4 | FINANCING ELIMINATION

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4.1 | Introduction

This chapter returns to the discussion of the economics and financing of malaria elimination that was introduced in Chapter 1. Elimination lies at one end of a continuum that spans intensive control of highly endemic malaria and goes through sustained control of modest levels of malaria to elimination (and sustaining elimination) of local transmission. Control of highly endemic malaria can bring major health gains with modest cost and, indeed, is among the most cost-effective of all available health intervention areas.[1] The objectives of moving from sustained control to elimination include, but also go well beyond, further reduction of morbidity and mortality. Chapter 1 discussed this broader range of objectives, which include improving the climate for foreign direct investment and tourism, contributing to the regional and global malaria elimination agenda, creating a sense of national accomplishment from closing the books on a major health problem, and engaging in a process that will in all likelihood strengthen both the public health and clinical care systems of a country.

In this chapter, we turn to two related and more specific issues concern-

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BOX 4.1 | Main Messages

- Countries considering elimination may wish to estimate carefully and compare the long-term costs of sustaining high levels of control versus eliminating. Elimination costs will likely be high during the drive to stop transmission; they may then become substantially lower during the subsequent period of holding the line at zero local transmission.
- In some countries, perhaps in a majority, the annual cost of sustained control will exceed the annual cost of sustaining elimination. This chapter presents a simple approach to allow such countries to estimate an approximate internal rate of return (IRR) for elimination efforts. If the IRR exceeds 3%, elimination is almost certainly something a country should seriously consider independently of other benefits, which may themselves be substantial.
- In order to ensure sustained funding after elimination and to avoid resurgence, donors will need to work with endemic countries to develop innovative financing mechanisms that ensure long-term funding and restrict the use of these funds to malaria. Endemic countries may also benefit from collaborating to seek funding for activities that are implemented across borders or regionally.
- A systematic evidence base on elimination economics should be developed: actual costs and financing should be formally documented in settings where elimination is now being undertaken or has recently been accomplished. This will increase data for elimination planning, and it may identify ways to reduce elimination costs, making it more economically attractive and sustainable.

ing the financing of elimination. The chapter correspondingly divides into two parts. The first part of the chapter explores the case where maintaining elimination may actually cost less than sustaining control and, therefore, be in some sense self-financing. The second part addresses standard issues of financing: where will the money come from, and how should particular problems associated with elimination, such as its long-term characteristics and frequent cross-border interrelations, affect the design of financial mechanisms and institutions?

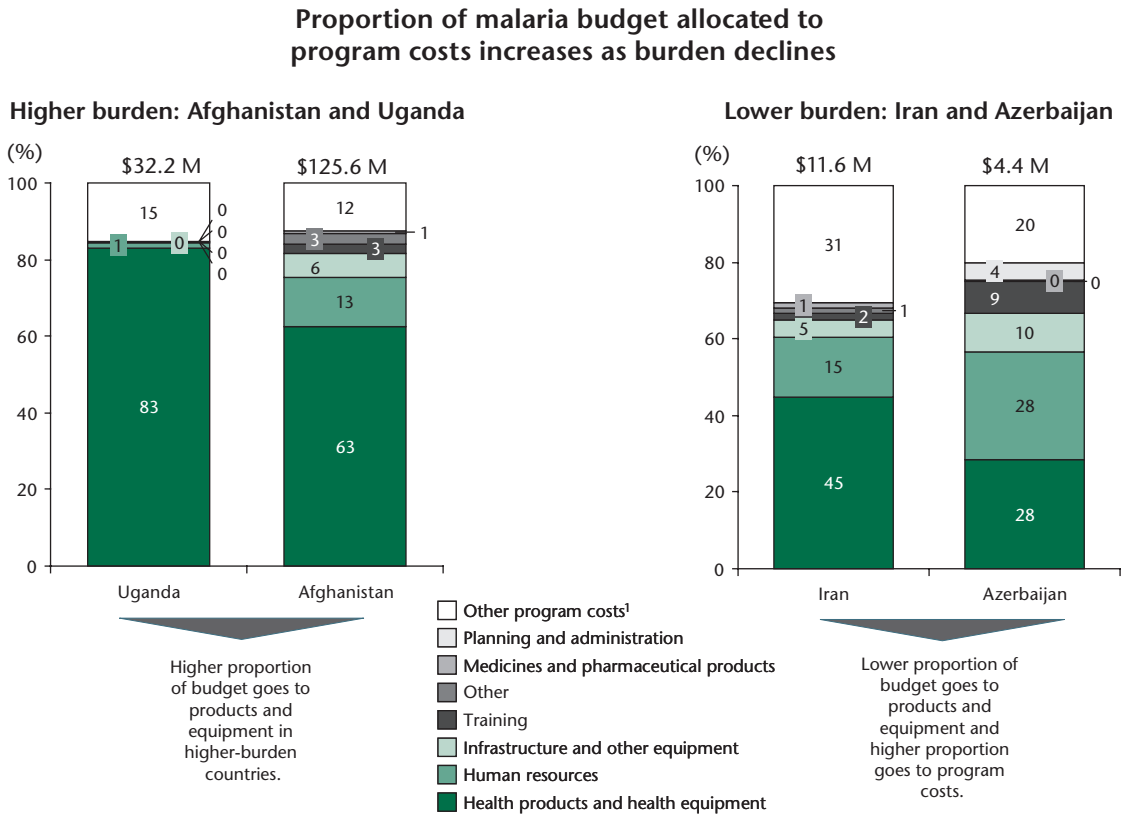
To explore the idea that elimination may be self-financing in some cases, we analyzed plans for malaria elimination efforts in the Jiangsu and Hainan provinces of China, and in Swaziland. For these locales we estimated current malaria control spending, the anticipated costs of elimination, and the savings from reduced malaria control activities that are expected to accrue after

