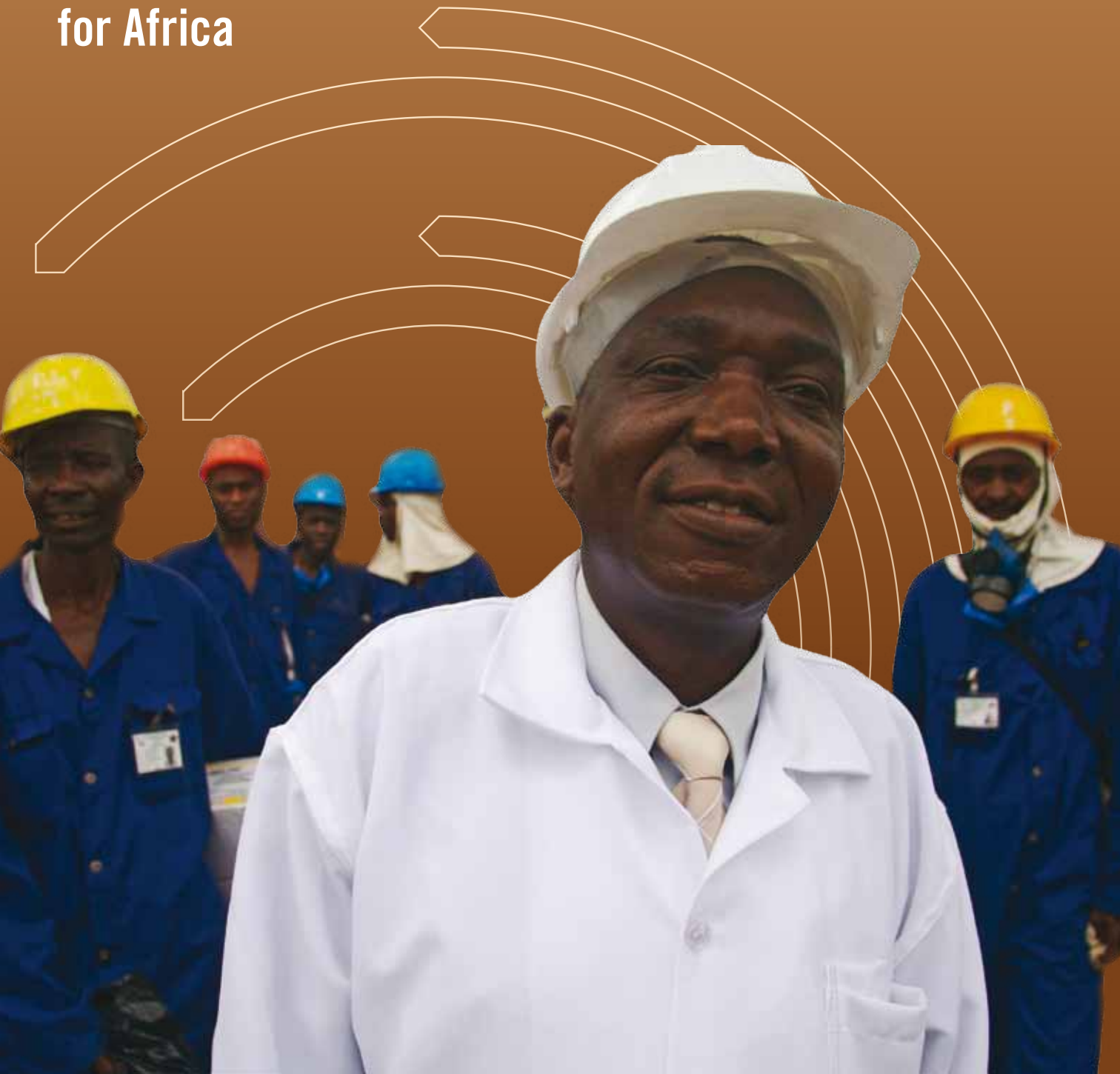




PROGRESS & IMPACT SERIES

Number 6 - May 2011

Business Investing in Malaria Control: Economic Returns and a Healthy Workforce for Africa

