



CASES IN GLOBAL HEALTH DELIVERY

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Malaria Control in Zambia

Dr. Elizabeth Chizema, coordinator of Zambia's National Malaria Control Centre (NMCC), sat at her desk in the capital city of Lusaka reviewing the results of the newly released 2008 Malaria Indicator Survey, a national household survey. Zambia's new "scale-up for impact" malaria control strategy seemed to be producing positive results. The survey reported dramatic increases in the number of households participating in indoor residual spraying (IRS) campaigns and accessing insecticide-treated bednets (ITNs) and a significant decline in the incidence of malaria since 2006. Challenges in both delivery and the appropriate use of malaria interventions, including antimalarial drugs and bednets, continued, however. With the 2009 annual budgeting and planning process approaching, Chizema considered how the NMCC and its partners could address the lingering uncertainties. Was the progress sustainable?

Overview of Zambia

Zambia is a landlocked country in southern Africa covering 752,612 square kilometers.¹ It is bordered by eight countries: Tanzania and the Democratic Republic of Congo (DRC) to the north; Botswana and Namibia to the south; Malawi and Mozambique to the east; and Zimbabwe and Angola to the west (see **Exhibit 1** for a map of Zambia).

Zambia's population density was 16 people per square kilometer, with sparsely populated rural areas.² The country had more than 70 ethnic groups. Christianity was the dominant religion,¹ and English the official language.³ There were 20,117 kilometers of paved roads and 71,323 kilometers of unpaved roads, the latter of which were largely in poor condition.⁴ Most infrastructure development had occurred in urban areas and along the major rail lines.⁵ In rural areas people traveled primarily by bicycle or on foot.

Upon independence from Great Britain in 1964, Zambia was one of the most affluent countries in sub-Saharan Africa, largely because of the vast copper reserves developed under British colonial rule. During the early 1960s the government nationalized the copper industry to finance development activities.⁶ Zambia also created state-owned companies in manufacturing, trade, and agriculture and imposed tariffs to stimulate economic diversification and the growth of local industries.⁶ Over the next decade, however, the

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declining price of copper and periods of prolonged drought severely strained the economy. The government increased its borrowing to compensate for decreased export revenue, accumulating a debt of more than USD 2 billion by 1981.⁶ As an increasing proportion of the country's revenues was diverted from development and social services to loan repayments, the government entered into debt negotiations with the International Monetary Fund and the World Bank. These institutions imposed a series of austere structural adjustment programs that ultimately worsened economic performance, debilitated social infrastructure, exacerbated poverty, and led to political instability. Zambia's debt rose to USD 6 billion by 2002.⁶ Per capita income declined from more than USD 700 at independence to USD 358 in 2003.⁶

In 2005, after Zambia met a variety of conditions for debt forgiveness, the International Monetary Fund and the World Bank's International Development Association provided debt relief of approximately USD 6 billion to Zambia under the Highly Indebted Poor Countries Initiative.⁵ Despite this assistance, debt payments still accounted for 31% of Zambia's GDP.⁷ In the early 2000s expansion in copper mining led to improvements in Zambia's economy, and by 2006 the real GDP growth rate was 5.8%.¹ However, Zambia's economic growth did not translate to improved living conditions for the vast majority of Zambians. While the economy relied heavily on its mineral resources, 85% of the labor force worked in agriculture, with the remaining 9% in services and 6% in industry.⁷ Migrant laborers formed a significant proportion of the workforce; while most of these were miners or agricultural plantation workers, some worked as truck drivers, commercial sex workers, fishmongers, cross-border traders, or military personnel. Zambia's unemployment rate approached 50%.¹

Basic Socioeconomic and Demographic Indicators *

INDICATOR		YEAR
UN Human Development Index ranking	165 (out of 177)	2007
Population (thousands)	12,620	2008
Fertility rate (total births per woman)	5.8	2008
Urban population (%)	35	2008
Drinking water coverage (%)	58	2006
Poverty rate (% living under USD 1.25 per day)	64	2008
Gini index	50.7	2004
GDP per capita in PPP (constant 2005 international dollars)	1,251	2008
GDP per capita (constant 2000 USD)	387	2008
Adult literacy (%)	70.7	2008

Health in Zambia

The majority of people in urban areas lived in informal settlements that lacked basic sanitation and water services.⁸ In 2002 the top 10 causes of death in Zambia were: HIV/AIDS, lower respiratory infections, malaria, diarrheal disease, perinatal conditions, tuberculosis, cerebrovascular disease, ischemic heart disease, measles, and road traffic injuries.⁹

* This data was compiled from the following sources: United Nations agencies and the World Bank.

Health System and Epidemiologic Indicators [†]

INDICATOR		YEAR
Average life expectancy at birth (total/female/male)	45/46/45	2008
Maternal mortality ratio (per 100,000 live births)	470	2008
Under-five mortality rate (per 1,000 live births)	145	2008
Infant mortality rate (per 1,000 live births)	88	2008
Vaccination rates (% of DTP3 coverage)	81	2008
Undernourished (%)	43	2007
HIV prevalence (% of population ages 15–49)	14	2008
HIV antiretroviral therapy coverage (%)	51	2007
Tuberculosis incidence (per 100,000)	468	2008
Tuberculosis treatment success rate (% of registered cases)	88	2008
Malaria cases (per 1,000)	358	2007
Government expenditure on health (% of total government expenditure)	11	2008
Government expenditure on health per capita (international dollars, USD)	26	2006
Total health expenditure per capita (constant 2005 international dollars, USD)	80	2008
Out-of-pocket health expenditure (% of private expenditure on health)	75	2008
External resources for health (% of total expenditure on health)	50	2008
Physician density (per 10,000)	1	2006
Number of hospital beds (per 10,000)	2	2008

Malaria imposed a considerable strain on the health system. In 2004 malaria infection accounted for 45% of hospitalizations and outpatient department visits.¹⁰ About 20% of children under five, mostly among the rural poor, tested positive for malaria parasites in 2006, and 13% suffered from severe anemia.¹¹ By 2007 malaria was the leading cause of morbidity and second leading cause of mortality in the country.¹² There were 4.4 million cases of malaria that year; incidence was down from 412 per 1,000 people in 2006 to 358 per 1,000.¹² Malaria accounted for 20% of maternal mortality, 40% of infant mortality, 47% of the overall disease burden among pregnant women, and 50% of the disease burden among children under five.^{12,10} It was endemic in all nine provinces of Zambia.¹³ Malaria transmission peaked in the rainy season from November to April.¹³

Health System

In the early 1990s, under the influence of the World Bank and International Monetary Fund's structural adjustment programs, the Zambian health sector underwent a series of reforms designed to decentralize health service delivery. The size and scope of the Ministry of Health's (MOH) responsibilities were significantly reduced and limited to allocating public health budgets, interacting with donors, setting

[†] Sources: World Bank Data and National Health Strategic Plan 2006–2010.

national policies, and performing other legislative and administrative tasks. The goal was to provide all Zambians with “equity of access to cost-effective, quality health care services, as close to the family as possible.”¹⁴

To facilitate decentralization, districts became the main administrative units in the health sector.¹⁵ District Health Management Teams (DHMTs) planned, implemented, and monitored health activities and supervised health centers. Provincial health officers provided intermediate management, coordination, and supervision of their respective districts. This decentralized structure allowed for the private sector and nongovernmental organizations (NGOs) to participate in service delivery and for health facilities and communities to engage in the decision-making processes. Neighborhood health committees, composed of both locally elected and volunteer representatives, were established to enhance community participation in the planning and provision of health care services at each health facility. Community health workers (CHWs) and community leaders were also involved in care delivery through health centers.

These reforms were reinforced in 2003 with the passing of the National Decentralization Policy, which aimed to further devolve responsibilities to the district level.¹⁴ The government also introduced user fees in an attempt to instill a greater sense of community ownership and accountability for health care and to generate more operating revenue for health facilities.¹⁶ The World Bank and the International Monetary Fund highlighted Zambia as a decentralization model for other countries in Africa.

Health facilities were responsible for providing a package of essential services called the Basic Health Care Package. The package, defined by the MOH, prioritized the 11 diseases and conditions with the highest levels of morbidity and mortality[†] and included antiretroviral therapy, improved treatment for malaria with artemisinin-based combination therapy (ACT), indoor-residual spraying (IRS) for malaria, and the introduction of the DPT+ Hib pentavalent vaccine.¹⁴ The estimated cost of providing the package was USD 18 per capita.¹⁴ After the introduction of user fees, despite some exemptions, the MOH became concerned about utilization of health services. To increase utilization of health services, the government removed user fees from all public rural health facilities on April 1, 2006. There was an immediate 50% increase in clinic and hospital visits among people older than five years and a 40% increase in drug consumption in rural areas.¹⁶

Several challenges, however, limited the MOH’s ability to effectively provide the Basic Health Care Package, including: the high disease burden (especially of HIV/AIDS and malaria); erratic supplies or stockouts of essential drugs and other commodities resulting from procurement and logistics management challenges;¹⁷ lack of financial coordination between the Ministry of Finance and the MOH that made it difficult to take advantage of lowered health commodity prices through pooled procurement; critical shortages of health workers; inadequate infrastructure, equipment, and transport, particularly in rural areas; and insufficient funding.

The MOH financed and procured drugs with the support of partners who either directly procured and supplied them or provided budgetary support to the MOH. Zambia’s Medical Stores Limited (MSL) managed the storage and distribution of drugs for the national health program. The MOH contracted an international supply and logistics company to manage MSL and improve the drug supply chain. Each month, MSL received orders from the health facilities via aggregation of demand forecasts at the district level. Medical Stores Limited filled orders from its own central warehouse, packaged the drugs by facility, and delivered them to the districts using a fleet of 14 trucks. The biggest challenge to maintaining a reliable

[†] Conditions with the highest morbidity and mortality included child health; nutrition; environmental health; control and management of communicable disease, including malaria, tuberculosis, sexually transmitted infections, and HIV/AIDS; mental health; control and management of non-communicable disease; epidemic and disaster prevention, preparedness, and response; school health; and oral health.¹⁴

supply of drugs was the long, often-unpredictable lead time for procurement. When stockouts occurred at MSL, the MOH was forced to purchase drugs at a premium from private in-country importers. While maintaining a higher buffer stock could prevent stockouts, the additional staff and warehouse space required to maintain the extra stock were considered too costly.¹⁸

The health sector received 11.2% of the national budget in 2008 and was financed by a combination of public resources, donor funds, and out-of-pocket expenditures, with donor funds constituting 50% of the total health expenditure.^{17,14} A new sector-wide approach applied in Zambia aimed to coordinate stakeholders involved in each sector, such as health, to support a single government-led policy and budget. The government would receive funds from donors and be responsible for the disbursement and accounting. Through the sector-wide approach's "district basket" mechanism, DHMTs received monthly grants from pooled donor funds. These funds were used to support service delivery and operational costs. About USD 3.35 million was distributed monthly in 2007 among Zambia's 72 districts, according to population size and disease burden.¹⁰

Malaria

Malaria is caused by one of five different parasites (see **Exhibit 2a and 2b** for the *Plasmodium falciparum* lifecycle and human susceptibility and symptoms). After an infected mosquito bites a human, a few transmitted parasites multiply rapidly in the human host until there are tens of billions of parasites circulating in the blood. These parasites cause intense flu-like symptoms marked by fatigue, headache, and muscle aches, with intermittent periods of high, wracking fevers; left untreated, the symptoms can progress to profound anemia, kidney failure, and coma—and in some cases, death. In other cases, the infection can become chronic, leading to anemia and prolonged periods of fatigue and lassitude.