elimination. The reader may reasonably question the general relevance of the examples from China and Swaziland. We use them in this chapter because they are the only detailed comparisons between the cost of elimination and the cost of sustained control that we have available at this time. However, similar detailed costing exercises are being worked on in a variety of other settings, including Mauritius, Morocco, and the Philippines. We will learn much from these cost comparisons, as they take place in very different epidemiological and ecological settings. This information will be posted on the MEG Web site as soon as it is available. Meanwhile, Section 4.2 presents results that we feel span a reasonable range of the circumstances likely to be encountered.

During an elimination campaign, when malaria transmission no longer poses a serious threat, donors or national treasuries may lose interest or redirect their funds to other pressing issues. This reduction in support may lead to a significant risk of resurgent malaria. Thus, financing mechanisms to ensure sustainability require two key features: stability and predictability. In Section 4.3 we explore financing mechanisms to help ensure an effective long-term strategy to prevent reemergence once malaria has been eliminated. Stable control efforts are essential to avoid backsliding, and thus to yield optimal health and financial dividends. The potential net savings referred to above and analyzed below require that malaria-elimination-related activities be sustained over years and decades, by definition in the absence of local malaria cases. The understandable tendency to redirect funds to more obvious health needs will need to be resisted. This challenge suggests the requirement for financial strategies that effectively isolate and protect funds for maintenance of malaria elimination. We explore four potential funding mechanisms, consider evidence of their use from other global health funding, and describe the pros and cons of each for sustained malaria elimination. First, however, we explore the possibility that malaria elimination may be cost-reducing and hence potentially self-financing.

4.2 When Will Elimination Be Cost-Reducing?

We review the anticipated costs of malaria control and elimination and then present more specific analyses of the anticipated costs and savings associated with malaria elimination in two provinces in China, and then in Swaziland. While these three case studies are unique, they highlight the sorts of analyses that individual countries and regions could conduct when contemplating a strategy of elimination.



1. Includes technical assistance, procurement and supply chain costs, communication materials, monitoring and evaluation, and overhead. Program costs are not directly related to commodities but to general support of malaria program. Adapted from: Global Fund applications.

FIGURE 4.1 | Malaria budget allocations of higher- and lower-burden countries

COSTS OF MALARIA CONTROL

Roll Back Malaria's Global Malaria Action Plan provides estimates of the long-term costs for the control and elimination of malaria. Over the near future, control costs are likely to total $6 to $7 billion per year. Figure 4.1 illustrates the types of resources required for both control and elimination programs. In higher-burden countries, the bulk of spending is dedicated to commodities (health products in the figure) such as bed nets, insecticides, and drugs. In lower-burden settings, the balance shifts toward human resources, as Azerbaijan's allocation shows. During and after elimination, surveillance and response costs will dominate. As discussed below, long-term costs are likely to decline due to decreasing need in many environments. This is because there will be only imported cases, a few relapsing and lingering infections, and lower and more-geographically-constrained risk. There may also be efficiencies associated with integration into national health services.

The costs of malaria elimination are less studied. Estimates from the Global Malaria Eradication Program in the 1950s and 1960s suggest a cost ranging between $0.50 and $2.00 per person per year, or $3 to $13 per person per year in today's dollars. More reliable and up-to-date are the estimated costs for elimination in countries or regions that are currently embarked on elimination and have made detailed Global Fund proposals (generally 5 years in length) to support their costs, though it is not assured that elimination will occur within the period of the proposal. Six such estimates are available:

- For Hainan Island, China, the annual costs of elimination are estimated to be $0.25 per person for the whole population of Hainan, and $2 per person at risk.
- For Sao Tome and Principe, the annual costs of elimination are estimated to be $11 per person.
- For the Solomon Islands and Vanuatu, the annual costs of elimination are estimated to be $18 and $25 per person, respectively.
- For Sri Lanka, the annual costs of elimination are estimated to be $1 per person for all Sri Lankans, and $5 per Sri Lankan at risk.
- For Swaziland, the annual costs of elimination are estimated to be $3 per person for all Swazis, and $7 per person at risk.

An important caveat about these cost data is that they relate to the costs of achieving elimination, rather than the costs of maintaining it once achieved. We know very little about the latter topic, and the collection of better cost data, both pre-elimination and post-elimination, is a high priority for operational research.

Caution is also needed in interpreting elimination cost differences among countries, since the costing exercises do not all include the same activities. For example, the costs for the Solomon Islands and Vanuatu include significant support for the malaria component of the routine health services and external management and technical assistance, both provided by the Pacific Malaria Initiative Support Centre in Brisbane. The costs for Swaziland, by contrast, include neither routine health service contributions to malaria elimination nor technical support from partner organizations.