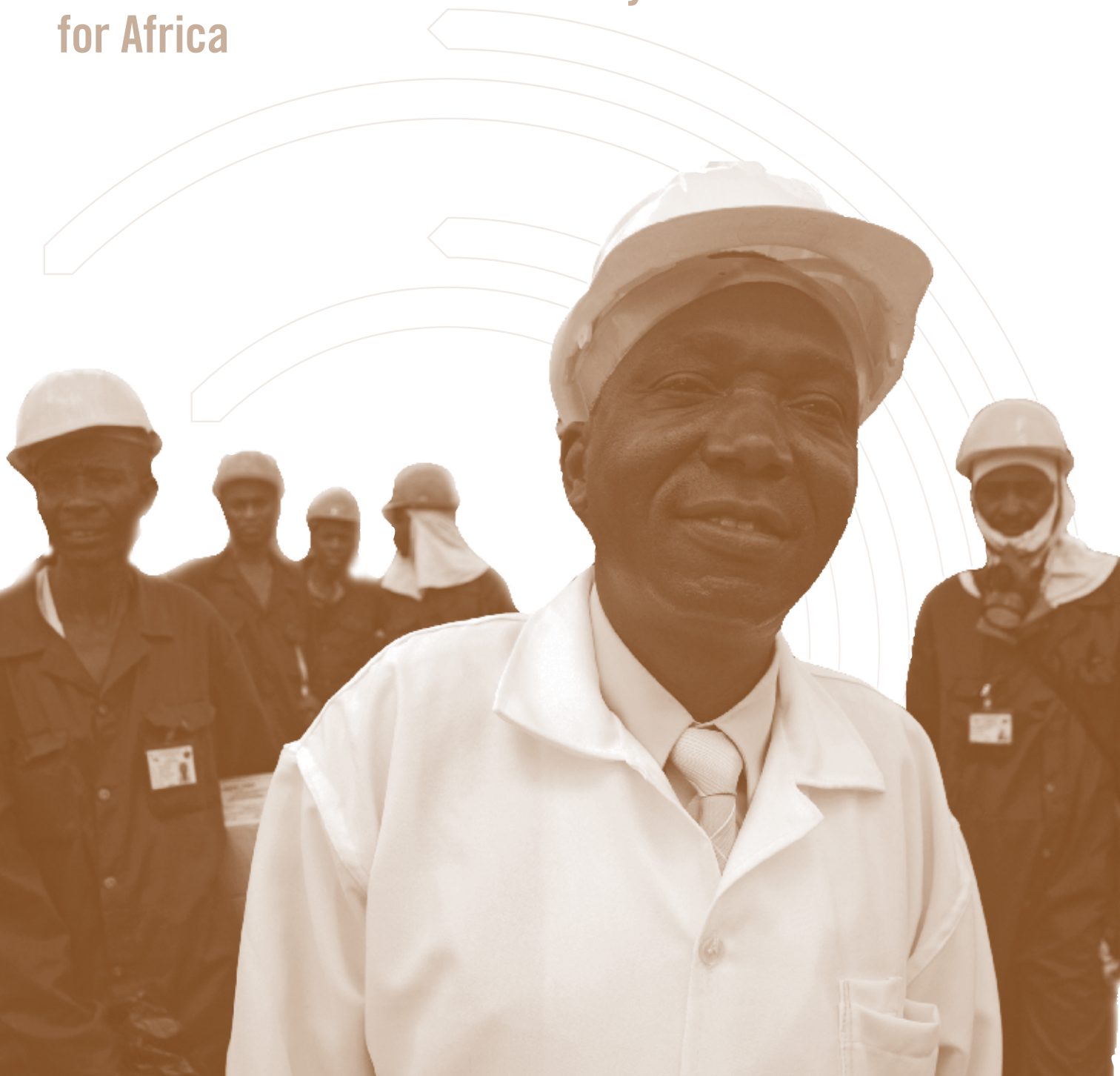




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Business Investing in Malaria Control: Economic Returns and a Healthy Workforce for Africa



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Most of the malaria burden and its effect on child survival occur in sub-Saharan Africa; as a consequence, this report focuses on the African region; other reports from the Secretariat and RBM partners will address the burden of malaria outside of Africa. The data provided in this report were assembled from January 2010 to January 2011. Due to constant updating of information supplied by countries and agencies, some numbers in this report may have since changed for this time interval; not all numbers are adjusted to a single date. However, such changes are generally minor and do not, at the time of publication, affect the overall observations or estimated impact. Monetary amounts are listed in United States of America dollars.