Global Control Efforts

In 1998 the World Health Organization (WHO), the United Nations Children's Fund (UNICEF), the United Nations Development Program (UNDP), and the World Bank revived the campaign to control malaria, and jointly launched the Roll Back Malaria (RBM) Partnership.¹⁹ The RBM Partnership aimed to mobilize global commitments toward a new era of malaria control and to cut the global burden of malaria in half by 2010. It emphasized the importance of partnerships in coordinating control efforts, enabling rapid scale-up, and integrating malaria control within existing health care delivery systems. In addition to coordinating activities among donors and governments, the RBM Partnership called for new vaccines, new prevention measures, and new, more effective antimalarial drugs.

In April 2000 the heads of state and senior government officials of 44 of 50 malaria-affected countries attended the African Summit on RBM in Abuja, Nigeria. They ratified the Abuja Declaration, committing themselves to "an intensive effort" to halve malaria mortality by 2010 and to cover 60% of the population with malaria prevention and treatment interventions.²⁰ Leaders pledged to allocate sufficient resources to sustain implementation of the RBM Partnership actions and to remove taxes and tariffs on malaria control commodities. They developed a detailed plan of action to specify activities for countries to undertake and indicators for monitoring.

In its first decade, the RBM Partnership made some progress in communication and coordination among institutions, but its global success was limited by the ineffective delivery of curative and preventive measures.⁶ Death and disease from malaria remained high throughout endemic areas, and widespread drug resistance to antimalarials posed a significant obstacle to malaria control.

By the end of 2008, several countries, including Ethiopia, Ghana, Rwanda, and Zambia, had shown progress in controlling malaria; Rwanda and Ethiopia had successfully reduced malaria-induced under-five mortality by more than 50%, largely attributable to the influx of financial resources made available by the WHO and the Global Fund to Fight AIDS, Tuberculosis and Malaria (“Global Fund”). With increased financing, programs became more comprehensive and better coordinated to deliver integrated malaria treatment and prevention strategies. These strategies included: indoor residual spraying (IRS), treatment with artemisinin-based combination therapy (ACT), the distribution of insecticide-treated nets (ITN) and long-lasting insecticidal nets (LLINs), and prevention of malaria in pregnant women through intermittent preventive treatment (IPTp). In September 2008 the international community and the RBM Partnership launched the Global Malaria Action Plan and committed nearly USD 3 billion to reducing the number of malaria deaths to zero by 2015 (see **Exhibit 3** for the Global Malaria Action Plan targets).

History of Malaria in Zambia

British colonial authorities recognized the burden of malaria in Northern Rhodesia—the area that later became Zambia—and sought preventative measures as towns and cities grew. The Mosquito Extermination Act of 1944 mandated household management of outdoor water containers in order to eliminate mosquito breeding sites.¹⁵ In the late 1950s Northern Rhodesia introduced an IRS program using dichloro-diphenyl-trichloroethane (DDT).¹⁵ Municipal councils and the MOH sprayed urban areas, and mining companies administered and financed the program in mining districts. Insecticide spraying was not conducted in rural areas, where malaria control was restricted to treatment services. Chloroquine, the most effective and inexpensive antimalarial at the time, was provided for free in the public sector across the country. One of the most effective early prevention and treatment efforts was observed in the Copperbelt among private mining companies, which implemented these efforts in the 1920s in order to sustain a healthy workforce.²¹

When the world copper price plummeted in the 1970s, the government reduced health expenditure significantly.¹⁵ In 1973 mosquito resistance and toxicity concerns led to a worldwide cessation of DDT use, and Zambia halted national malaria prevention efforts completely.²² As chloroquine-resistant strains increased, malaria rates quickly rose in both urban and rural settings. Over the next three decades, malaria incidence rates in Zambia tripled from 121 per 1000 in 1976 to 428 per 1000 in 2003.²³

Malaria Control

The National Malaria Control Center (NMCC) was established in 1997 under the directorate of the Public Health and Research division in the MOH to coordinate malaria control across the country. The NMCC consisted of a coordinator, three specialist officers, and several administrative staff.

In preparation for the inception of RBM Partnership objectives in Zambia, in 1999 the Zambian government participated in global and regional RBM Partnership consensus-building meetings.¹³ In April 2000 the Minister of Health signed the Abuja Declaration, committing to bring malaria control interventions to 60% of Zambia’s population by 2005.¹⁵ One NMCC officer pointed to the signing of the Abuja Declaration as a turning point for malaria control in Zambia: “There were activities outlined to show what was required in order to achieve that commitment. So it wasn’t just a declaration that was empty; it was actually the beginning of work.” New partners joined the NMCC’s malaria control efforts and worked together to implement the National Malaria Control Program.

The NMCC began to integrate RBM Partnership principles of evidence-based decision making and locally adapted strategies after conducting a national malaria situation analysis to gather baseline data in 2000. In consultation with domestic and international technical experts, the NMCC formulated the National

RBM Strategy for 2000–2005—Zambia’s first National Malaria Strategic Plan—to achieve the targets set by the Abuja Declaration. In accordance with the Abuja Declaration, the NMCC planned to implement integrated prevention, treatment, and education interventions. Prevention focused on ITNs and IPTp starting in 2003 and some vector management, including IRS and the elimination of mosquito breeding sites. The government established an interministerial National Malaria Task Force—reporting directly to the vice president and chaired by the deputy minister of health—to oversee the development of the program. Following the national inception process, the NMCC introduced the RBM Partnership principles to individual provinces and districts, which were encouraged to prioritize malaria in local planning cycles and annual budgets.¹⁵ As the RBM movement catalyzed global interest in malaria, new partners approached Zambia to become involved in malaria control, while existing partners increased their contributions. Informal monthly partner meetings evolved into a National Malaria Working Group to enhance partner coordination.

Antimalarial Policy Change

As malaria control activities expanded, ongoing drug efficacy studies revealed increasing resistance to chloroquine across the country. By 2002 chloroquine resistance averaged 60% nationally, up from 1995 chloroquine treatment failure rates that ranged from 5.4% to 13.6%.²² The WHO recommended changing drug policy when chloroquine resistance reached 25%. The increasing incidence of drug-resistant malaria prompted the MOH to establish a multidisciplinary Drug Technical Advisory Group, consisting of pharmaceutical, medical, research, policy, and DHMT representatives, to review Zambia’s malaria treatment policy.

The advisory group reviewed the limited range of alternative antimalarials to replace chloroquine and subsequently recommended the ACT artemisinin-lumefantrine as first-line treatment in March 2002. It selected artemisinin-lumefantrine because of its proven therapeutic efficacy in Zambia and because it was the only ACT available as a fixed-dose combination (a combination of two different drugs in one tablet).²² At the time, however, a single course of Coartem®—the artemisinin-lumefantrine formulation manufactured by Novartis—was 40 times more costly than chloroquine, even after the WHO and Novartis negotiated a pricing agreement.^{22§} As a result, some advisory group members were concerned that Coartem® pricing was beyond what the public sector could afford in Zambia. After much debate, the MOH adopted artemisinin-lumefantrine as first-line treatment for malaria in October 2002, and Zambia became the first African country to provide ACTs as first-line treatment for free in the public sector.²² The MOH remained directly involved in the national roll-out process. In early 2003 the NMCC developed *Guidelines for the Diagnosis and Treatment of Malaria* to reflect this drug policy change. Dr. Elizabeth Chizema, a district manager of health at the time, recalled, “Having identified ACTs as a cost-effective intervention, Zambia came in and said, ‘Let’s go for it!’ Zambia was the first country in Africa to use ACTs. There were no funds, everyone was just talking about how expensive it was, but the government just said ‘we’ll go for it.’”

The NMCC applied successfully to Round 1 of the Global Fund. With its 2003 funding, the NMCC purchased quinine and diagnostic tests as well as the ACTs it had committed to providing for free in the public sector; sprayed five urban areas; trained health workers in ACT use and IPTp; and hired additional NMCC staff. The NMCC and its partners implemented widespread trainings to orient officials and health workers to the new treatment guidelines and provided educational materials to support the changes. One NMCC officer recalled, “We would go to the district, do the training, give them the drugs, and go to the next . . . So it was very labor-intensive. But by December the target was met: all districts were trained, all

[§] For a teaching case on Novartis and Coartem®, see Spar D, Delacey, B. The Coartem® Challenge. HBS No. N1-706-037. Boston: Harvard Business Publishing; 2006.

were using ACTs.” In addition to Global Fund money, the government also increased its expenditure on malaria control and eliminated taxation on malaria control commodities, including nets, insecticides, and antimalarials.¹³

The New Malaria Strategic Plan

Despite the expansions in malaria control stimulated by the Abuja Declaration, the RBM Partnership, and the increased funds, by 2005 Zambia was falling short of its target to cover 60% of the population with malaria interventions. It struggled with forecasting drug demand, managing the drug supply chain, and with clinical adherence to new guidelines, including both diagnosis and treatment. In response, the NMCC resolved to intensify its efforts.

In 2005, as the MOH prepared the National Health Strategic Plan for 2006 to 2010, the NMCC and its partners began developing the next National Malaria Strategic Plan. The partnership reviewed existing programs and assessed the gaps between current and target coverage rates and outcomes. The NMCC transitioned to the RBM Partnership–recommended “scale-up for impact” approach (see **Exhibits 4a and 4b** for more information on the approach). This approach was guided by the “three ones”: one national plan, one coordination mechanism for implementation of the plan, and one monitoring and evaluation system.²⁴ It called for rapid national dissemination of a comprehensive package of evidence-based malaria prevention, control, and treatment strategies. The MOH estimated 6.5% of total health finances would be needed for malaria control from 2006 to 2010.¹⁴

With this framework to guide their efforts, the NMCC and its partners, including provincial and district representatives, developed a joint strategic plan emphasizing accelerated coverage of prevention interventions and strengthened diagnosis and treatment (see **Exhibit 5** for the evolution of malaria targets in Zambia). The NMCC believed that it was well positioned to meet the targets established by the Abuja Declaration and sought to surpass them by: achieving 80% coverage of key interventions, reducing malaria incidence by 75%, and significantly reducing deaths attributable to malaria by the end of 2011. The national government developed a vision of a “malaria-free Zambia.”²³ One NMCC program officer described the new target: “As a program, we changed our direction. We wanted to do things differently . . . We scaled up all interventions—IRS, ITNs, free distribution of nets. We scaled up case management . . . We set ambitious targets. And it has paid off . . .”

Chizema was promoted from a district director of health to the position of NMCC coordinator in 2006. As a district director, she had learned how to develop and manage partnerships; as a self-described “community person,” she brought this inclusive attitude to the NMCC. Chizema appreciated the specific capacities of the districts and understood the need to provide them with appropriate support in her new position.