Costs also vary widely depending on local circumstances. The high costs in the Solomon Islands and Vanuatu are linked to the logistic challenges of providing sustained services to small populations on remote islands. Differences in cost structures, particularly in the labor markets, between the different

BOX 4.2 | Projected Cost Savings from Malaria Elimination in Jiangsu, China

The MEG obtained data on current control and anticipated incremental elimination costs from Jiangsu health officials, based on ministry of health expenditures and budgets (national, provincial, and local), as well as Global Fund proposals. The current and projected elimination costs are divided functionally, allowing us to understand spending in four broad categories that we believe will respond differently to successful elimination efforts: surveillance, treatment, prevention, and program management. The analysis explores the costs of elimination versus sustained control over 20 years, accounting for future savings due to reduced malaria control costs. It includes an examination of the implications of imported malaria cases for potential reductions in control costs.

Jiangsu is a central province considering elimination. In 2007, there were 940 reported malaria cases, all *Plasmodum vivax*, in a population of 73 million (0.129 per 10,000). Underreporting is estimated at 4.5-fold, suggesting 4,230 actual cases per year. These internal cases include those that are imported. Jiangsu would expect to achieve elimination by 8 years from the formal beginning of its program. This goal is reflected in our longitudinal analysis.

In the longitudinal analysis, we tried two approaches to estimate savings in malaria control costs. First, we relied on the expert opinion of officials we interviewed regarding the scale of efforts required to achieve sustained control in the long term. Second, we used an algorithmic approach. We assumed that malaria control cost savings (e.g., decreased need for prevention) reflect the reduction in cases and that different types of costs may be differentially sensitive to these case reductions. For example, a 90% reduction in cases might correspond to a 90% reduction in treatment costs. The model allowed us to explore the effect on results of different quantitative values for assumptions. The two analysis methods yield very different results for Jiangsu (although rather similar estimates for Hainan).

Imported malaria cases are important to overall costs and to potential savings. To explore the effect of imported cases, we incorporated two parameters in the analysis. First, we specified a 0-to-1 scale that represents the severity of the border problem. In this scale, 0 designates no border cases and 1 designates a very severe border problem. Roughly, the score reflects the proportion of current cases due to border crossing. Second, we specified how the border problem affects the sensitivity of control costs to the reduction in cases. For example, a value of 0.3 for surveillance means that a border problem of a severity equal to 1 results in an added 30% surveillance cost (as compared with the start of the elimination phase); border problems of lesser severity lead to proportionally lower additions to costs. The model allows the effect on results of different input values to be explored.

The over-time analysis explores how elimination might affect total malaria control costs over 20 years. We compare current ongoing costs (i.e., ongoing sustained control) with the added costs and subsequent savings from elimination. This presents a more inclusive, and thus likely more realistic, assessment of the net costs of elimination than a shorter-term analysis.

For Jiangsu, the longitudinal result appears attractive. The reason is that the anticipated incre-

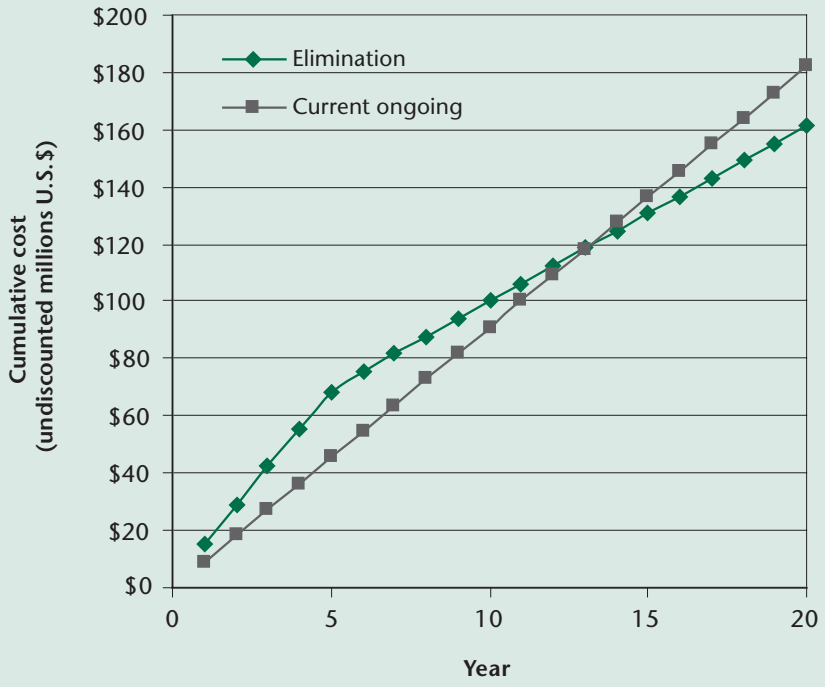


FIGURE 4.2 | Cumulative costs over time, elimination versus sustained control, for Jiangsu, China (algorithmic approach) (adapted from Kahn et al.[2])

mental cost of elimination is small in relation to current control costs. Jiangsu officials estimate $6.5 million in annual incremental elimination costs, as compared with $9.1 million in annual sustained-control costs (71% more).