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Enquiries | Roll Back Malaria Partnership Secretariat | Hosted by the World Health Organization | Avenue Appia 20 | 1211 Geneva 27 | Switzerland | Tel: +41 22 791 5869 | Fax: +41 22 791 1587 | E-mail: inforbm@who.int

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ACRONYMS AND ABBREVIATIONS

ACT	<i>Artemisinin-based combination therapy</i>
BIMCP	<i>Bioko Island Malaria Control Project</i>
FTE	<i>Full-time employee</i>
IPTp	<i>Intermittent preventive treatment for pregnant women</i>
IRR	<i>Internal rate of return</i>
IRS	<i>Indoor residual spraying</i>
KCM	<i>Konkola Copper Mines</i>
LLIN	<i>Long-lasting insecticide-treated net</i>
LSDI	<i>Lubombo Spatial Development Initiative</i>
MCDI	<i>Medical Care Development International</i>
MCM	<i>Mopani Copper Mines</i>
MDGs	<i>Millennium Development Goals</i>
NMCP	<i>National Malaria Control Programme</i>
RBM	<i>Roll Back Malaria</i>
RDT	<i>Rapid diagnostic test</i>
SP	<i>Sulfadoxine-pyrimethamine</i>
UNICEF	<i>United Nations Children's Fund</i>
WHO	<i>World Health Organization</i>
ZS	<i>Zambia Sugar</i>

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FOREWORD

Over the last decade, the fight against malaria has intensified in scale and scope, thanks to a greater involvement of a variety of partners and a large increase in external funding for endemic countries. This public health fight is credited for a major reduction in morbidity and mortality related to the disease as well as for playing a key role in bringing down overall child mortality.

Today, our fast-paced progress against the disease is enjoying unprecedented momentum, thanks to a vast increase in financial resources, national and international political support, and access to effective and affordable preventive and therapeutic tools. Our experience here, in Zambia, shows that success is fragile, that efforts need to be sustained and, above all, that all actors in our societies need to be involved. In a time of financial constraints, the contribution of the private sector is not only welcome, it is necessary.

What role can businesses play in malaria control? What is the rationale for their engagement? Data are scarce to motivate executives to take action from an economic perspective. We are proud to offer a sound economic analysis coming from three companies operating in Zambia (two involved in copper mining and one in sugar) documenting the benefits that companies can obtain from investing in malaria control, both for their employees and the surrounding communities. Businesses across the African continent that played an active role in fighting malaria are also presented in this document to highlight the variety of experiences to date.

In Zambia, these three companies have been working in coordination with our National Malaria Control Centre, following its prevention guidelines and treatment protocols. The success of these prevention and control programmes highlights the synergy encountered when private companies and the public sector work closely together. We sincerely hope that the documentation of the benefits presented here, both for the companies and the communities in which they operate, will encourage many others to follow their lead. We will only win the fight against malaria if we can bring along all forces of our societies in broad and strong partnerships.

Kapembwa Simbao
Honorable Minister of Health
Republic of Zambia
Chair of the Roll Back Malaria Partnership

Felix Mutati
Honorable Minister of Commerce,
Trade and Industry
Republic of Zambia

WORLD ECONOMIC FORUM LETTER OF ENDORSEMENT



BUSINESS INVESTING IN MALARIA CONTROL: ECONOMIC RETURNS AND A HEALTHY WORKFORCE FOR AFRICA

The World Economic Forum welcomes this report and congratulates the Roll Back Malaria Partnership for its sustained collaboration with the private sector. This report confirms the economic benefits that companies can derive from engaging in global health in general and malaria in particular in this case. The Forum will continue to be a strong advocate for businesses—across industries—to engage

in partnerships for health; by mobilizing their resources and skills and by providing products or services, businesses can support the health of their employees and their families and contribute to the health of the communities where they operate.

*Olivier Raynaud
Senior Director, Global Health
and Healthcare Industries*

EXECUTIVE SUMMARY

Malaria hurts business, both directly, through its impact on a firm's workforce, and indirectly, by damaging the economic environment in which a firm operates.