Financing

Chizema recognized the benefits of external resources in the malaria budget and the national health budget as well as the potential risks they brought to the financial sustainability of the programs. Ensuring that sufficient funds were available for the timely procurement and distribution of key interventions was a continued concern for Chizema, despite the growing number of donors and the size of their commitments.

Although it did not reach the first National Malaria Strategic Plan targets, Zambia’s documented progress by 2005 and its commitment to improving malaria control attracted the attention of donors, NGOs, and the private sector. As the 2005 planning meetings began, new technical and financial resources became

available. At the NMCC's open forum on malaria control, one participant reflected, "There was an attitude of 'malaria control is for everyone,' and this was quite visible in the NMCC. They were very inclusive." As the Minister of Health advocated for more partnerships, the accumulating evidence of program successes and national political commitment fostered increased confidence among potential partners and donors. The World Bank Malaria Booster Program—a new partner—provided USD 20 million to Zambia for 2005 to 2008. The Malaria Control and Evaluation Partnership in Africa, with funding from the Bill & Melinda Gates Foundation, joined the NMCC partnership in 2005 and committed USD 35 million for 2005 to 2013. In 2006 USAID selected Zambia as one of 15 beneficiaries of the President's Malaria Initiative and budgeted USD 15 million for control activities through 2008.¹⁰ By 2009 the Global Fund had disbursed roughly USD 66 million through Rounds 1, 4, and 7 for malaria control in Zambia over six years.²⁵ Other donors, such as UNICEF, the Japanese International Cooperation Agency, and the WHO, remained involved with steady or increased resources (see **Exhibits 6 and 7** for NMCC's resource allocation and budget).

Implementation Framework

"The thing about malaria control is that you cannot attribute it to one partner. It's a concerted effort."

—Operational Research Officer, NMCC

With the new strategic plan, Chizema and her team at the NMCC strengthened collaborations with the diverse range of partners (see **Exhibit 8** for partners' roles in malaria control). Technical working groups for each intervention (ITNs, IRS, etc.), consisting of NMCC officials and representatives of other implementing organizations, met quarterly to report progress, share challenges, plan future activities, and develop guidelines to support the program.

The technical working groups also contributed to the annual action plans that incorporated the roles of domestic partners and budgeting and that were intended to support provincial and district teams in developing local malaria control plans. They were different from previous plans, which largely sidestepped provincial authorities and worked directly with districts (see **Exhibit 9** for the national planning process). In developing the 2007 Annual Action Plan, Chizema invited a wide range of partners to a three-day plan development meeting. "A lot of people were really amazed—they were impressed to see everyone here and working throughout—really committed. So when the action plan was developed for 2007, it really had everyone's input," Chizema reported. That year, the NMCC strengthened connections with the provincial health offices, involving them in planning meetings and midterm reviews. Provincial teams acted as an extension of the NMCC, monitoring and coordinating the districts; they effectively gave the NMCC "legs on the ground."

In 2007, with Chizema's guidance, the NMCC provided national malaria control guidelines to the districts and provinces in time for their annual planning meetings. Dr. Chilandu Mukuka, deputy coordinator of the NMCC, understood the importance of empowering both the districts and provinces in the annual action plans. He explained:

It is greatly encouraged that partners are involved and that districts take the stewardship in the implementation of the program at the district level . . . Everyone is focused toward achieving results at the district. Everyone's looking at the same goal and working towards the same objectives, and that means that the community is very much engaged because they are the recipients of the interventions, so they have a say in what should be going on.

Some partners, such as the Malaria Control and Evaluation Partnership in Africa and the US President's Malaria Initiative-supported Health Systems Strengthening Partnership, were housed directly in the NMCC's headquarters to enhance partner integration and communication. The Zambia Malaria

Foundation, an umbrella organization established to coordinate community-level activities, brought together domestic NGOs, church groups, youth scouts, and other community organizations. One NMCC program officer reflected, “I think the first thing is to *know* your partners. Get their interest, their agenda . . . When you are planning an activity—from the onset, from the beginning—involve your partners all along the way.”

Chizema and her team at the NMCC retained ultimate control over policy decisions. One donor commented, “Our sole goal is to support [the NMCC] in implementing their action plan.” The global and African malaria control objectives—the Abuja targets, the RBM Partnership goals, the Millennium Development Goals—also helped align the goals of partners and the NMCC. Mukuka, also a former district director, described the approach to working with partners:

We plan together, so there is one plan, and all the partners buy into that one plan. Depending on their comparative advantage, they will support us in different ways: some will give us funds; others will give us technical support; others will procure materials on our behalf . . . So, I think the principle of the “three ones” is very important because that ensures everybody is working towards one goal, as opposed to different partners doing different things.

Key Interventions

Insecticide-Treated Nets

With increased funds in 2005, the NMCC began mass ITN distribution campaigns. Initially, the NMCC allocated nets to districts based on population estimates from the government’s Central Statistics Office. Coverage of ITNs was generally defined as three per household in areas not reached by IRS. The NMCC utilized four channels to deliver ITNs to the population:

- 1) Regional mass distribution campaigns to distribute free nets to all households
- 2) Distribution through antenatal clinics to pregnant women and children under five, as part of the Malaria in Pregnancy Campaign
- 3) Equity program to provide free nets to vulnerable populations, such as orphans, people living with HIV/AIDS, the chronically ill, and the elderly
- 4) Commercial sales

When distribution took place, however, many communities received an inadequate supply of nets. After recognizing the problems, the permanent secretary of health, the official beneath the minister of health, directed all partners to coordinate ITN distribution with the NMCC. The NMCC developed ITN distribution guidelines and standardized reporting forms to record the number of nets distributed, the number of households reached, and the specific location covered. The NMCC ITN specialist continually updated a central ITN database to track coverage and needs. The NMCC also instructed partners to link with the DHMT in their distribution efforts. Thus, in 2006, with the development of the new strategic plan, the DHMTs partnered with Neighborhood Health Committees, whose volunteer members surveyed individual households to determine net ownership and needs and then helped to distribute the required nets directly to the households they had surveyed. The NMCC and DHMTs also coordinated mass distribution of ITNs with vaccination campaigns, with Child Health Week activities, and through primary schools. The NMCC and its partners distributed a total of 4 million nets between 2003 and 2006. After the new policies were implemented, they distributed 3 million nets to six provinces in 2007 alone (see **Exhibits 10a and 10b** for ITN distribution and sources).¹²

In the past, the NMCC had used Medical Stores Limited for storage and delivery of smaller quantities of nets. However, MSL’s storage capacity of 200,000 nets was insufficient for the new mass distribution

campaigns. To circumvent storage shortages, under the new strategic plan and Chizema's leadership, the NMCC instructed suppliers to deliver ITNs directly to districts in 2007, saving both time and storage and delivery costs. According to some estimates, distribution directly to districts saved USD 250,000 for every 300,000 ITNs delivered.²⁶ DHMTs recruited partners, such as the World Food Program, to assist with local storage and transport of ITNs. One partner commented:

Before, we operated sort of like "cowboys." We took everything on our own. There was less reporting on what we were doing. You reported towards the end of the year on what we did. But, now we have quarterly meetings. There's an ITN technical working group . . . All the partners come in and talk about the challenges with ITNs, the bottlenecks and so on. That has really improved the working relationship.

Although these mechanisms alleviated some of the stressors, Chizema was still concerned about ITN storage and transport at the district level.

With greater oversight of its partners, the NMCC also mandated that only the WHO-recommended long-lasting insecticidal nets (LLINs), such as Permanet® and Olyset®, be procured and distributed in Zambia from 2006 onward. These LLINs cost about USD 7.40 per net. While a variety of partners distributed nets through the mass distribution and equity channels, Society for Family Health, a USAID-funded implementing partner, had primary responsibility for net distribution through the Malaria in Pregnancy Campaign because of its existing work in reproductive health. Society for Family Health procured and distributed nets directly to the districts using its own national distribution network and trucks. At the district level, the DHMT delivered nets to health centers, or health center staff collected nets from the DHMT, depending upon the availability of transport. Originally, the Society for Family Health had provided the nets at a highly subsidized cost (about USD 2.50 each), employing a social marketing approach. In 2007, when the government mandated that all nets be provided for free, the Society for Family Health rapidly realigned its policy with the MOH. Health facility staff stamped standard antenatal and under-five patient record cards to track free LLIN distribution.

In 2008 Chizema and the NMCC decided to raise the bednet target to 100% household coverage, an increase from the 80% target established in the initial 2006–2011 National Malaria Strategic Plan. According to the 2008 Malaria Indicator Survey, 62% of households had a least one ITN,²⁷ compared with 13.6% in 2002.²⁸ While ITN coverage had increased dramatically nationwide, utilization—those who actually slept under the nets—was only 41.1% among children under five and 43.2% among pregnant women.²⁷ However, this still represented a significant improvement over the 2002 figures, which showed that 6.5% of young children and 8% of pregnant women slept under a net.²⁸

Indoor Residual Spraying

Encouraged by the reductions in malaria incidence mining companies achieved with IRS campaigns in 2001 and 2002, the NMCC reincorporated IRS into national malaria control efforts in 2003. The NMCC initially aimed to provide IRS in 22 of Zambia's 72 districts by 2011. In light of the reported success of IRS and the scale-up strategies proposed in the new strategic plan, the NMCC increased the number of districts receiving IRS in a phased approach, from 5 in 2003, to 15 in 2007, to 36 in 2008 (see **Exhibit 11** for IRS coverage). The NMCC prioritized IRS in densely populated urban and peri-urban areas and in economically important locales. Districts were selected according to disease burden, level of urbanization, population density, housing structure, health facility distribution, capacity to handle IRS operations, and available human resources.²³ Spray operators used DDT for mud- or grass-walled homes and deltamethrin, lambda-cyhalothrin, and alpha-cypermethrin (pyrethroids) for homes with plastered and painted walls.

With experience, the NMCC refined the annual sequence of activities involved in the spraying campaign. Before 2007, the NMCC provided a given district with either IRS or ITNs, but not both. However,

with continued success and demands from districts to implement IRS, some districts became eligible for both ITNs and IRS. During the first quarter of 2007, the NMCC, in collaboration with partners and the DHMTs, conducted needs assessments in the selected districts to estimate the number of structures targeted, the number of spray operators required, and the quantities of supplies needed. These estimates helped to inform the MOH Procurement Unit, which was responsible for procuring pumps and insecticides.

In 2007 the NMCC, with the help of the Malaria Control and Evaluation Partnership in Africa and Health Systems Strengthening Partnership, introduced geo-coding to enhance the accuracy of IRS. With the help of neighborhood health committees and community leaders, the NMCC and its partners recruited community members with at least a high school education to geo-code using a personal digital assistant (PDA) system and door-to-door surveys. Geo-coders trained for three days under the supervision of the NMCC and DHMTs. Geo-coders recorded the precise geographical location, the number of rooms, the number of household members, the type of wall surface (for insecticide selection), net ownership, and history of previous spraying. Geo-coded data refined procurement and distribution details and enhanced spraying logistics.

In the third quarter the DHMTs, with the help of neighborhood health committees, recruited spray operators who met NMCC guidelines (appropriate age, height, weight, and strength) from their communities. Under Chizema's guidance, the NMCC used local community members to enhance communities' acceptance of spraying at the household level. In a 21-day training course, district supervisors taught spray operators practical spraying drills and oriented them in the basic scientific background of IRS.