After year 5, we assume that the sensitivity of each cost category decreases. For example, with no border effects, we assume that treatment costs are 100% sensitive (1.0) to case counts and that prevention is fairly (80%) sensitive to case counts after 5 years once elimination is nearly achieved (0.8).

The extent of importation risk affects this sensitivity. If migrants largely originate from nonendemic areas, as is the case on Hainan Island, we would assume that importation risk is low at 0.05. On the other hand, Jiangsu is a mainland province that borders the higher-endemic province of Anhui. With this greater importation risk for Jiangsu, we use a value of 0.25 so the final sensitivities are lower.

The result for Jiangsu is presented in Figure 4.2. The undiscounted cumulative costs for elimination are $161 million over 20 years, versus $182 million for sustained control. The undiscounted cost lines cross at 14 years, a short period for reaching total cost savings. If control costs following elimination are $4 million, as discussed by Jiangsu officials (lower than our algorithm-based estimate of $6.2 million), then the lines cross after only 9.5 years.

The scale of the border problem affects the internal rate of return for Jiangsu. If we increase the border problem scale from 0.25 to 0.4, based on the estimate that 40% of current cases are being imported, the lines cross at 18 years. If we decrease the border problem scale from 0.25 to 0.05, based on a sharp reduction in imported cases, the lines cross at only 11 years.

economies will also have a large effect on elimination costs. We return later to more detail on Hainan and Swaziland costs.

ELIMINATION AS A POTENTIALLY COST-REDUCING INVESTMENT

While prevention and treatment costs in highly endemic areas are generally very cost-effective, elimination presents different economic issues. First, elimination is contemplated only in situations with relatively few malaria cases. Thus, new strategies are likely to yield relatively few malaria cases or deaths averted when compared with the same strategies in high-burden settings. On the other hand, elimination offers the prospect of significant savings in future malaria control costs. Successful elimination would reduce treatment costs, as only imported cases would require treatment. Elimination would also potentially lead to a large reduction in prevention-related costs, as intervention measures are confined to restricted geographic areas such as entry ports and border zones. In some cases, therefore, pursuing elimination may "pay for itself."

We conducted a preliminary analysis of planned malaria elimination in Jiangsu and Hainan provinces, China, and in the southern African country of Swaziland. Our goal was to explore long-term costs versus savings, focusing on a 20-year time horizon.[2] To provide a sense of the data sources available for these studies, and the nature of the results, Box 4.2 summarizes the MEG's case study for Jiangsu, China.

THE INTERNAL RATE OF RETURN ON ELIMINATION INVESTMENTS

Box 4.2 provides a flavor of the complex considerations that underpin cost projections either of sustaining control or of moving toward elimination. A background paper for the *Prospectus*[2] provides more detail on that example from Jiangsu, China, and on additional examples from Hainan, China, and Swaziland. The next step involves calculating internal rates of return (IRRs) to provide an argument in favor of investment in elimination when the long-term annual costs of sustained control exceed the long-term annual costs of elimination.

The three cost flows and two ratios that are essential to understanding the financial attractiveness of elimination are shown in Table 4.1. The table also provides estimated values of these numbers for Hainan, Jiangsu, and Swaziland. The flows include the cost of maintaining the status quo (C), the cost of the transition to interrupted transmission (T), and the cost of maintaining elimination (E). The table defines these terms and expresses the values in millions of

TABLE 4.1 | Estimated costs of eliminating malaria in three locales

Cost parameter	Hainan Island, China	Jiangsu Province, China	Swaziland
C = cost of sustaining high level of control (U.S. $ millions per year)	2.9	9.1	0.7
T = transition cost of getting to zero (U.S. $ millions per year for 5 years, averaged)	5.8	13.9	2.4
E = annual cost of sustaining elimination (holding the line) (U.S. $ millions per year)	2.4	6.13	1.25
e = elimination cost ratio, i.e., cost of elimination phase as a fraction of sustaining control = T / C	2.0	1.53	3.43
s = annual cost savings as a fraction of cost of sustained control (cost savings ratio) = (C – E) / C	0.17	0.33	–0.79[a]

[a](i.e., increasing by 79%)

U.S. dollars per year for the three cost streams. Two ratios that are defined give annual elimination costs (e) as a fraction of sustained control costs, $e = T / C$, and long-term annual cost savings (s) also as a fraction of sustained control costs, $s = (C – E) / C$. Here e provides a sense of the cost of the elimination investment, and s provides a sense of its financial returns. The case of Swaziland is instructive here: the planned long-term costs of elimination exceed those of control, and hence s, the savings, is negative. To reiterate a point made in Chapter 1 and earlier in this chapter, a negative s in no way suggests that elimination is not worthwhile. However, it does imply that the full range of benefits must be assessed and that the effort may not be "cost-reducing" over time.

Given e, elimination costs, and s, the savings, and then using the methods outlined in Box 4.3, a calculation of an internal rate of return shows an ultimately cost-saving elimination investment. Figure 4.3 presents IRRs for a range of values of e and s. It shows, as would be expected, that IRR values will increase for a given cost (e) as the value of the cost savings (s) increases. The figure also places Hainan and Jiangsu results into the larger range of possibilities. This figure serves as a working tool for others to use in estimating IRRs.

