

FOUR MALARIA SUCCESS STORIES: HOW MALARIA BURDEN WAS SUCCESSFULLY REDUCED IN BRAZIL, ERITREA, INDIA, AND VIETNAM

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Abstract. While many countries struggle to control malaria, four countries, Brazil, Eritrea, India, and Vietnam, have successfully reduced malaria burden. To determine what led these countries to achieve impact, published and unpublished reports were reviewed and selected program and partner staff were interviewed to identify common factors that contributed to these successes. Common success factors included conducive country conditions, a targeted technical approach using a package of effective tools, data-driven decision-making, active leadership at all levels of government, involvement of communities, decentralized implementation and control of finances, skilled technical and managerial capacity at national and sub-national levels, hands-on technical and programmatic support from partner agencies, and sufficient and flexible financing. All these factors were essential in achieving success. If the goals of Roll Back Malaria are to be achieved, governments and their partners must take the lessons learned from these program successes and apply them in other affected countries.

INTRODUCTION

Several highly effective tools are now available to control malaria. Insecticide-treated bed nets (ITNs) can reduce child mortality by almost 25%.¹ Intermittent presumptive treatment of pregnant women reduces low birth weight in their newborns.² Artemisinin-based combination therapy holds great promise for reducing mortality from malaria and curtailing onward transmission.³

Many malaria-affected countries have found it difficult taking these interventions to scale. Insufficient financing, weak health infrastructures, limited skilled human capacity, and poor quality private sector services are posited as barriers to scaling up. Such challenges have led some to question whether Roll Back Malaria will achieve its goal of halving the global malaria burden by 50% by 2010.

Nonetheless, several countries have successfully reduced malaria morbidity and mortality in the last decade, including Brazil, Vietnam, Eritrea, India, South Africa, Mozambique, Mexico, Oman, Saudi Arabia, Egypt, and Morocco. These countries' experiences offer hope to other countries that control of malaria is possible with available tools. This report documents the malaria control efforts of Brazil, Eritrea, India, and Vietnam and discusses key factors that led to the success of these programs.

METHODS

These four countries were selected for review because their success is well documented, they represent the four regions most heavily affected by malaria (Africa, South Asia, Southeast Asia, and the Amazon Basin), and they all had received financial support from the World Bank, which originally commissioned an analysis from which this report is drawn.

Information was gathered from World Bank project documents and available published and unpublished reports. Interviews were conducted with selected persons who were involved in the design, implementation, and/or supervision of these projects, including national program directors, technical

partners, and World Bank project staff. Those interviewed were asked a single question: "What, in your opinion, made this program work?" Responses were transcribed and evaluated to determine common success factors across the four programs.

This report also reflects the insights of the author, who was involved in the design and supervision of World Bank projects in Eritrea and India. Draft versions of the manuscript were shared with key country, partner agency, and World Bank informants for review and comment.

RESULTS

What follows is a brief summary of each country's program and its impact on malaria burden. This is followed by a review of common factors that are believed to have contributed to these countries' successes. These key success factors have been grouped along several dimensions, including country context, epidemiology, and technical, programmatic, and financial aspects.

Brazil. In 1989, Brazil launched a new malaria control effort, the Project for Control of Malaria in the Amazon Basin (PCMAM), with \$73 million financing from the World Bank. Prior to PCMAM, Brazil had made great progress in controlling malaria in most of the country, relying heavily on widespread indoor residual spraying (IRS). However, in the Amazon Basin, there was an upsurge in malaria cases and deaths, particularly in new agricultural settlements and mining areas. PCMAM was to intensify efforts in this region.

In the early years of PCMAM, Brazil undertook a major and somewhat turbulent reorganization of its health sector. The national vertical program responsible for malaria control had its functions integrated under the new National Health Foundation (FNS). The national government also devolved many functions to municipalities, including responsibility for implementing of malaria control activities. During this period, control efforts stalled.

