased attention to community-led malaria-control initiatives in recent years, there is little evidence of the impact of these approaches on a large-scale.<sup>20, 21</sup> Appropriate approaches must be developed within each country and adapted to local community structures and cultural practices.

*Target vulnerable populations* In many countries, special attention will need to be paid to particular subgroups within the population. The last sources of transmission are often found among groups such as cultural and ethnic minorities, nomadic or forest populations, and/or migrant workers, which often have less contact with the formal health system. Ensuring the necessary participation of these groups in elimination interventions will often require adaptation of approaches to unique social, cultural, and political dynamics. The failure of the first elimination campaign in Mexico, for example, has been partly attributed to resistance among indigenous populations in the south of the country.<sup>19</sup>

*Set expectations and promote vigilance* It is important that advocacy efforts set appropriate expectations of the duration and benefits of elimination with politicians and communities. Overselling the program will quickly lead to disappointment and reversals.<sup>22</sup> In addition, once cases begin to near zero, it is critical that the program

**TABLE 2.2 | Framework for an elimination advocacy campaign by stakeholder group<sup>1</sup>**

Stakeholder	Outcome	Message	Information needs
<b>National leaders (e.g., heads of state)</b>	Commitment to long-term support for elimination	Elimination will bring great benefits to your country and your neighbors.	Health and economic impact estimates; elimination commitments by neighbors
<b>Ministry of finance</b>	Significant and long-term financial support	Malaria elimination is good for economic development and is cost-effective.	Economic impact and cost-effectiveness estimates
<b>Ministry of health</b>	Leadership of elimination program; appropriate investment in and management of the health system	Eliminating malaria will reduce the burden on the health system. Maintaining elimination requires constant vigilance.	Detailed analysis of health system needs to achieve and sustain elimination
<b>Local government leaders</b>	Effective sustained management of activities; commitment of local resources and leadership	Elimination is a national priority that will greatly benefit communities in your area. Activities need to be sustained, or dangerous epidemics will occur.	Commitments by national and regional leaders; local budget and management needs for effective implementation
<b>Business leaders</b>	In-kind and financial contribution to elimination activities	Malaria elimination is good for business (e.g., greater productivity and more tourism and investment).	Economic impact estimates; mapping of opportunities for business contribution
<b>Donors</b>	Substantial and sustained funding for elimination program	Elimination will contribute to health and economic development goals. Elimination funding must be long-term and predictable.	Inclusion of elimination in national development strategies; analysis of long-term financing needs and mechanisms for predictability
<b>NGOs</b>	Active participation in malaria elimination activities	Elimination will save many lives and benefit communities. NGOs have an important role to play.	Mapping of opportunities and needs for NGO engagement
<b>Public</b>	Sustained engagement in elimination activities and appropriate health behavior	Malaria remains a deadly threat even once it has been eliminated.	Simple examples of malaria resurgence from other countries

1. Courtesy of Dr. Matthew Lynch, Johns Hopkins Center for Communication Programs

consistently reinforce the continued threat of resurgence and need for sustained investment vigilance. This can be done through advocacy and education campaigns (e.g., through schools), as well as by promoting national unity and pride in the achievement of elimination.

*Develop robust financial arguments* Many stakeholders, including ministries of finance and international donors, will question whether malaria elimination is the best use of limited resources. It is thus imperative that the economic case for elimination also be well presented. When this is done, the indirect impact of elimination on the health system (strengthening systems and reducing patient burden), foreign direct investment, and tourism should be considered, as should the strong arguments for considering elimination a regional public good (see Chapter 1).

Well-targeted and sustained advocacy and communications campaigns will be critical to executing strategies and achieving the objectives outlined above. An example of a comprehensive elimination advocacy campaign is outlined in Table 2.2. In most cases, it will be important for organizations other than the National Malaria Control Program (NMCP) to implement aspects of such a campaign (e.g., targeting national leaders and ministers). As such, it will be important for the NMCP to form strategic partnerships with NGOs and other organizations that can fill this important role.