Mass campaigns educated families about the importance of IRS, enabling the NMCC to increase uptake; 93% of homes in targeted districts accepted IRS in 2007, exceeding goals of 85% acceptance set in the strategic plan.¹² The NMCC used a variety of media—national radio and television campaigns, local dramas, and door-to-door campaigns led by neighborhood health committee members—to dispel misconceptions and communicate the benefits of spraying. The NMCC found it most effective to initiate awareness-raising activities well in advance of the actual spraying campaigns to improve IRS acceptance. The NMCC measured pre- and post-spray mosquito and parasite numbers to assess the impact of IRS. Additionally, the NMCC convened meetings immediately post-spraying to evaluate the implementation of the program and to capture key challenges and successes to inform the following year's activities. With each year, the program was able to reduce the cost of IRS by improving the accuracy of commodity procurement, encouraging higher efficiency from spray operators, and increasing household acceptance rates, thereby reducing wasted supplies and time.

Spraying commenced in September, before the rainy season and in advance of the increase in the mosquito population. The timing eliminated the need for people to move their belongings out into the rain, which had been an obstacle in previous IRS campaigns. Spray operators received small stipends for their work and covered about 12 to 15 houses per day over 20 to 60 days, depending on the size of the district (see **Exhibit 12** for IRS reporting form).

Chizema and her team at the NMCC encouraged districts to recruit partners to assist with storage and transport. In Lusaka, for example, the City Council provided storage facilities for the pumps and chemicals, and a private tobacco company provided the sedimentation tanks for the insecticides. In other districts, World Vision and CARE aided in community education and other partners assisted in transporting spray operators to their work sites.

District storage and transport remained persistent challenges for the IRS program, however. The NMCC strove to engender greater ownership of the intervention among DHMTs, which often viewed IRS as a central program. The NMCC hoped to further involve DHMTs and other partners with the storage and transport responsibilities. One IRS program officer reflected:

One of the lessons we've learned is ownership: the program needs to be owned by the district. Second, the importance of partnership . . . You can't just carry out this intervention as a loner. You need the community. This partnership is not just about engaging the council, the bank, and the private companies, but also the communities. We've got health committees in the communities; we need to engage those. We need to build a partnership with these people so they can influence their communities to have their houses sprayed.

Malaria in Pregnancy Campaign

The NMCC worked closely with the MOH's Reproductive Health Unit to strengthen the malaria component of antenatal care, which was offered for free across Zambia. The MOH aimed to provide at least 80% of women with a package of interventions to reduce the burden of malaria in pregnancy by December 2008. The package included three full courses of IPTp—preventive antibiotics for malaria during pregnancy—and an LLIN. Nearly every Zambian woman made one or more antenatal visits during her pregnancy, leading to high initial uptake of sulfadoxine-pyrimethamine (SP), the antibiotics used for preventing malaria through IPTp.²³ However, many women did not return to antenatal clinics for follow-up visits or presented too late to receive all three doses of IPTp. Through the new strategic plan, by 2008 more than 80% of pregnant women received at least one dose of IPTp, and more than 60% received two or more doses,²⁷ an increase from the 0.5% of women who took SP during pregnancy in 2002.²⁸ Though the NMCC provided technical expertise, malaria in pregnancy interventions were integrated with regular antenatal care provided by health facilities; midwives and nurse-midwives delivered the services.

Vector Management

Before 2007 the NMCC received little support from donors for mosquito-larval control and environmental management. In 2008 the NMCC procured 5,000 liters (1,320 gallons) of larvicides for distribution to select districts. Community-based workers applied the larvicides to mosquito breeding grounds, such as ditches and swamps. Districts promoted environmental modifications such as digging canals and drainage ditches and land filling to eliminate water-collection holes and other potential mosquito breeding sites in urban areas. Neighborhood health committees were active in environmental management, regularly clearing stagnant water and raising awareness about the importance of draining water around the house.

Diagnosis

The gold standard in Zambia for malaria diagnosis was microscopy. However, inadequate human and financial resources limited the availability of lab services across the country. In 2006, 38% of patients with malaria had access to laboratory diagnostic services.¹⁰ That year the NMCC collaborated with the MOH's National Tuberculosis Program to jointly train a new cadre of health workers in malaria and tuberculosis microscopy; by 2007, 279 laboratory staff had been trained.¹⁰ With donor funds, the NMCC also equipped more health facilities with needed microscopes.

In 2006, in response to persistent human resource shortages and in accordance with the new strategic plan, the NMCC introduced rapid diagnostic tests (RDTs) to supplement microscopy. Teams of NMCC staff and partner representatives conducted provincial trainings on RDT with DHMTs who then trained and supervised health workers at the district level. In 2006 the NMCC distributed 400,000 Global Fund-supported RDTs to rural health centers that lacked microscopy.¹⁰ Health workers—nurses, clinical officers, doctors, midwives, and casual day employees (auxiliary health workers)—were trained and authorized to use RDTs. The NMCC introduced RDTs with a phased approach, gradually expanding from pilot sites to national coverage. In 2008 NMCC had distributed 2 million RDTs across the country.¹² Facilities with labs also received RDTs and training to enable confirmation of cases when microscopy was unavailable.

Many clinicians, however, were reluctant to use RDTs. For years, clinicians had been taught that “fever equals malaria” and treated patients accordingly. Despite high accuracy rates, health workers accustomed to high malaria incidence were distrustful of negative RDT results; they presumptively treated patients for malaria based on their clinical symptoms. Patients with fever also expected to receive antimalarials and pressured clinicians to prescribe the medication. Faced with time constraints and long patient queues, clinicians often skipped RDTs. Although RDTs were significantly faster than microscopy for diagnosing malaria, in areas with no history of diagnosis, RDTs were viewed as an added step that required health workers to spend more time with each patient. In 2008, only 10.9% of febrile children under five were reported to have received a finger or heel stick for diagnosis.²⁷

Chizema stressed the need to change diagnostic practices among clinicians. “We really want health care workers to understand that diagnosis is important. We can no longer continue treating fever as malaria,” she said. She observed that distributing RDTs during the high-transmission season led to greater acceptance among clinicians. In addition, the DHMTs’ enforcement of a policy requiring positive diagnostic results prior to prescribing antimalarials led to improvements in clinical practice.

Treatment

In 2005 the ACT Coartem®, Zambia’s choice for first-line treatment of malaria, cost roughly USD 1.33 per course, and overall treatment of an uncomplicated case of malaria with ACTs, including diagnosis, drugs, and personnel, cost an estimated USD 7.34.²⁹ Despite the increased cost of treating malaria, the drug policy change of 2003 had drastically improved the treatment of uncomplicated malaria, leading to reductions in malaria mortality (see **Exhibit 13** for trends in malaria mortality).

Through the new strategic plan, the NMCC aimed to ensure that by 2008 at least 80% of malaria patients in all districts would receive prompt and effective treatment within 24 hours of the onset of symptoms (including confirmed diagnosis). By 2008, 64% of children under five with a fever presented for treatment from a facility or provider within 24 hours of symptom onset,²⁷ an increase from 4.5% in 2006.¹¹ The percentage of children with a fever who received ACTs within 24 hours, however, rose only from 8.3% in 2006¹¹ to 12.7% in 2008.²⁷

Zambia struggled to ensure that adequate supplies of ACTs were consistently available at the district level. Although national supplies of Coartem® at Medical Stores Limited were generally adequate and MSL typically delivered the drugs efficiently to the district pharmacies, poor transport, stocking, and ordering at the district level resulted in frequent ACT stockouts at health centers. In 2007, 40% of health facilities had ACT stockouts for one to two weeks, and some reported regular stockouts lasting up to two weeks per month.³⁰ As a result, many patients were given written prescriptions and referred to private pharmacies to purchase Coartem®, where it often retailed for USD 5 to USD 10. To address stockouts, the NMCC and its partners implemented district-level trainings to improve inventory management.

The NMCC, the US President’s Malaria Initiative, the World Bank, and other partners were also developing a pilot study to investigate how transport and human resource interventions at the district level could affect distal supply chain issues. The NMCC also sought to improve both stock management at the central level and drug quantification and forecasting systems at the district level.

Nevertheless, in sparsely populated rural areas, access to health care remained limited. Health facilities were long distances from households, and transport was a significant obstacle. Consequently, many rural patients with malaria did not present to a health facility in time for treatment. To address these accessibility challenges, the NMCC decided to involve CHWs in “home management” of malaria. Before the drug policy change, CHWs had been equipped with chloroquine and used symptom-based algorithms to diagnose and treat uncomplicated malaria. When ACTs were introduced, the NMCC withdrew chloroquine, and CHWs

were instructed instead to refer suspected cases to health facilities. Over time, Chizema and her team at the NMCC realized that they were missing many malaria diagnoses in the community and that the time and expense of routinely visiting clinics to seek medical care prevented many rural patients from accessing treatment. In 2007 the NMCC operational research branch conducted a feasibility study and determined that volunteer CHWs meeting educational and literacy requirements were capable of administering RDTs and ACTs to diagnose and treat uncomplicated malaria. In 2008 they began the first phase, training select CHWs in 11 districts and providing them with Coartem® and RDTs in their home management kits.

Information, Education and Communication and Behavior Change Communication

The NMCC recognized that although the average Zambian's knowledge of malaria was high and despite its effort to increase the availability of malaria commodities, utilization of interventions remained insufficient. In 2005 the NMCC developed an integrated Malaria Communication Strategy to supplement isolated, event-driven campaigns, such as World Malaria Day, with more routine education throughout the year. The Malaria Communication Strategy established guidelines on messaging, effective interventions, and behavior change and enhanced the NMCC's outreach and ability to sustain communication campaigns.

With the acceptance of the new strategic plan for 2006 to 2010, Chizema and her team intensified their efforts to improve their information, education and communication (IEC) and behavior change communication (BCC) efforts. The IEC branch encouraged communities to adopt positive malaria control behavior and, on a broader scale, aimed to generate the political will and mobilize the resources needed for control efforts. The IEC technical working group assisted all NMCC units with their communication needs, such as correct net utilization, IRS acceptance, prompt care-seeking behavior, and adherence to RDT results by health workers. The NMCC engaged high-level politicians and popular musicians to raise the profile of malaria control across the country. Communication channels included television, community radio, community theater, posters and educational materials in health facilities and community organizations, and door-to-door campaigns. Interventions were tailored to the needs of the community, and the NMCC directly supported districts and provinces in developing IEC activities. In 2007 the NMCC and its communication partners conducted a skill-based BCC workshop with selected DHMT officials. NMCC and partner representatives provided practical training in how to develop effective malaria education messages, choose appropriate communication channels, and analyze community needs.

The NMCC sought advice from communities when designing communication campaigns. Neighborhood health committees notified health facilities of malaria-related problems and misconceptions in their communities. Together, community members and health facilities planned activities, such as live performances, or requested resources from the NMCC to deal with concerns.