In 1993, working with the Pan-American Health Organization (PAHO), Brazil devised a new strategy, the foundation of which was the targeting of control efforts to high-risk municipalities.⁴ The new strategy required strengthening of surveillance and monitoring and evaluation activities so control efforts could be better targeted. Technical focus shifted to

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rapid case management and more selective use of IRS and environmental management. Malaria treatment was made widely available, including through local shops in mining areas, and all fevers were presumptively treated for malaria. Mefloquine was introduced as an alternative to chloroquine, which remained the first-line treatment.

As part of the decentralization, finances for malaria control activities were given directly to municipalities, which generated local ownership and facilitated the development of local capacity in malaria control. Malaria control staff at FNS retained responsibility for procuring drugs and insecticides, setting standards, and providing technical support.⁴

By 1996, PCMAM had documented a 60% decrease in malaria morbidity, from 557,787 cases in 1989 to 221,600 in 1996.⁴ The proportion of cases caused by *Plasmodium falciparum* decreased from 47% to 29% during this period. It was estimated that two million cases of malaria and 231,000 deaths were averted.

Eritrea. In 1999, the Ministry of Health of Eritrea established a new strategy and program for control of human immunodeficiency virus infection acquired immunodeficiency syndrome (HIV/AIDS), malaria, sexually transmitted diseases, and tuberculosis dubbed HAMSET. The development of HAMSET was motivated by a large malaria epidemic in 1998 during which 264,023 cases and 509 deaths, particularly in working-age adults, were reported at health facilities and by growing concerns about the rise of HIV/AIDS in the Africa region (National Malaria Control Program, Eritrea, unpublished data).

The World Bank invested \$40 million to support HAMSET (World Bank Project Appraisal Document) and the United States Agency for International Development (USAID) provided significant resources to the Ministry of Health for technical support on malaria through their Environmental Health Project (EHP). The EHP's support included placing expatriate staff in the National Malaria Control Program (NMCP) to develop capacity in entomology and epidemiology at national and sub-national levels (USAID Environmental Health Project, unpublished data) and financial and technical support for extensive operational research to inform program priorities.

The HAMSET technical strategy sought to reduce and better target IRS to the highest-risk areas and scale up rapid diagnosis and effective treatment of fever cases, environmental management activities, and ITN use (NMCP Eritrea, unpublished data). At the core of this strategy was the strengthening of disease surveillance and operational research activities, whose data would be used to select and refine the mix of strategies and for geographic targeting of control activities.

Implementation of HAMSET was decentralized to zoba (zonal) and sub-zoba levels. Eritrea had a long-standing zoba-level malaria control capacity that was initially developed to oversee the implementation of IRS activities. Zobas were provided financial resources based on approved annual work plans. The NMCP's functions included technical leadership, policy and standard setting, procurement of essential commodities, and coordination of partners. The NMCP also provided oversight and capacity building of zoba level malaria staff. Communities were actively involved in malaria control activities, including the distribution and re-treatment of ITNs and environmental management.

By 2003, ITN use by children less than five years of age in malarious areas increased from 20% to 63% (NMCP, Eritrea,

unpublished data). Malaria morbidity decreased from 179,501 reported cases in 1999 to 65,540 cases in 2003, a decrease of 63%, and the mortality rate decreased from 13.3% to 3.9%.

India. After several years of increasing malaria morbidity and mortality, the Government of India sought and received a \$165 million credit from the World Bank in 1997 to implement the Enhanced Malaria Control Project (EMCP) in 100 high-risk districts in eight north Indian states. A primary goal of EMCP was to enable India's National Anti-Malaria Program (NAMP) to transition from its unsuccessful eradication strategy to more modern control methods (World Bank Project Appraisal Document). The widespread use of IRS was curtailed and targeted to high-risk areas. The EMCP put emphasis on full-scale implementation of early diagnosis and prompt treatment of cases at facility and village levels, introduction of ITNs, and alternative vector control methods (including environmental management and use of larvivorous fish). The quality and completeness of malaria surveillance was improved and laboratory diagnostic capacity was expanded.