Direct economic costs from malaria are incurred when workers are absent due to illness or because they have to stay at home to care for sick family members. Reduced worker productivity, increased healthcare spending and a damaged corporate reputation (when firms fail to adequately deal with a malaria outbreak, for instance) can also have a direct cost. The disease can also impact business indirectly due to the effect it can have on the local economy through the deterioration of human capital, the loss in savings, investments and tax revenues and the reduction in public health budgets. A 2006 report published by the Global Health Initiative of the World Economic Forum found that 72% of companies polled in sub-Saharan Africa reported a negative malaria impact, with 39% perceiving these impacts to be serious.

This report provides an economic analysis of the malaria prevention and control programmes instigated by three companies in Zambia that focused on two direct benefits: reduced medical spending in company clinics and reduced absenteeism.¹ A cost-benefit analysis was conducted based on the benefits and costs of malaria control for the three companies; it showed that among the

157 000 individuals (including 33 000 employees, their dependents and surrounding members of the communities) protected over the period 2000–2009:

- Annual malaria cases decreased by 94% (from 27 925 to 1631).
- Annual malaria-related work days lost decreased 94% (from 19 392 to 1133).
- Malaria-related spending at company clinics decreased 76% (from US\$ 1.02 million to US\$ 241 000).
- 108 000 malaria episodes were averted and more than 300 lives saved.

For these companies, investing in malaria prevention and control for workers and their dependents was cost-effective, resulting in increasing their bottom line, producing an estimated rate of return of 28% under very conservative assumptions. While malaria control interventions seem to pay off quickly, they also appear fragile: temporary reductions in disease control budgets quickly result in a resurgence of malaria episodes.

¹ This deliberately narrow focus has, in fact, probably resulted in an underestimation of the wider economic benefits.



The private sector is a powerful partner, capable of working independently or partnering with national governments to fight the disease. This report provides strong evidence that businesses can and should be involved in malaria control efforts. Not only have the companies profiled in this report demonstrated their ability to dramatically reduce malaria-related illnesses and deaths among workers, their families, and communities, but they have also reaped substantial benefits. In particular, AngloGold Ashanti in Ghana, Marathon Oil in Equatorial Guinea and BHP Billiton (through the Lubombo Spatial Development Initiative) in Mozambique all reduced company health-care costs and work days lost to the disease; through public-private partnerships, these companies helped to secure substantial funding

from the Global Fund to Fight AIDS, Tuberculosis and Malaria to expand the scope of their efforts to a much larger population. These companies have also strengthened capacity among national governments to implement successful malaria control programmes.

Implementing employer-based malaria control programmes (in collaboration with local partners or as a complement to national scale-up activities) are major contributions the private sector can and should make. Malaria prevention has been shown to be a sound investment, both for a company and its workers; companies can build stronger businesses, while improving workers' lives.

KEY POINTS

- Malaria is bad for business: the disease is responsible for decreased productivity, employee absenteeism and increased health-care spending, and can negatively impact a company's reputation. In 2005, nearly three quarters of companies in the Africa region reported that malaria was negatively affecting their business.
- Malaria infection in company employees can impact the local economy through the deterioration of human capital; losses in savings; obstruction of the availability of local resources, investments and tax revenues; and strained public health budgets.
- Both small and large businesses have proven to be powerful contributors in the fight against the disease. Three companies in Zambia—Mopani Copper Mines, Konkola Copper Mines and Zambia Sugar—have made dramatic progress in a 10-year period, decreasing malaria cases and absenteeism by more than 90%.
- Companies have been able to scale up malaria control quickly and have seen a rapid return on investment. Malaria-related spending at the clinics of these three companies decreased by more than 75%, and a very conservative estimate showed that the companies gained an annualized internal rate of return of 28%.
- Strong models exist for businesses to take leadership roles in controlling malaria, protecting their workers and their families, strengthening their businesses and extending programmes into communities.
 - i) In Bioko Island, Equatorial Guinea, investments by Marathon Oil helped reduce malaria parasite prevalence in children by 57% in just four years; the project was extended through 2013 to develop local capacity and extend the programme to the mainland.
 - ii) In Ghana, gold producer AngloGold Ashanti reduced malaria cases among miners in the Obuasi region from 6600 per month in 2005 to 1150 per month in 2006, and became the first private-sector partner to be the principal recipient of a US\$ 138 million grant from the Global Fund to Fight AIDS, Tuberculosis and Malaria.
 - iii) BHP Billiton's malaria control programme helped reduce malaria infections from 625 per 1000 population to fewer than 200 per 1000 in Mozambique's Maputo Province. The initiative's success helped secure two grants totalling US\$ 47 million from the Global Fund for regional control of malaria.
- The private sector is a critical partner and can collaborate with and complement national programmes to leverage resources for and implement effective malaria control. The benefits reaped by malaria control efforts in the business context are fragile and can be temporary unless durable investments are made to ensure continued success. Country partners, including the private sector, have and must continue to play an active role in securing in-country and external funding to achieve the proven benefits of malaria control.