Chizema and the NMCC members recognized that local leaders were more highly respected in their communities than Lusaka-based staff. In 2007 the NMCC engaged the national House of Chiefs—30 chiefs from all nine provinces, who governed chiefs across the country—in an orientation on malaria control. The chiefs were interested in health issues and responded favorably to the NMCC recommendations, such as promoting mass ITN distribution campaigns and encouraging IRS acceptance. Following the training, the chiefs requested orientations at the provincial level to increase participation of all chiefs across the country. The NMCC also attempted to enhance the links between the DHMTs and local leaders.

Monitoring and Evaluation

All public and mission facilities, and some private health facilities, used the national Health Management Information System (HMIS) for routine reporting of health outcomes and health care service delivery. Each health facility recorded patient visits, diagnoses, and outcomes in standard registers and

submitted totals to their respective DHMTs. District authorities aggregated facility data and submitted them electronically to the MOH. The Information Unit of the MOH generated quarterly reports from which the NMCC extracted malaria-specific data for its own analysis.

In addition to the HMIS, effective tracking, reporting, and dissemination of malaria-related indicators, such as incidence and mortality, were crucial for program development. Using WHO recommendations, in 2003 the NMCC established the Malaria Information System in 10 sentinel districts to track malaria-specific data that were not captured by the HMIS (see **Exhibit 14** for selected Malaria Information System districts). With some funding from the Global Fund, the Malaria Information System operated at all health facilities, providing monthly reports on laboratory confirmed malaria cases, cases of anemia, malaria in pregnancy, vulnerable groups sleeping under an ITN, and antimalarial stocks. It was anticipated that the Malaria Information System would be integrated into the HMIS in 2009.

In 2006 in accordance with the new strategic plan, the NMCC made revisions to the HMIS malaria indicators to more accurately assess the burden of malaria and program performance. Key indicators included *confirmed* cases of malaria, deaths attributed to *confirmed* inpatient malaria cases, and the percentage of pregnant women receiving one, two, or three doses of IPTp.³¹ The NMCC expected the MOH to implement these revisions by 2009. It also advocated for monthly, rather than quarterly, reports from the HMIS in an effort to produce more actionable data. Finally, with the help of partners, the NMCC augmented facility data with household data to assess disease incidence as well as program performance (see **Exhibit 15** for progress in malaria control interventions).

The NMCC recognized that monitoring and evaluation, in addition to informing program development, served to demonstrate progress. With the help of partners such as the World Bank, UNICEF, the WHO, the Malaria Control and Evaluation Partnership in Africa, and others, the NMCC produced progress reports to share its achievements with the government, donors, and implementers. Demonstrating positive results was key to maintaining partner attention; as one NMCC officer put it, “Everyone wants to be associated with winners.”

As Zambia’s malaria control improved, however, the NMCC recognized that stronger surveillance systems and more frequent feedback on transmission would be required to respond rapidly to outbreaks and keep incidence low. Incomplete reporting due to a shortage of health workers was a key impediment; with high clinical demands, few clinicians kept adequate records. Increased supervision of health facilities was required to enhance the reliability of malaria and other disease indicators.

The operational research branch of the NMCC had the mandate of assessing the effectiveness of malaria control interventions and responding to challenges in implementation. It adapted WHO and other international recommendations to the Zambian context and advocated for evidence-based policies, such as the use of ACTs in pregnancy and the use of RDTs and ACTs by CHWs. The operational research branch also conducted drug efficacy studies to continually monitor resistance. The NMCC technical working groups brought the operational research branch specific questions to investigate. In addition to conducting applied research, the branch aimed to build research capacity by assembling multidisciplinary research groups and including university students and district staff on research teams. Although important findings emerged from the operational research studies, many awaited application.

Looking to the Future

Malaria parasite prevalence in children under five had declined from 21.8% in 2006 to 10.2% in 2008, and severe anemia dropped from 13.3% in 2006 to 4.3% in 2008.^{12,27} In 2007 reported in-patient malaria cases

and deaths were lower by 33% and 24%, respectively, as compared with the average from 2001 and 2003.³² When the 2008 Malaria Indicator Survey was released, Minister of Health Dr. Brian Chituwo commented:

These are remarkable figures—something all of us should be proud of. These achievements have been possible because of the strong partnership that the Ministry enjoys with partners. But, at this moment we cannot pat ourselves on the back and say we’re done. No. We must maintain what we have achieved and with this momentum, galvanize our efforts and press for even greater successes.³³

The WHO had recently showcased Zambia’s progress in malaria control, and like the minister, Chizema feared that the positive press could have a paradoxical effect of making donors consider the job done.

With the significant improvement brought by the new strategic plan and increased political and donor commitment, Chizema wondered whether malaria elimination was a reasonable goal for the country and what steps would be necessary to make this a reality both in Zambia and in the region at large. Chizema believed that it was necessary to emphasize regional collaboration when considering eliminating malaria from Zambia. She explained:

As a country, we are landlocked, so we need to talk about cross-border collaboration so that when we talk about elimination in Zambia, we are also talking about elimination in Namibia, Botswana, Angola, and all the other neighboring countries. Otherwise, yes, you can eliminate malaria from Zambia, but it will still get in. There is so much mobility that malaria will be reintroduced.

As Chizema prepared for the 2009 annual action plan meetings, she reflected on the persistent gaps in malaria control in Zambia—inappropriate utilization of ITNs, frequent ACT stockouts, inadequate confirmation and appropriate treatment of malaria cases, and incomplete reporting—and how the NMCC could sustain the progress toward its targets and ensure the continued support of its partners.

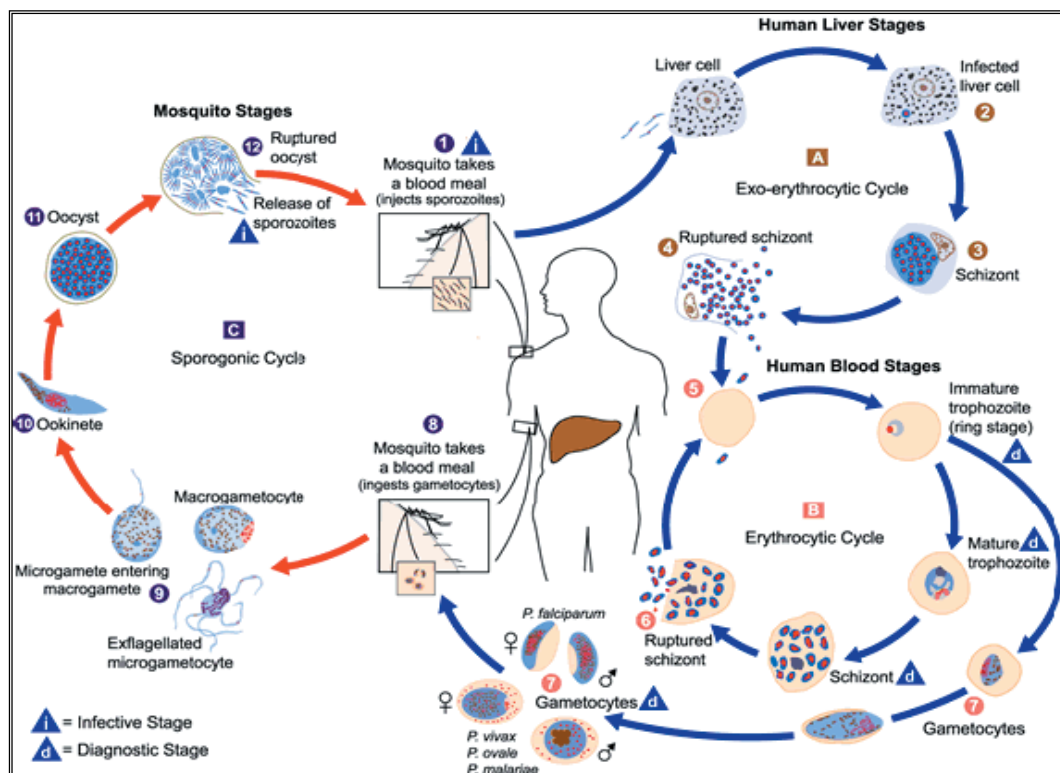
Appendix *List of Abbreviations*

ACT	artemisinin-based combination therapy
BCC	behavior change communication
BHCP	Basic Health Care Package
CHW	community health worker
DDT	dichloro-diphenyl-trichloroethane
DHMT	District Health Management Team
DTP3	third dose of diphtheria toxoid, tetanus toxoid, and pertussis vaccine
GDP	gross domestic product
HMIS	Health Management Information System
IEC	information, education and communication
IPTp	intermittent preventive treatment for malaria in pregnancy
IRS	indoor residual spraying
ITN	insecticide-treated net
LLIN	long-lasting insecticidal net
MIS	Malaria Indicator Survey
MOH	Ministry of Health
MSL	Medical Stores Limited
NMCC	National Malaria Control Centre
PPP	purchasing power parity
RBM	Roll Back Malaria
RDT	rapid diagnostic test
UN	United Nations
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USD	United States dollars
WHO	World Health Organization

Exhibit 1 *Map of Zambia*



Source: University of Texas Libraries.

Exhibit 2a *Plasmodium Falciparum* Life Cycle

Source: United Nations Integrated Regional Information Networks. Killer Number One: The Fight against Malaria. 2006; 47. Available at: <http://reliefweb.int/sites/reliefweb.int/files/resources/FC51BFA05D96476885257185007332F2-irin-health-feb2006.pdf>.

Exhibit 2b Overview of Malaria: Human Susceptibility and Symptoms

Malaria is caused by one of five different parasites: *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale*, and *Plasmodium knowlesii*. *P. falciparum* causes the most severe cases of malaria and is the primary parasite in sub-Saharan Africa.

There were roughly 247 million cases of malaria and 1 million malaria-related deaths worldwide in 2008.³⁴ Though most of those infected will survive a bout with malaria, it is a life-threatening illness. Most people develop flu-like symptoms, marked by fatigue, headache, and muscle aches, with intermittent periods of high, wracking fevers and profound malaise. If untreated, a subset of people progress to severe malaria, marked by anemia, kidney failure, coma, and eventually death. Severe cases are particularly prominent in children under five and pregnant women. Other susceptible groups include people with underdeveloped or stressed immune systems and previously unexposed travelers or migrants to malaria-endemic regions. Repeated episodes often lead to partial immunity; older children and adults in endemic areas generally tolerate chronic malarial infection, although they still suffer from mild to moderate degrees of anemia. Of total malaria-induced mortality, 90% of deaths occurred in sub-Saharan Africa, and 85% were in children. Nearly one in five child deaths in the region were caused by malaria; a child under five died from malaria approximately every 40 seconds there.

The *Anopheles* mosquito is the primary vector; mosquitoes acquire immature forms of the parasite (known as *gametocytes*) during blood meals from infected humans. Malaria parasites complete their reproductive stage in the mosquito's gut and begin to mature in the mosquito's salivary glands. After piercing human skin during a subsequent blood meal, the mosquito injects anticoagulants and transfers the malaria parasites into the human bloodstream. The few initial parasites multiply rapidly in the human host's liver before being released into the bloodstream. Millions of parasites then infect and rupture red blood cells, releasing daughter parasites (*merozoites*) that continue to invade red blood cells.