Progress during the first years of the project was slow, resulting in an unsatisfactory midterm project review and a re-designing of the project. State health departments, which were excluded from the original project design, were given responsibility and financing to supervise and support district-level implementation. Despite the redesign, implementation remained sluggish and project disbursement was briefly suspended until a change of government brought new leadership to the Ministry of Health and Family Welfare and the NAMP. This new leadership negotiated with the World Bank to lift the suspension after meeting a series of benchmarks, and implementation took off rapidly (World Bank Project Supervision Reports).

With the states now overseeing district implementation, NAMP focused its efforts on setting policies, procuring key commodities, monitoring and evaluation (including operational research), and supervision of state-level malaria control staff. India benefited from a high number of skilled district level staff who had been trained in malaria control during the time when eradication activities were being carried out. In some instances, malaria officers from high performing districts were shifted to more problematic districts. Financing provided to district authorities stimulated local governments, community groups, and non-governmental agencies (NGOs) to become involved in activities such as re-treatment of ITNs, stocking of larvivorous fish in water bodies, and community awareness campaigns.

From 1997 to 2004, more than 300,000 village-based volunteers were trained in malaria case management and deployed in EMCP Districts. Approximately two million ITNs were distributed and more than 20,000 larvivorous fish hatcheries established (National Vector Borne Disease Control Program, India, unpublished data). Malaria morbidity decreased in EMCP districts by 43% and nationwide by 38%. Almost one million fewer cases were diagnosed in 2004 than in 1997. Three states, Gujarat, and Andhra Pradesh, and Maharashtra, reduced malaria morbidity by 65–70%. At the same time, the population covered by IRS in EMCP districts decreased by almost 50%.

Vietnam. After great success controlling malaria during the eradication era, the malaria burden in Vietnam surged in the 1980s and early 1990s, reaching 1.3 million cases and 2,658

deaths by 1992.⁵ This coincided with two decades of a deteriorating economy and decreased funding to the health system, which contributed to a greatly weakened health infrastructure.

In response, the National Institute of Malariology, Parasitology, and Entomology (NIMPE), which was established during the eradication era, devised a new strategy to control malaria. At the same time, the government of Vietnam began reinvesting in the public health system and in malaria. Domestic allocations expanded more than 2.5-fold for health and almost 10-fold for malaria from 1991 to 1994.

The major technical innovation was the introduction of ITNs and an extensive communications campaign, educating the population on malaria and the importance of using and retreating ITNs. The use of IRS became more targeted. Because of widespread drug resistance, the national drug policy was changed, replacing ineffective treatments with mefloquine and later artemisinin-based drugs. These treatments were made widely available both in the public and private sectors. The World Health Organization Regional Office for the Western Pacific (WPRO) played a key role in assisting NIMPE in developing the new strategy and providing technical support for implementing it.⁵

Another feature of the malaria strategy in Vietnam was the involvement of all levels of government and communities. Steering committees were established that linked government authorities with malaria control staff at each level. These committees set goals, allocated budgets, and monitored progress. The committees used the existing local health infrastructure to conduct key functions, including supervising village volunteers and responding to outbreaks. Youth leagues, women's unions, and village heads also played key roles, particularly in distribution and re-treatment of ITNs.

In 1997, the World Bank provided \$25 million to build on the early successes of the program. This project supported procurement of insecticides, drugs, and some equipment for all 61 provinces, but focused most of its resources on 15 high-burden provinces (World Bank Project Appraisal Documents). These 15 provinces were targeted for training in case management, strengthening of surveillance activities, public awareness campaigns, and improvement of laboratory capacity.

By 2003, the number of malaria cases had decreased to 164,706 cases, or 12% of 1992 levels (World Bank Supervision Documents). The malaria mortality rate decreased to 0.06% and outbreaks of malaria ceased.

KEY SUCCESS FACTORS

Country context. All four programs were launched in periods of relatively strong economic growth and political stability. Vietnam was rapidly recovering from a period of economic crisis. Brazil, Eritrea, and India had growing economies. The effect of such favorable economic conditions on the health sector was most notable in Vietnam, where government investments in health almost tripled in the period between 1991 and 1994. However, it must be noted that the economy of Eritrea has deteriorated somewhat since project launch.