## 2.6 | **Malaria Elimination and Constructive Engagement with the Health System**

The strength of the basic health system is integral to elimination, and most countries will have to strengthen that system to achieve and sustain zero transmission. However, that is not to say that a health system must be perfect for elimination to be achieved. Rather, the MEG recommends a careful examination of which components of an elimination program must be pursued through a strengthened health system and which can employ alternative approaches.

The health system is often equated with the formal, government-led public health infrastructure in the country. However, there is often a range of other organizations and facilities that provide health care and other essential services related to malaria elimination, including private, nongovernmental, and faith-based organizations. In fact, elimination will only be achievable in some countries if these organizations play a substantial role. However, there are a

number of areas where government health system priorities and coordination are vital. These include the following:

*Case management* Appropriate diagnosis and treatment of patients presenting with fever at health facilities is essential to elimination. It is not feasible or effective to develop an infrastructure of human resources solely for primary malaria care. The health system must be strong enough to provide sufficient coverage and quality of case management, including the consistent supply of drugs and other commodities to the health facilities.

*Surveillance and monitoring* Health facilities will also be responsible for reporting the majority of new malaria cases to the central level. While a malaria-specific system may be adopted, it will need to build on the infrastructure of the general information system. If that system is weak, it is likely that malaria surveillance will also not reach sufficient levels of speed and accuracy, jeopardizing a rapid response.

*Planning and coordination* As already described, an elimination program faces significant risk of fatigue among policy makers and consequent financial volatility. If elimination efforts are planned and budgeted for “off-budget” or as isolated activities, the risks of uneven resource flows increase. It is therefore imperative that elimination be incorporated into all core planning and budgeting activities, and in decentralized systems, it must be part of district health plans to help to ensure sustainability.

Beyond these areas, it is possible, and in some cases advisable, for the program to employ approaches that are complementary to the basic health system. It may be necessary, for example, to complement a weak surveillance system with periodic surveys, which could be conducted by a health research institution. Distribution of long-lasting insecticide-treated nets (LLINs) may be more efficiently achieved through the private sector or a faith-based organization. Opportunities for using elimination resources to build the capacity of the basic system should be pursued as long as they do not detract from the elimination goal. They can include expanding initially malaria-specific systems to support other diseases, as has been done with polio surveillance in some countries, and additional broad performance incentives for general health professionals, among others.<sup>23</sup>

Although the government must lead and typically implement the majority

of the elimination effort, the nongovernmental sectors can, as we have indicated, contribute substantially in a number of key areas. These include, but are not limited to, the following:

*Direct provision of services* Some NGOs and private organizations are also well positioned to provide diagnosis, treatment, case management, and other services, particularly in remote communities. In addition, major businesses (e.g., tourism) with a stake in elimination can be used to provide services to their employees and surrounding communities.

*Outsourcing of key functions* Nongovernmental groups may be able to implement certain elements of an elimination program where government capacity or competency is weak. It may be efficient to outsource the implementation of complex technical functions, such as behavior-change communication, commodity procurement, and mass distribution campaigns, to private organizations that are particularly suited for logistically intensive functions.

*Systems strengthening* Others can play an important role in building and supporting the government's capacity to achieve elimination, including by contributing additional skilled staff or implementing key training programs. Some organizations can also assist in essential advocacy and resource mobilization. However, the integration of all actors, private as well as public, into district planning is vital to a strong system.

It is typically understood that once elimination is achieved, the national malaria program will be disbanded and any ongoing malaria activities will be incorporated into the general health services.<sup>1</sup> We question this assumption. The premature dismantling of eradication programs during the 1970s and 1980s created many challenges for subsequent malaria control, including significant loss of technical staff at all levels, and contributed to resurgence during that period.<sup>24</sup> Other elimination efforts, such as for Guinea worm, have faced similar challenges when integration has been pursued prematurely and resources and attention diverted away from essential activities.<sup>23</sup> Therefore the eventual integration of malaria elimination activities should occur gradually and be carefully managed to prevent erosion of the capacity to intervene, thus protecting against possible resurgence of infection. For this reason, in some settings it may be advisable to maintain a robust, distinct national program for some time after transmission is initially interrupted, as was done on Taiwan.<sup>25</sup>

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