Mosquitoes' larval development requires relatively stagnant bodies of water, such as swamps, ponds, and irrigation ditches, potholes, discarded cans, and tires that fill with water after rains. As a result, malaria transmission typically increases exponentially after heavy rains, when there is a surge in the mosquito population.

Source: Compiled by case writers.

Exhibit 3 *Global Malaria Action Plan*

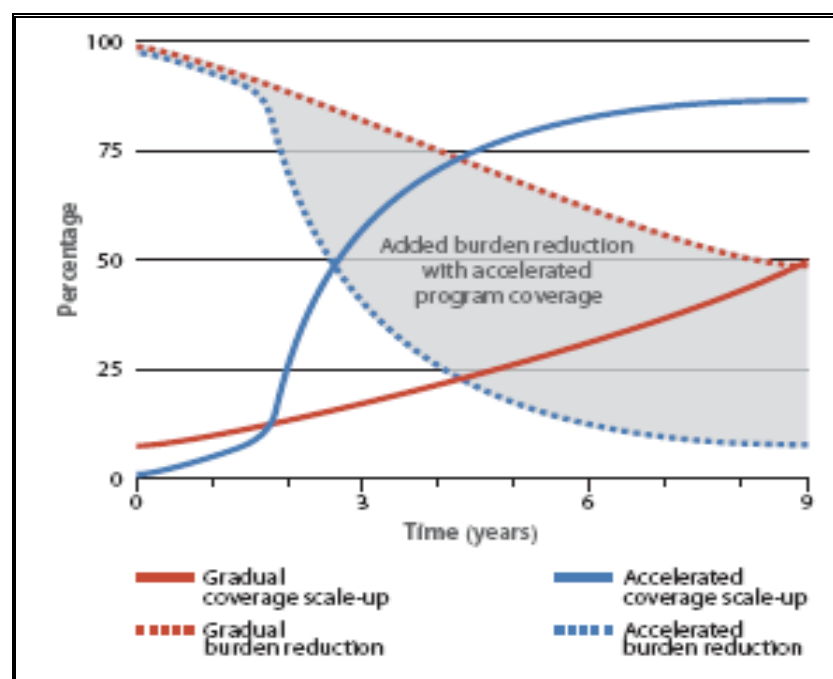
Primary objectives:

- Achieve universal coverage, as recently called for by the UN Secretary-General, for all populations at risk with locally appropriate interventions for prevention and case management by 2010 and sustain universal coverage until local field research suggests that coverage can gradually be targeted to high-risk areas and seasons only, without risk of a generalized resurgence
- Reduce global malaria cases from 2000 levels by 50% in 2010 and by 75% in 2015
- Reduce global malaria deaths from 2000 levels by 50% in 2010 and to near zero preventable deaths in 2015
- Eliminate malaria in 8–10 countries by 2015 and afterwards in all countries in the pre-elimination phase today
- In the long term, eradicate malaria worldwide by reducing the global incidence to zero through progressive elimination in countries

To achieve these targets, the Global Malaria Action Plan outlines a three-part global strategy:

- Control malaria to reduce the current burden and sustain control as long as necessary
- Eliminate malaria over time country by country
- Research new tools and approaches to support global control and elimination efforts

Source: World Health Organization. World Malaria Report 2008. Geneva; 2008.

Exhibit 4a *Malaria Program Scale-up: Coverage and Burden Reduction*

Source: Malaria Control and Evaluation Partnership in Africa. Scaling Up for Impact through Comprehensive Program Improvement. Seattle; 2007.

Exhibit 4b *Scale-up for Impact: Principle of the “Three Ones”*

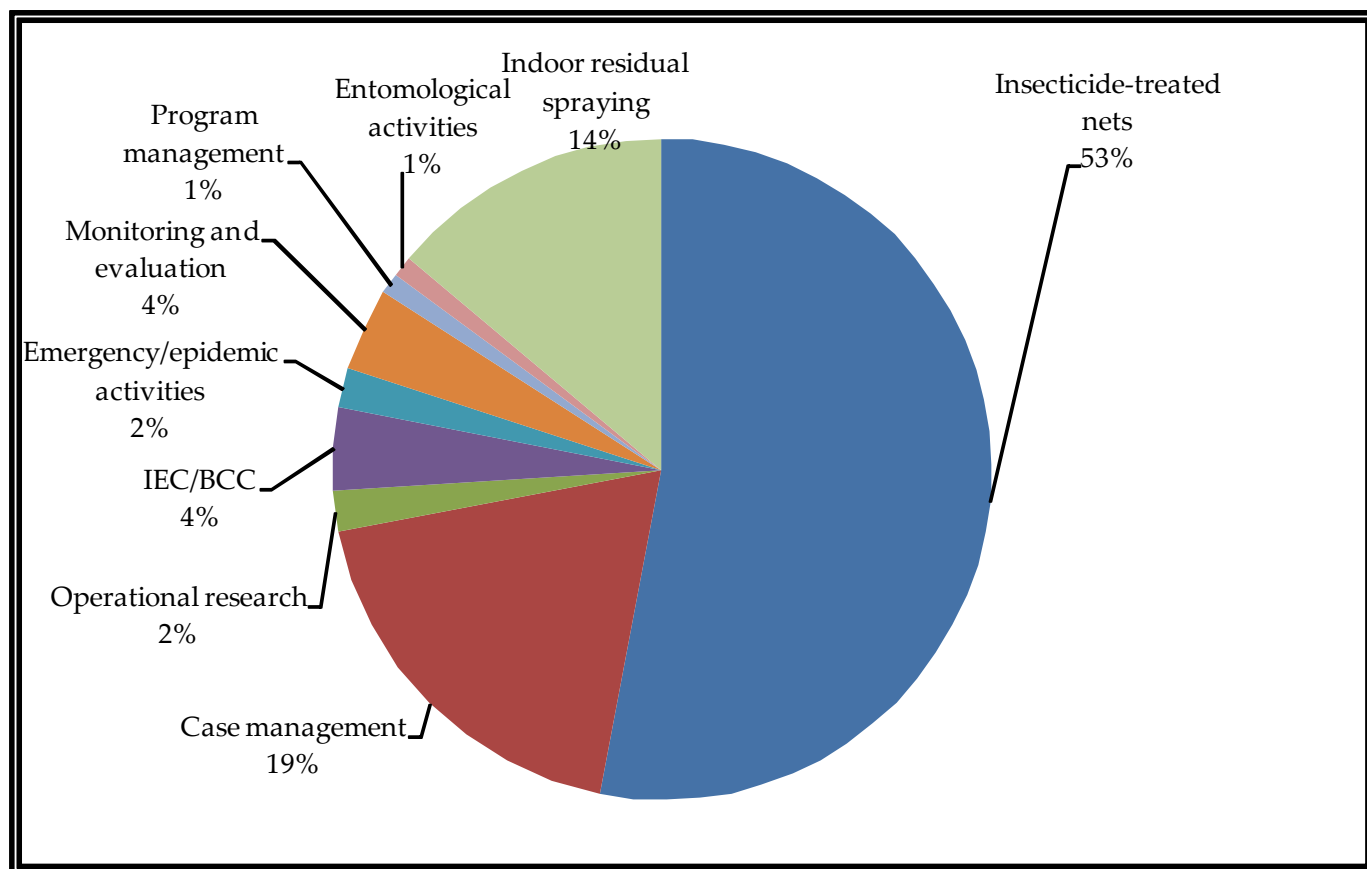
One national plan	<ul style="list-style-type: none"> o Multiyear strategic plan o Three-year implementation plan o Annual action plan o Business plan for human resources, supply chain management, etc.
One coordination mechanism for implementation	<ul style="list-style-type: none"> o Financial and human resource support o System support for administration, partnering, etc. o Intervention support
One monitoring and evaluation system	<ul style="list-style-type: none"> o Monitor coverage and use o Document action o Track impact on illness, anemia, death o Identify gaps for next planning cycle

Source: Malaria Control and Evaluation Partnership in Africa. Scaling Up for Impact through Comprehensive Program Improvement. Seattle; 2007.

Exhibit 5 *Evolution of National Malaria Control Strategic Plan Targets in Zambia*

Parameter	National Malaria Control Strategic Plan 2000–2005	National Malaria Control Strategic Plan 2006–2011
Guiding principles	RBM principles	RBM principles and scale-up for impact concept
ITN coverage target	60% of households with ≥ 1 ITN	>80% of households with average of 3 ITN/household
IRS coverage target	Not defined	>85% coverage of eligible households in 15 districts
IPTp coverage target	90% of pregnant women using IPTp	>80% of pregnant women receiving 2 doses IPTp
Target for ITN use in pregnant women	50% of pregnant women sleeping under ITN	>80% of pregnant women sleeping under ITN or in a house sprayed with IRS
Target for ITN use in children <5 years of age	60% of children <5 years of age sleeping under ITN	>80% of children <5 years of age sleeping under ITN or in a house with IRS
Target of PECM (prompt and effective clinical management)	60% of sick persons have access to PECM	>80% of sick person treated with effective antimalarial within 24 hours of onset

Source: Adapted from: Stekete, RW, Sipilanyamb, N, Chimumbw, J, et al. National Malaria Control and Scaling Up for Impact: The Zambia Experience through 2006. *American Journal of Tropical Medicine and Hygiene*. 2008; 79(1):45–52.

Exhibit 6 NMCC Resource Allocation in 2008 (Estimated/Budgeted Values)

Source: Adapted from Ministry of Health Zambia. 2008 National Malaria Control Action Plan: Actions for Scale-Up for Impact on Malaria in Zambia. Lusaka; 2007.

Exhibit 7 *National Malaria Control Program Estimated 2008 Budget: Part 1*

Activity	Budget (USD)
Insecticide-treated Nets	\$32,061,426
Mass distribution (incl. 3.5 million LLINs)	\$26,101,723
Malaria in Pregnancy Campaign (incl. 490,000 LLINs)	\$4,009,059
Equity Programme (vulnerable populations)	\$270,628
Retreatment of nets	\$1,339,503
Technical meetings and seminars	\$23,776
Zambia Business Coalition against Malaria workshops/meetings	\$16,568
Support for Provincial Health Offices	\$4,893
Community Malaria Booster Response strengthening	\$295,276
Indoor Residual Spraying	\$8,583,000
National-level IRS coordination	\$74,000
Implement IRS in 36 districts (incl. 1,245 spray pumps, 32,500 insecticides, 2,500 sets of personal protective equipment)	\$7,827,000
Geo-coding and mapping houses	\$30,000
IRS IEC/BCC materials	\$152,000
Environmental safeguards	\$500,000
Entomology	\$800,400
Conduct entomological surveys	\$61,200
Vector susceptibility and resistance surveys	\$54,000
Evaluation of new insecticides/larvicides as alternatives to DDT	\$54,000
Operationalise Malaria Decision Support System	\$120,000
Larval source management	\$336,000
Environmental safeguards	\$125,000
Meetings and supervision	\$50,200
Prompt and Effective Case Management (PECM)	\$11,137,502
Malaria diagnosis for all health facilities (incl. 2 million RDTs and training 30 new microscopists)	\$2,554,720
Drug logistics management (incl. 3.8 million doses of Coartem®, 400,000 x 3 doses SP)	\$6,213,490
Home management for malaria (w/ ACTs and RDTs)	\$391,000
Improvement of case management with ACTs in private sector	\$24,000
FANC (for malaria in pregnancy)	\$1,737,500
Severe malaria management	\$167,262
Monitoring and supervision	\$49,530