The inception of these programs signified a new commitment to malaria control at the highest levels of government. Although the immediate stimuli for these new initiatives were large epidemics or upsurges of malaria cases and deaths that

affected working-age adults, at the core of this commitment was the recognition that malaria was a barrier to economic development. Evidence of such commitment moved well beyond simple rhetoric. For example, the Ministry of Health of Eritrea put malaria control as its top priority for World Bank investment in the health sector. Both Vietnam and India significantly increased their domestic budgets for malaria control (in Vietnam by almost 10-fold over a four-year period). Senior Ministry of Health members also saw it as their responsibility to remove bureaucratic obstacles and monitor program progress.

Epidemiologic factors. These four countries sit in different geographic regions and have different mosquito vectors and climates. Nonetheless, there are similarities in the epidemiology of malaria. All four countries are characterized by wide geographic variability of disease risk and burden, which is related to variations in local climate. Malaria in these four countries kills and severely debilitates people of all ages. In all four countries, the development of these new program strategies were preceded by periods of large epidemics or markedly increased burden that heavily affected people in their productive years of life.

The impact of malaria on working adults in these countries and its obvious economic repercussions appears to have been significant factors in the decisions by these governments to place a high priority on malaria control. It is notable that many countries in tropical and sub-tropical Africa, where the disease burden rests heavily on young children, have not given malaria control as high a priority and, to date, have not had success in reducing malaria burden.

Although overall transmission intensity is moderate to low in these four countries, each had pockets of high-level transmission. In addition, malaria burden in India, Vietnam, and Brazil was most heavily concentrated in areas with large tribal or indigenous populations. Health infrastructure in these areas is weaker, comparable with that of many parts of Africa, and the populations are disconnected from public health structures and most resistant to health promotion activities. However, weak underlying infrastructure did not prevent any of these countries from taking control interventions to scale.

Technical approach. All four countries adopted similar technical approaches to control malaria. For years prior to the implementation of these programs, their strategies had focused on vector control, particularly IRS, with little or no success. The new strategies used multiple approaches, balancing case management with prevention, and introducing new technologies, particularly ITNs. In India, Brazil, and Vietnam, this shift in strategy was an explicit objective of the World Bank projects.

The new strategies emphasized improving and expanding the availability of effective case management. The use of IRS was more targeted and alternative vector control measures were scaled up. The choice of measures varied by country and included environmental management, larviciding, and use of larvivorous fish. Distribution of ITNs became a key prevention strategy, particularly in Vietnam and Eritrea.

It should be noted that three of these countries (India, Brazil, and Eritrea) resisted some of the advice provided by external technical partners. For example, program managers in these countries were reluctant to rapidly phase out IRS, as some technical partners recommended. Despite heavy global pressure to adopt artemisinin-based combination therapy, In-

dia and Eritrea achieved success by focusing on scaling-up rapid treatment with chloroquine and sulfadoxine-pyrimethamine. When these program managers decided to deviate from the advice given by partners, it appears to have been based on their knowledge of their unique country conditions and the results of operational research, not on a reluctance to adopt newer strategies.

Another essential aspect of the technical approach of these countries was the emphasis on targeting interventions to high-risk areas. In India, these were the 100 most heavily affected districts in eight states. Similarly, interventions were highly targeted to high-risk municipalities in the Amazon Basin in Brazil, the 15 high-burden provinces in Vietnam, and heavily-affected zones in Eritrea. Such targeting was only possible because these countries invested in improving their malaria surveillance systems. Laboratory capacity was strengthened and case reporting was streamlined, integrated, and computerized. There also was a strong emphasis in developing capacity at sub-national level to analyze and interpret surveillance data, which then impacted decision-making at district level. Operational research activities were also expanded and were essential in updating policies, particularly on drug treatment and ITNs.