In conclusion, we observe that Hainan, Jiangsu, and Swaziland span the continuum of possible outcomes for assessing whether elimination is self-financing: For Swaziland, the result is clearly negative. For Jiangsu, the IRR (at 10%) is sufficiently high to justify elimination by itself. For Hainan, elimination is ultimately cost-reducing, but the relatively low IRR of 3% suggests the need for careful assessment of the benefits to Hainan before a decision is made

BOX 4.3 | The Simple Algebra of Rate of Return

Investments entail giving up resources now to attain more resources later. An investment of $100 that yields $200 in 10 years is said to have a rate of return of 7.2% because $100 invested with 7.2% per year compound interest will yield $200 after 10 years. Alternatively phrased, the "present value" of $200 ten years from now at 7.2% per year is $100. The concept generalizes to circumstances when costs and benefits are spread over multiple years. Investing in malaria elimination will sometimes yield financial savings, in the sense that the annual costs of maintaining sustained control can exceed the annual costs of maintaining elimination. During the transition period of getting local transmission to zero, costs will exceed those of sustained control. The present value of these excess costs over a period of years, assumed for purposes of this example to be 5 years, can be viewed as an investment. If the ongoing cost of holding the line (maintaining elimination) falls below that of sustained control (after the 5-year investment period), then there will be a return on the investment that is equal to the difference between those numbers each year. Again, there will be a present value of benefits that is the sum of the present values in each year.

The present values of costs and benefits vary with the interest rate. A common figure of merit for investments is the IRR, that is, the interest rate that equalizes the present value of costs and of benefits. In these calculations we assume that the benefits continue unchanged over an extended period. In reality, because of changes in economic levels, the level of malaria in neighbors, or the effectiveness of available control measures, both costs and benefits will change with time. If the numbers are known, the change is easy to incorporate into the analysis. The results presented in this *Prospectus,* however, should be viewed as a first approximation, as suggestive rather than definitive.

With this as background, the following equations yield the results we have used for this *Prospectus*.

Let

PVC(r) = present value of costs, given an interest rate of r

PVB(r) = present value of benefits, given an interest rate of r

C = annual costs of sustained control

T = annual costs of transition to elimination

E = annual costs of maintaining elimination

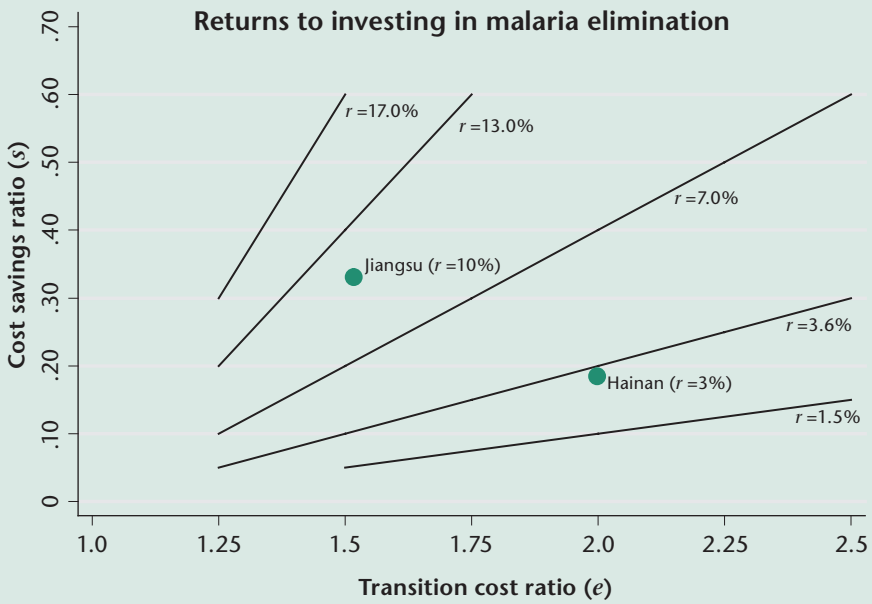


FIGURE 4.3 | Internal rates of return for investing in malaria elimination (from Kahn et al. background paper[2])

NOTE: These are cost estimates prepared for planning purposes and, as such, do not directly reflect historical experience with costs. The background paper by Kahn et al.[2] describes sources and makes estimates of the sensitivity of the results to the underlying assumptions.

Then the present value formula gives the following:

(1) $PVC(r) = \sum_{t=0}^{4} (T-C)/(1+r)^t$

(2) $PVB(r) = \sum_{t=5}^{t=100} (C-E)/(1+r)^t$

Equation (1) assumes costs remain constant for the first 5 years, and equation (2) assumes benefits last until year 100. (The results vary little whether the assumption is 100 or 60 or 40.) Table 4.1 gives values—based on planning exercises—for T, E, and C for Hainan, Jiangsu, and Swaziland.

Given T, E, and C for a country, it is possible to calculate the IRR for the elimination investment by solving for the value of r that makes equation (1) equal equation (2). As discussed in the text, for example, Hainan Island's IRR is about 3.6%.

to undertake elimination. Once these analyses have been done, financing is the next logical need to discuss.