Exhibit 7 (cont'd) National Malaria Control Program Estimated 2008 Budget: Part 2

Activity	Budget (USD)
Operations Research	986,178
Conferences / research (incl. drug efficacy trials)	
IEC/BCC Advocacy Plan (Large funding)	2,219,000
Launch communication strategy	30,000
BCC capacity building	386,500
IEC materials	230,000
BCC proposals	272,000
Advocacy and coordination meetings	138,000
Community mobilization (incl. radio and television shows)	437,000
Media and radio efforts	169,500
Promotional events	390,000
Engage traditional healers	64,000
Engage private sector	102,000
Monitoring and Evaluation Activities (Big funding gaps)	2,183,500
National M&E coordination	57,000
Programmatic and district performance monitoring (incl. support to sentinel districts)	885,500
Evaluation and reporting (incl. 2008 Malaria Indicator Survey)	1,177,000
M&E capacity development (incl. staff trainings)	64,000
Program Management	877,507
Organization, alignment, coordination (incl. meetings with provinces, districts, partners, other ministries)	32,738
Policy, program planning, and design	30,973
Human resource management (incl. some NMCC salaries)	130,778
Financial management	285,857
Program implementation	38,005
Infrastructure and equipment	262,915
Commemoration of national days	10,715
Institutional capacity development	85,526
Emergency Planning Activities	982,000
Emergency and malaria epidemic preparedness plan	497,000
Malaria early warning systems plan	275,000
Establish emergency fund	210,000
TOTAL ESTIMATED COST	59,830,513

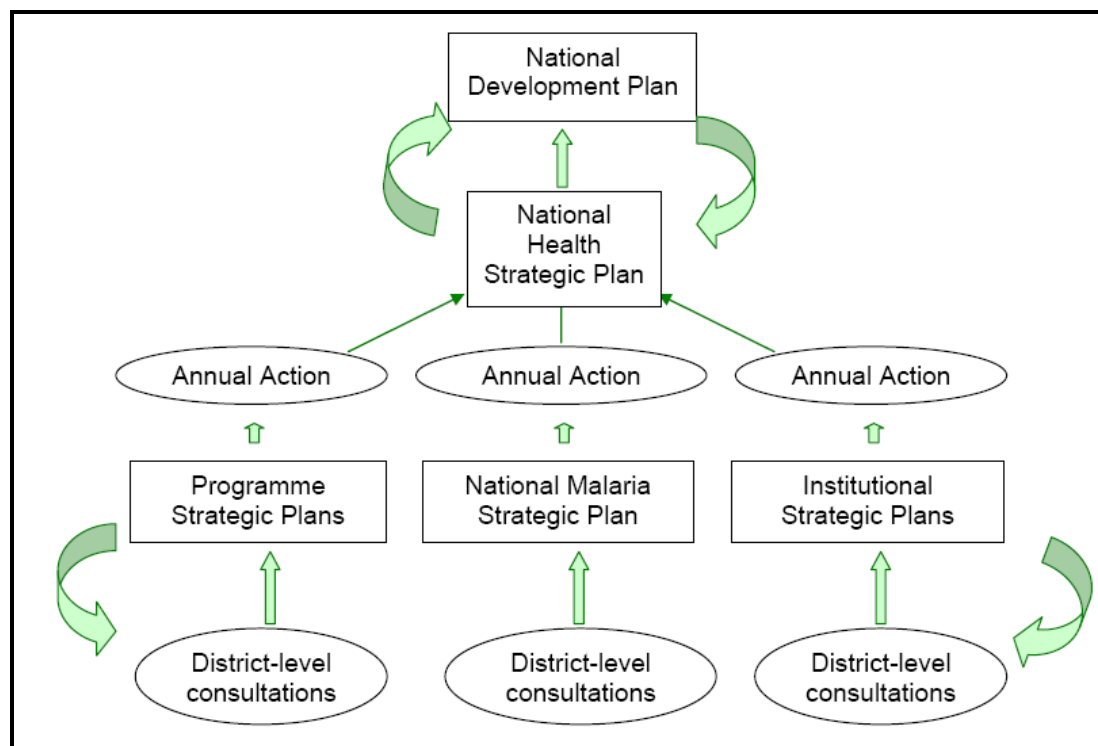
Source: Adapted from Ministry of Health Zambia. 2008 National Malaria Control Action Plan: Actions for Scale-Up for Impact on Malaria in Zambia. Lusaka; 2007.

Exhibit 8 *National Malaria Control Program Partners and Key Involvement*

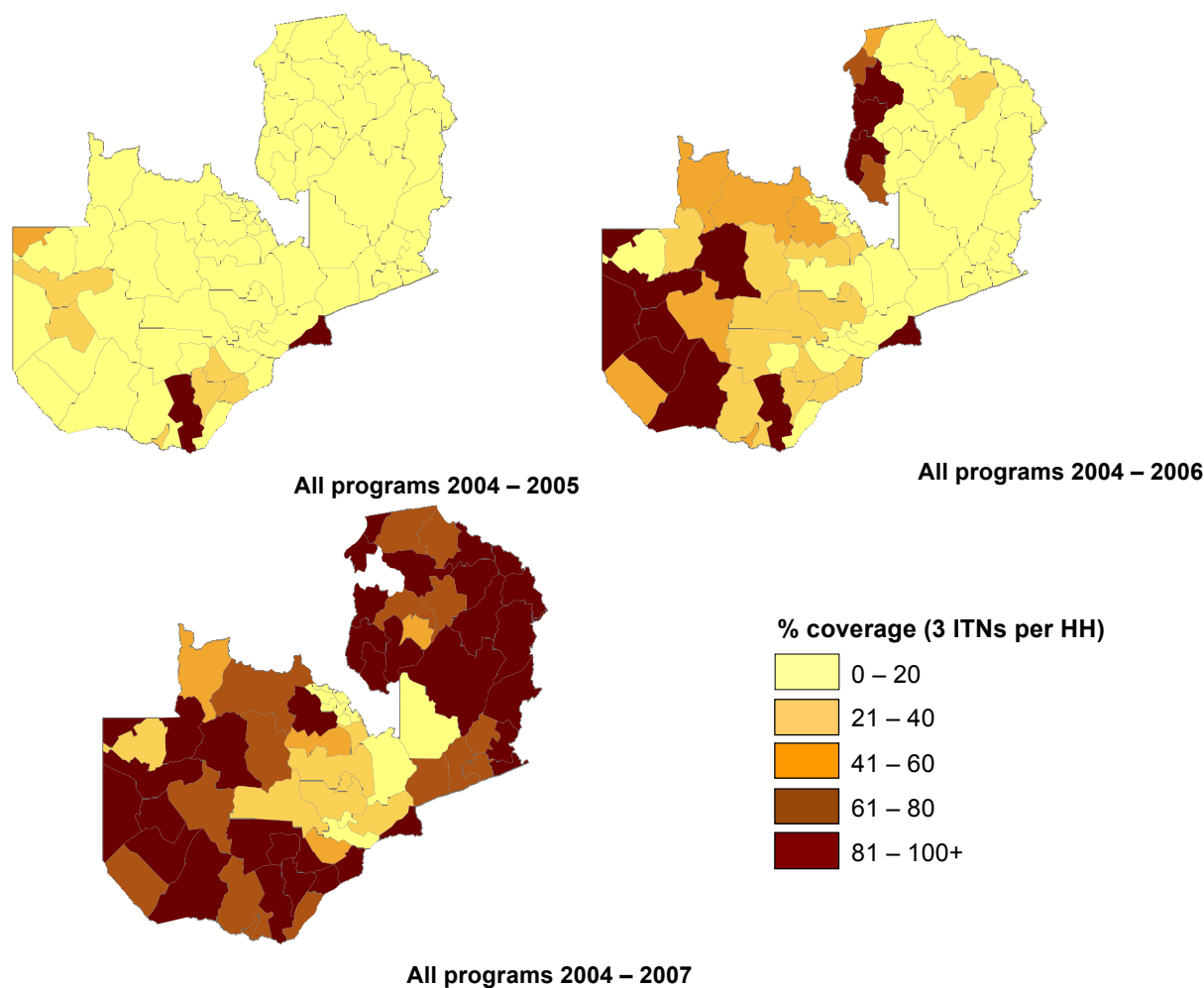
Partner	Type	Main Role/Involvement
Japanese International Cooperation Agency	Bilateral	ITN distribution
President's Malaria Initiative	Bilateral	Funds, technical support
Zambia Malaria Foundation	Community-based organization	IEC, ITN distribution
John Snow International	Consulting	Supply chain management improvement
Global Fund	Donor	Funds (ACTs, diagnostics, IEC, IRS, ITN distribution, M&E health systems strengthening)
Child Health Unit	Government	ITN distribution, case management, IEC
Ministry of Defense	Government	ITN distribution (transport)
Ministry of Education	Government	IEC, ITN distribution
Reproductive Health Unit	Government	Malaria in Pregnancy, ITN distribution
ZANIS	Government	IEC
Health Communication Partnership	Implementing (funded by PMI)	IEC
Health Systems Strengthening Partnership	Implementing (funded by PMI)	IRS
Society for Family Health	Implementing (funded by PMI)	ITN distribution (antenatal, <5)
JIPHEGO	International NGO	Malaria in Pregnancy
Malaria Consortium	International NGO	IEC, M&E
Malaria Control and Evaluation Partnership in Africa	International NGO	Funds, IEC, ITNs, M&E, advocacy, technical support
RAPIDS	International NGO	ITN distribution (equity channel)
House of Chiefs	Local authority	IEC, ITN distribution
Zambia Business Coalition Against Malaria	Local collaboration	IEC
Roll Back Malaria	Multilateral	Advocacy, technical support
UNICEF	Multilateral	Funds, ACTs, IEC, ITN distribution, technical support
WHO	Multilateral	Technical support, M&E
World Bank	Multilateral	Funds (IEC, ITN distribution, IRS, health systems strengthening)
Barclay's Bank	Private	ITN distribution (mass distribution)
Konkola Copper Mines	Private	IRS, ITN distribution
Churches Health Association of Zambia	Religious organization	ITN distribution, case management, Malaria in Pregnancy
Research Triangle Institute	Research Center	Operational research
Tropical Diseases Research Centre (TDRC)	Research Center	Operational research
University of Zambia (UNZA)	Research Center	Operational research

Note: List of partners and main involvement is not fully comprehensive.

Source: Compiled by case writers from program documents and interviews.

Exhibit 9 *National Planning Process*

Source: Ministry of Health Zambia. 2008 National Malaria Control Action Plan: Actions for Scale-Up for Impact on Malaria in Zambia. Lusaka: 2007.