Programmatic factors. Prior to the implementation of these programs, all four countries had centrally managed, vertical implementation strategies. Under this arrangement, village-level functionaries were paid by the national malaria control program and worked solely on malaria control. The most extreme example was in Brazil, where malaria treatment was provided by free-standing malaria clinics that had no formal link to local public health facilities.

Coincident with the development of new control strategies, there was a significant move towards integration and decentralization of implementation. Brazil decentralized the responsibility and resources for malaria control to municipalities. In Eritrea and India, responsibility for implementation was shifted to zonal and state health authorities, respectively. Vietnam built structures linking governments and malaria control staff at provincial, district, and commune levels. The decentralization of responsibility and resources stimulated ownership of malaria control efforts by local governments. Such local involvement was seen to be pivotal to the success in all four countries.

Despite moves toward decentralization, the national malaria control programs remained strong and played important roles in supporting implementation. The national malaria control programs in all four countries continued to procure insecticides, drugs, ITNs, and other essential commodities. They also mobilized technical and programmatic support for districts. For example, when it became clear that implementation in Orissa, India was lagging behind other states, the NAMP developed an intensive schedule of supervision visits that helped kick-start control efforts.

All four program directors had strong technical and managerial skills. They had experience in developing comprehensive implementation plans and budgets and were capable of efficiently navigating their bureaucracies, quickly moving requests for funds replenishments, disbursements, and procurements. Some of them developed these managerial skills running the former vertical malaria control programs.

The public health infrastructures of these countries were more developed than many other malaria-affected countries,

particularly those in sub-Saharan Africa. However, the areas targeted by these programs had weak infrastructures. These countries also benefited from capacity developed under the prior vertical control programs, which provided some of the basic infrastructure necessary for implementation.

One distinguishing characteristic of these four country programs was the presence of skilled technical staff at sub-national level. The experience in India demonstrates that state malaria control programs were critical to the success of control efforts. The same could be said of the zonal malaria control officers in Eritrea. All four programs made great efforts to build technical and programmatic capacity at district level.

Partnership issues. A unique feature of these four country programs was the presence of a lead partner agency that provided technical and programmatic support. In Eritrea, the USAID Environmental Health Project played a lead support role, providing full-time staff and helping the NMCP to identify, mobilize, and finance external technical and programmatic support as needed. In Vietnam and Brazil, intensive hands-on technical guidance and implementation support was provided by WPRO and PAHO, respectively.

At the local level, partnerships also played an essential role. In India, local health departments have partnered with tribal welfare, education, and agricultural departments, as well as NGOs and community groups. Private shopkeepers in mining areas in Brazil were trained to diagnose and treat fever cases. Local partnerships often are focused on specific activities. For example, NGOs in India are contracted to distribute and retreat ITNs and tribal welfare workers offer malaria treatment to their surrounding communities.

Financing. The financing provided by the World Bank coupled with increases in resources provided by the government represented a dramatic increase in funding for malaria control activities in India, Eritrea, and Vietnam. In all countries, government investments went beyond support solely for salaries and minor operating expenses. In India, government support to the National Anti-Malaria Program included resources for procurement of all required stocks of DDT. Several state governments in India also invested some of their own resources in malaria control.

Disbursement and use of funds was rather brisk when compared with World Bank health projects in many other countries. One factor that may explain such rapid disbursement is that program managers either had direct control of or easy access to those who did control the purse strings. These managers also had a great capacity to move their bureaucracies so that finances flowed and procurements were made in a timely manner. In contrast, malaria control program managers in many countries have little or no access to those who control the finances, who are several levels of bureaucracy above them.

Decentralized control of resources was important in all countries. This was believed to be pivotal to the success of the programs in Brazil and Vietnam because it allowed local authorities to prioritize spending on malaria based on local needs and provided them with a strong sense of ownership. Similarly, the program in India initially faltered until state health departments were given control of some resources. Providing resources directly to zonal health authorities was also a key component of the project in Eritrea.