4.3 Financing Malaria Elimination

INTRODUCTION—THE NEED FOR SUSTAINED FINANCING

Once the costs have been established pertaining to sustained control or pursuing elimination, finding sustainable funding for the long term is the next challenge. First we will look at historical patterns of country-level, international health financing. Then, current opportunities for regional malaria initiatives will be explored.

Continuing control efforts for a disease that no longer causes significant morbidity or mortality is a challenge in that such efforts may lead to fatigue, lapsed funding, and then attenuation of control efforts. In addition, the effectiveness and cost of sustaining elimination within a country often depend on actions taken beyond its borders. These issues are essential to take into account when thinking about long-term and international financing. Figure 4.4 provides concrete examples of the volatility of donor support to health, an essential component of malaria funding for low-income countries considering elimination. The volatility is perhaps more important today than during previous elimination efforts, as many of the countries that are considering elimination today are largely dependent on official development assistance (ODA) for health sector spending. The specific implications of this deserve further study and attention, as halting elimination efforts after they begin could result in significant rebounds in morbidity and mortality.

Successful malaria elimination programs can thus have a downside: reduced incidence results in diminishing awareness and, potentially, a corresponding loss of funding to sustain control efforts. Ongoing, high-volume control efforts likewise lead to decreased political salience. Resurgence of malaria in previously low-transmission areas is often blamed on such factors as insecticide resistance or supply shortages, yet many of these proximal causes may ultimately stem from decreases in funding and attention for malaria programs. In the past, rising donor fatigue within the international community led to a reduction in commitment at the same time that countries, impatient with lengthy elimination or eradication processes, reduced funding or shifted it to other programs. In many countries, indoor residual spraying (IRS) activities were the first item to be scaled back; there is a direct link found between donor fatigue and demise of the IRS program.[3] In India, the resurgence of

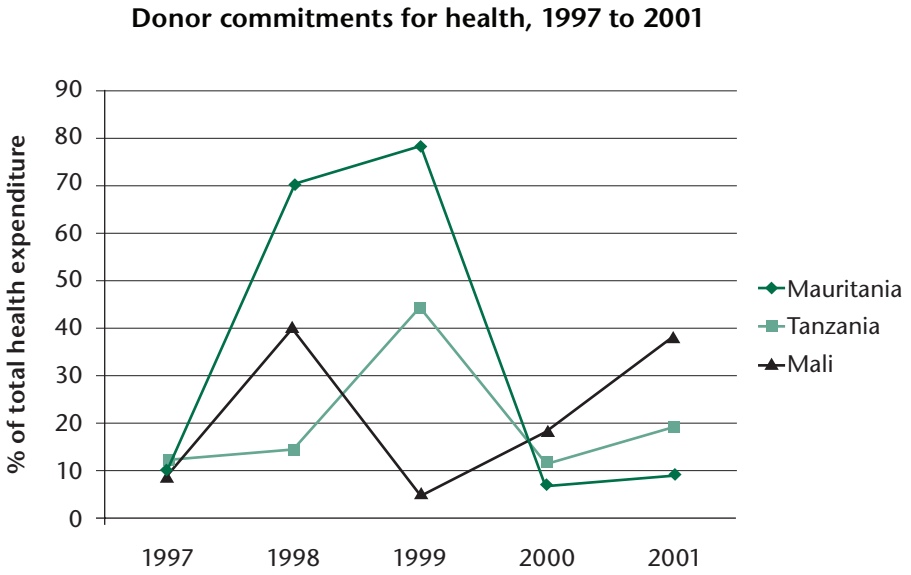


FIGURE 4.4 | Funding for health in three countries, 1997-2001 (from Gottret and Schieber[3])

malaria in the late 1960s may have been the result of this deterioration of vector control.

Governments with limited health budgets also shifted funds away from drug supplies and surveillance activities, resulting in poor detection and treatment in addition to weak program management and supervision.[4] Failing financial support contributed to staffing shortages in India: key positions were left unstaffed, creating a shortage of technical and operational guidance. At the same time, urban municipalities endured gaps in financing, leading to an increase in urban cases and the creation of urban foci of transmission that may have paved the way for the resurgence.[5] The continuation of funding and support might have ensured proper control and management, thereby preventing or minimizing the resurgence experienced by many countries. Large-scale morbidity and mortality might have been prevented.

Research support for development of new insecticides and drugs was likewise limited after 1963 when international funding was dwindling. This downward trend discouraged young scientists from pursuing studies on malaria, and as a result, research and development stagnated.[5] With the deterioration of financial support of these essential efforts in the fight against malaria, the momentum generated by the elimination and eradication campaigns quickly ground to a halt. Meeting the challenge of sustaining financing thus remains a priority for countries considering elimination. The lessons from the Global

Malaria Eradication Program relay the importance of sustaining financing over the long term to prevent the climate for a resurgence of the disease and the resulting morbidity and mortality.