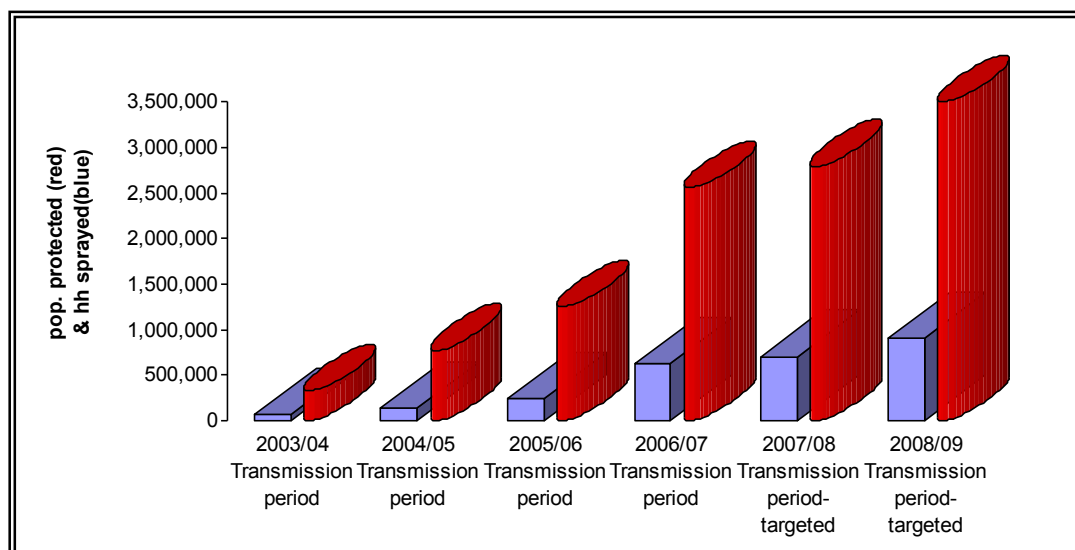
Exhibit 10a *ITN Distribution Coverage, All Sources*

Source: Adapted from Ministry of Health Zambia. 2008 National Malaria Control Action Plan: Actions for Scale-Up for Impact on Malaria in Zambia. Lusaka; 2007.

Exhibit 10b *Main Sources of ITNs in 2007*

Source	Quantity of Nets Procured
Global Fund	1, 082, 000
World Bank	1, 080, 000
President's Malaria Initiative /PEPFAR/RAPIDS	505, 000
Japanese International Cooperation Agency	392, 500
USAID/ Society for Family Health	322, 348
UNICEF	16, 500
Malaria Control and Evaluation Partnership in Africa	18, 000
TOTAL	3, 416, 348

Source: Ministry of Health Zambia. 2008 National Malaria Control Action Plan: Actions for Scale-Up for Impact on Malaria in Zambia. Lusaka; 2007.

Exhibit 11 *Indoor Residual Spraying Coverage, 2003–2008*

Source: Ministry of Health Zambia. 2008 National Malaria Control Action Plan: Actions for Scale-Up for Impact on Malaria in Zambia. Lusaka; 2007.

IRS Form 1

**SPRAY OPERATORS DAILY REPORT
DISTRICT INDOOR SPRAYING PROGRAMME**

DISTRICT:.....LOCALITY /COMPOUND

DATE.....

INSECTICIDE

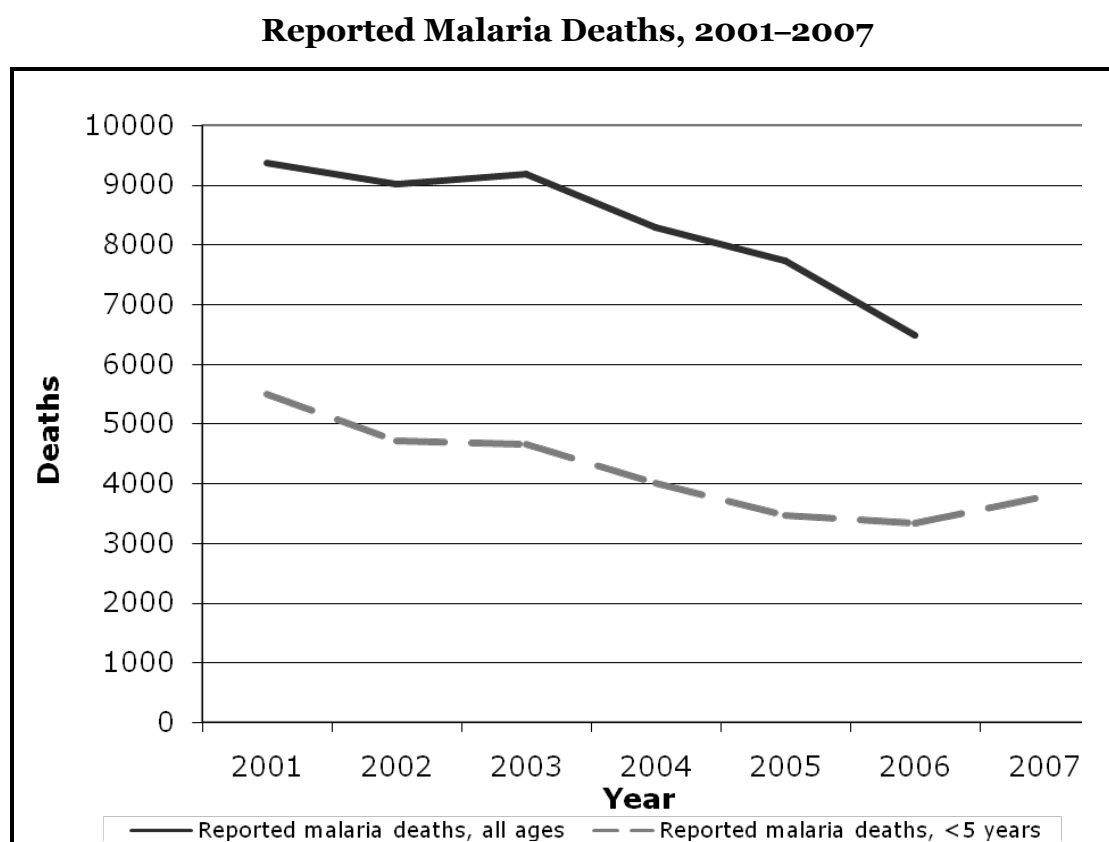
NAME OF OPERATOR

NAME OF TEAM LEADER TARGET.....

House Number		Total No. of rooms sprayed		Total No. of rooms not sprayed		Number of people protected	Sprayed last year Y/N	No of rooms with bed nets	No of bed nets	Reasons for not spraying					
S/N	House Number	F	I	F	I					SP	L	NB	F	R	O
Totals															
Extra rooms (tally)															
Total Pump/Can Refills															
No of sachets used															

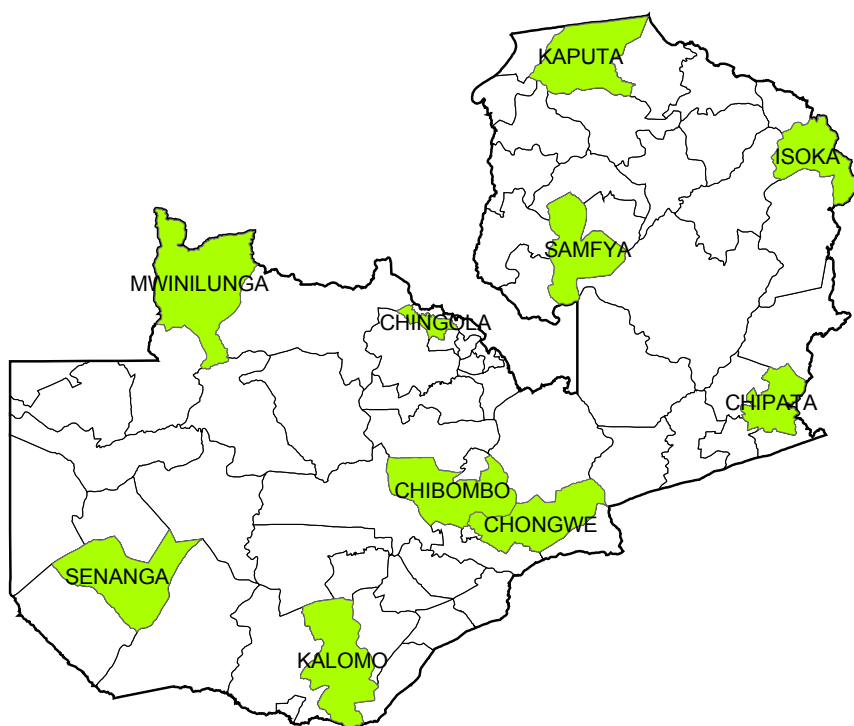
Reasons for not spraying: SP – Sick Person, NB – New Born , L – Locked, F- Funeral
.R – Refused, O - Others

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Exhibit 13 *Trends in Malaria Mortality in Zambia, 2001–2007***Reported Malaria Deaths and All-cause Deaths, 2001–2007**

Year	2001	2002	2003	2004	2005	2006	2007
Reported malaria deaths, all ages	9369	9021	9178	8289	7737	6484	NA
Reported malaria deaths, <5 years	5498	4717	4653	4008	3470	3342	3783
All-cause deaths, all ages	35,358	39,482	39,117	38,466	38,740	35,541	NA
All-cause deaths, <5 years	16,680	16,377	15,459	13,569	12,796	12,469	13,842

Source: Adapted from World Health Organization. World Malaria Report 2008. Geneva; 2008.

Exhibit 14 *Sentinel Districts Used for Malaria Information System*

Source: Zambia MOH (2005). National Malaria Prevention and Control Monitoring and Evaluation Plan 2006–2011.

Exhibit 15 *Progress in Malaria Control Interventions, 2002–2008*

Indicator	DHS 2002 (%)	MIS* 2006 (%)	MIS 2008 (%)
Mosquito Net Coverage and Use			
Households with at least 1 net	27.2	50.1	71.5
Households with at least 1 ITN	13.6	44.4	62.3
Children <5 years who slept under net	16.3	26.6	47.5
Children <5 years who slept under ITN	6.5	22.8	41.1
Malaria in Pregnancy Campaign			
Pregnant women who slept under net	17.4	23.9	45.5
Pregnant women who slept under ITN	7.9	21.1	43.3
Pregnant women who took any antimalarial drug	35.8	76.9	88.1
Pregnant women who took at least 2 doses of IPT	NA	61.9	66.1
Prompt, Effective Case Management for Fever/Malaria Among Children <5 years			
Children who reported fever in 2 weeks preceding survey	43.3	29.2	28.1
Febrile children who took any antimalarial drug	51.9	57.3	43.3
Febrile children who took any antimalarial drug in 24 hours	36.8	37	28.9
Febrile children who took ACT in 24 hours	NA	12.7	8.2
Febrile children who sought treatment from facility/provider in 24 hours	NA	4.5	64.0
Malaria Parasite Prevalence and Anemia in Children <5 years			
Children with malaria parasites	NA	21.8	10.2
Children with severe anemia (hemoglobin <8g/dL)	NA	13.3	4.3

Note: MIS represents the Malaria Indicator Survey.

Sources: Chipimo M, Banda R. Demographic Health Survey, Chapter 10: Malaria. 2002.

Ministry of Health Zambia. Zambia National Malaria Indicator Survey 2006. Lusaka: MOH; 2006.

Ministry of Health Zambia. Zambia National Malaria Indicator Survey 2008. Lusaka: MOH; 2008.

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