World Bank factors. As stated earlier, the World Bank was a major financier of all four country programs. The Bank took

a very proactive approach to supervision of these projects. It ensured active technical supervision and programmatic support either through its own resources or through partner agencies, including the World Health Organization and USAID.

Another feature of the involvement of the World Bank in these four countries was its flexibility. In India, after an unsatisfactory mid-term review, the World Bank worked aggressively with the government to restructure the project significantly and remove major bottlenecks to implementation. The World Bank also demonstrated flexibility in the procedures for procuring insecticides. Similarly, the World Bank reallocated funds from an earlier health sector project in Eritrea so that the Ministry of Health could purchase antimalarial drugs, supplies, vehicles, and operational support in response to a large malaria epidemic in 1998.

However, the World Bank was not averse to restrict the use of funds when progress was not satisfactory. When progress remained slow after the project re-design in India, the World Bank suspended disbursement until the government met a series of benchmarks, which included the review and revision of some malaria control policies.

DISCUSSION

The success of these four malaria control programs appears to be the result of the confluence of factors. A sound targeted technical approach, skilled human resources, and good infrastructure at national and sub-national levels, strong technical and programmatic support from partners, and sufficient and flexible finances were all essential for these programs to accomplish their goals.

Many of the lessons learned from these program successes could easily be appropriated by other countries. The key success factors listed here should not be viewed as a menu, but rather a group of essential characteristics required for program success. Countries interested in achieving such successes must strive to address all of these factors.

It must also be pointed out that some of these factors are beyond the control of the malaria control program. If a country is involved in civil conflict or a program manager has no access to those who control the finances, then success is unlikely.

Recent global advocacy campaigns have focused very narrowly on debates over the choice of drug or insecticide. The experiences of India and Eritrea should teach us that these arguments miss the point. What appears to have been most important was the full-scale implementation of rapid case management along with a mix of prevention strategies, rather than simply procuring the right drug or insecticide.

These country examples also point out that implementation strategy does matter. Control efforts faltered in India and Brazil until the programs were redesigned. Most notably, decentralization of program implementation and financing greatly facilitated the progress of these programs. A strong central malaria control program also was required for technical and programmatic support. The involvement of local political leaders in control efforts was pivotal to success, particularly in Vietnam and Brazil.

The World Bank played an important role in the success of these programs that went beyond simply providing financing. Technical and programmatic support mobilized by the Bank was an important contribution to their success. So too was the

willingness of the Bank to be flexible, supporting the re-design and re-allocation of financing to overcome barriers and meet the changing needs of the program. Other donors should take note.

However, no single factor was more important than the strong commitment and leadership at all levels of government. Government and community leaders from national to local levels considered malaria a priority problem for both health and economic development and dedicated their domestic resources and personnel power to address it. National malaria control program managers understood what worked in their countries and knew how to develop plans and effectively navigate their bureaucracies to implement those plans. Senior Ministry of Health staff saw malaria control as their responsibility and made efforts to facilitate implementation and keep their malaria programs accountable for results. Without this leadership and ownership, it is doubtful that these programs would have gotten off the ground even if all other success factors had been in place.

Received August 8, 2005. Accepted for publication August 29, 2005.

Acknowledgments: I thank the following individuals for providing information and additional unpublished materials for the preparation of this report: Tewolde Gebremeskel (NMCP, Eritrea); Eugene Brantly (Research Triangle Institute, Washington, DC); Jotna Sokhey, (National Vector Borne Disease Control Program, India); Eva Jarawan, Alexandre Abrantes, Son Nam Nguyen, K. Sudhakar, Anabela Abreu, Suprotik Basu, and Olusoji Adeyi (World Bank, Washington, DC). I also thank Martin Alilio and Susan Zimicki (Academy for Educational Development) for their critical review of the manuscript.

Financial support: This work was supported by the Human Development Network, World Bank (Washington, DC) and the Global Health, Population, and Nutrition Group, Academy for Educational Development (Washington, DC).

Disclosure: The author wishes to disclose that he serves as a consultant to the World Bank. This statement is made in the interest of full disclosure and not because the author considers this to be a conflict of interest.

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