Considering this history of fluctuating support, it is important to recognize that lower income countries will require external assistance for elimination that has a long-term and consistent commitment. This funding must be maintained even after malaria is eliminated and the focus moves toward preventing reintroduction. Yet, as we have seen, donor support can fluctuate in ways that complicate and even paralyze the management of a long-term intervention. This is a particular risk when working with diffuse and hypothetical benefits, as with malaria elimination: The risk of bounce-back is significant. Financing for elimination that is sustained over the long term is the only way to ensure that the benefits of elimination will evolve, and these methods are explored in more detail below.

Consistent financing is also important for regional elimination efforts, and different financing options are available to partners of this type of strategy. First, in a small number of cases, a country on one side of the border will be relatively high-income and could, if it chose, finance cross-border control efforts for both countries out of its own budget. Second, neighboring countries can receive donor funding individually and then collaborate across their borders. A third option is for countries to form a regional consortium and apply together to the Global Fund or other sources of international financing. For example, the four eliminating countries in southern Africa could join forces, create links with their northern neighbors (the E8 countries), and write a regional application to strengthen the necessary structures to ensure cross-country coordination and effective implementation on the border areas. Typically this would also include some elimination work within their borders. Whether funds are sought regionally or nationally, strong multi-country and cross-border collaboration and coordination will greatly facilitate elimination in continental countries with malarious neighbors. To date, it has been relatively difficult to find donor resources for regional or cross-border efforts, as most health ODA channels consider the country the basic unit of lending or granting.

FINANCIAL MECHANISMS

Financing mechanisms to ensure sustainability require two key features: a secure source of funds and the ability to restrict use of those funds to ongoing malaria control. By secure we mean stable and predictable, not subject to wide fluctuations. Table 4.2 summarizes several mechanisms that have the potential to meet these requirements. These are then further discussed below.

TABLE 4.2 | Four examples of long-term funding mechanisms for elimination

Mechanism (source)	Pros	Cons
Very long-term external assistance (from standard donors such as bilateral and multilateral agencies, foundations)	• Funder is committed to specified purpose; funds are not lost to local competing priorities. • Funding is flexible and can support cross-border efforts and adjust amount or structure as needed.	• Funds rely on external funder (are not internally sustaining). • Funder may face competing priorities for other diseases/countries. • Funds are time limited.
Domestic earmarked tax (tapping national tax base)	• Funds are substantial if based on large transaction base. • Income can be retained in earmarked funds.	• Taxed parties resist. • Earmarked funds may be reassigned due to competing priorities.
Trust fund (from standard donors, foundations, domestic taxes for middle-income countries)	• Funds are very substantial if they tap global capital markets. • Spending can be tightly restricted by charter. • Funds can support cross-border efforts.	• If funds are from bonds, donors must commit to repayment. • Funds are inflexible if conditions change.
Endowment (from private or public sources)	• Annual funds are predictable if endowment is stable. • Spending can be tightly restricted by charter.	• Annual spending is limited, does not tap principal. • Funds may be inflexible if conditions change. • Donor comfort level with endowments is often low.

Long-Term Official Development Assistance ODA can entail the prospective commitment for one or more decades of foreign aid dedicated to a specific purpose. This approach is similar to current health assistance efforts, and it differs fundamentally only in duration. A well-known and successful example is the Onchocerciasis Control Program (OCP), which was launched in 1974 and, at its peak, covered 30 million people in 11 countries. Funding was planned for 20 years and was divided into 6-year phases. Continuation was conditional on performance.[6] Another example is substantial funding by the Bill and Melinda Gates Foundation for the Global Alliance for Vaccines and Immunization (GAVI). These long-term commitments allow time for rollout of ambitious health initiatives and can be tailored to them. However, they may be more appropriate for activities with an anticipated end date than for post-elimination malaria control of uncertain duration. They may also be subject to competing priorities at the funder level.

Long-term ODA may be a very suitable option for regionally implemented programs.

Earmarked Taxes Earmarked taxes are special taxes, often levied on a single type of transaction, to generate funds for a designated public purpose. They are designed to be simple to administer in that they are added on to an existing tax mechanism. By being proportionally very small, they do not substantially distort commercial transactions, yet they are substantial in magnitude through application to a large transaction base. In the United States, a "black lung" tax on private companies funds medical care for pneumoconiosis. Another recent successful example is the Solidarity Tax on aircraft tickets used to support UNITAID, which purchases drugs for the developing world.[7-10] Funds can be retained in special funds. Challenges include potential opposition from taxed parties and a fund's vulnerability to competing priorities if earmarking does not fully shield it. However, general taxes used for health are typically more vulnerable than earmarked taxes.[11]

Trust Funds and Endowments Trust funds are financial reserves dedicated to a specific purpose, both present and future. They are funded mainly up-front with initial investments, rather than pay-as-you-go taxes. Funding can derive from taxes but can also tap into other mechanisms, such as international capital markets. A very successful recent example is the International Finance Facility for Immunisation (IFFIm). IFFIm sells bonds on capital markets, with the repayment obligation falling to participating European bilateral donors.[12] Bhutan provides another example of a health trust fund to which government and donors contribute. Ethiopia has also taken a trust fund approach, using a Millennium Development Goals Trust Fund to secure multi-donor commitments to procure essential health commodities, including malaria control commodities. This mechanism permits initial investments, such as would be required to achieve malaria elimination, and also protects a portion of funds as needed for future activities. If chartered appropriately, the trust fund can protect funds for specific uses.

Endowments are similar to trust funds, except that annual spending is often limited to interest on the principal. The stock market crash of 2008, however, underscored the vulnerability of endowments to asset price fluctuations unless funds have been very conservatively invested.

Private Sector Dedicated Funds Corporate initiatives can assist with malaria elimination in two separate ways. An excellent example is (PRODUCT)^{RED}, which has generated over $120 million for the Global Fund through regular contributions from sales of participating products. A related philanthropic approach is the use of credit cards for which a small percentage of all billing is contributed to a public fund, as with the American Express RED card.

BOX 4.4 | Corporate Financing of Malaria Control Foci in Ghana and South Africa

In low-income countries, where a domestic program budget is likely to be insufficient for elimination and where donor funding may prove unreliable, industries such as mining and tourism provide examples of supplemental private funding sources that provide mutual benefit to a company and the local population. Two examples come from Ghana and South Africa.

In 2004 and 2005, malaria was considered to be the "most significant health threat" to the operations of AngloGold Ashanti Limited in the Obuasi gold mine in the southwest of Ghana.[13] The workforce suffered a prevalence rate of over 20%, leading to between 2,600 and 3,900 sick days annually. Available domestic resources were not sufficient to make a difference, and productivity declined. In response, AngloGold Ashanti initiated an integrated malaria control program in 2006 that included scientific studies as well as IRS, larviciding, case management, and surveillance. Costs for the first year were an estimated $1.7 million, with an annual budget of $1.3 million in the following years. This program yielded a 73% decline in reported cases in less than 2 years, drastically reducing absenteeism and increasing productivity in the mine. AngloGold Ashanti plans to expand the malaria program into three other mines in the southwest of Ghana, in addition to programs in Guinea, Mali, and Tanzania. Their commitment to malaria provides a model for private sector participation when the national budget is unable to foot the bill.

The tourism industry is also directly affected by malaria. In South Africa, tourism brings an estimated 8.45 billion international dollars every year into the country.[14] In the Lubombo region, a popular destination for international tourists, malaria is "identified as the primary impediment to the effective development of the high potential Lubombo tourism area." In response, the Business Trust, the government of South Africa, the Global Fund, and other donors co-funded a regional malaria control program, the Lubombo Spatial Development Initiative, or LSDI, in 1999.[15] Seventy percent of funding for LSDI is from the private sector (Chapter 2).

The results of the intervention are substantial: in the 1999-2000 season, when incidence reached 42,395 cases in the KwaZulu Natal province alone, 89% of tourism operators felt that malaria was a detriment to the industry, and 53% had cancellations because of malaria concerns.[16] In contrast, from 2002 to 2003, only 42% of operators believed malaria to be a detriment to their profits and 9% recorded cancellations due to malaria. In the interests of tourism, private companies have worked with government programs to control malaria, driving down transmission rates and increasing revenue in the region.

A separate motivation for corporate involvement reflects the importance of malaria control for conducting business. Box 4.4 describes two successful cases of private sector involvement in implementation of control efforts, as well as their financing. While corporate interest offers no promise for carrying a major fraction of the financial burden, in some circumstances such contributions will be significant. Further, if corporations execute their investments efficiently, they can provide a useful model for other companies (Box 4.4). In this way, there are potential mechanisms to create long-term financial structures for malaria elimination. Donor support is available for low-income countries, but knowledge of the funding volatility over the years can make a good idea seem precarious. A thorough investigation and evaluation of the funding sources and methods to secure funding (listed above) is essential before getting down to the business of elimination.

4.4 Conclusions

1. Estimating three categories of costs can help inform the elimination decision. The categories comprise the following:
   - annual costs of sustaining control at a high level
   - the investment (or transition) cost of going from sustained control to zero local transmission
   - the annual costs of holding the line at zero local transmission

   The *Prospectus* presents three sets of estimates of planned costs in these categories, and the MEG has initiated case studies to expand the knowledge base.
2. For two of the three costing case studies reported in this *Prospectus*—from Hainan and Jiangsu, China—long-term elimination costs lie below those of sustained control. These cases lead to the calculation of an internal rate of return of elimination as a cost-reducing investment. Even if long-term costs of elimination exceed those of sustained control, as they did for our case study from Swaziland, benefits may well exceed costs for elimination. The value of rate-of-return assessments, however, lies in findings of rates of return sufficiently high—greater than 3%, say—to justify elimination even in the absence of assessed benefits.

3. Financing elimination has two unusual challenges:
    - The time horizon may exceed a quarter of a century, leading to "elimination fatigue" on the part of voters and donors.
    - Cross-border externalities and global public good point to the need for coordinated multi-country financing.
4. To address these particular financing problems, several less-frequently used financial instruments should be considered to complement general revenue taxes and standard forms of foreign aid:
    - very long-term ODA (conditional on performance)
    - earmarked taxes
    - trust funds
    - endowments
5. Alongside exploring financial solutions to the elimination efforts, it would also be useful to concurrently explore political solutions. Most elimination financing is likely to come from traditional channels, and long-term political commitment—at donor and endemic country level—may be the most powerful driver of all.

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