INTRODUCTION

Each year there are an estimated 250 million malaria cases worldwide and 800 000 deaths related to the disease (1). Prevention and control efforts to date have been led by governments, international partners and donors. But while effective methods to control and treat malaria exist, they are not always available to the nearly three billion people at risk of the disease.

While many governments have demonstrated very high levels of commitment to fight the disease, most governments in endemic areas lack the resources needed to comprehensively deal with malaria, which is why international funds have been crucial to control efforts. In recent years, more than US\$ 1.5 billion annually has been channeled to countries, mostly through the Global Fund to Fight Aids, Tuberculosis and Malaria, the US President's Malaria Initiative and the World Bank. This sum, however, falls well short of the estimated US\$ 5–6 billion annually required to fight the disease. This gap in funding has prompted many interested parties to urge greater private-sector involvement, especially since malaria control efforts can have a positive economic impact for the community in general and the private sector in particular.

In this report, the direct and indirect effects of malaria on businesses are described in Chapter 1, though it must be noted that quantitative data on the effects of the disease on economies and

businesses are scarce. Chapter 2 presents recent attempts to quantify the benefits of malaria prevention and control undertaken by mining and sugar companies in Zambia. Three other examples of private-sector involvement in malaria control in Africa are also presented (Boxes 1, 2 and 3).

The motivations behind these private-sector initiatives vary. They include a desire to safeguard the health of a company's workers and their families, thereby improving employees' well-being and productivity; to enjoy good public relations and commercial standing; and to foster strong business partnerships that might help expand markets. While participating as a good partner and developing positive public relations is very important, this report highlights the more quantifiable health and economic benefits of direct investment in malaria prevention for the companies themselves, which have variously experienced greater operational efficiencies presumably leading to increased market share and profits, and for the wider community, which has enjoyed improved health and follow-on economic benefits.



Box 1: Marathon Oil in Equatorial Guinea

With malaria affecting its activities on Bioko Island, Marathon Oil took bold steps to protect its workforce and operations. The initiative, a public-private partnership, drastically reduced malaria incidence on the island. Furthermore, its success was instrumental in helping the Equatorial Guinea Government secure multi-million dollar external funding to help establish a nationwide integrated malaria control programme.

In 2002, Marathon Oil Company acquired exploration and production rights in the Alba Field oil and gas reserve—one of the largest in the African region—off the shores of Bioko Island in Equatorial Guinea (Figure I.1). The company quickly identified malaria as the key health issue for employees and local communities. It determined that eliminating, or at least drastically reducing, malaria on Bioko Island would have the dual benefit of relieving the health-care and economic burden visited on the local population by this devastating disease, and helping to secure the health and productivity of the local workforce.

Marathon and its business partners, Noble Energy, GEPetrol and SONAGAS, teamed with the Equatorial Guinea Government to form an implementation team of health specialists, led by the nongovernmental organization Medical Care Development International (MCDI).

The Bioko Island Malaria Control Project (BIMCP), a five-year US\$ 15.8 million initiative, was launched in 2003 with the goal of reducing malaria transmission by reaching all of the approximate 150 000 population on the 2000-square kilometer island with a broad package of malaria control interventions.

Figure I.1
Map of Equatorial Guinea, including Bioko Island



Project interventions included (2–5):

- twice-yearly indoor residual spraying (IRS) of all households;
- malaria rapid diagnostic tests (RDTs) and artemisinin-based combination therapy (ACT) provided free of charge at local health centres to children under the age of 15 and to pregnant women;
- intermittent preventive treatment for pregnant women (IPTp) with two doses of sulfadoxine-pyrimethamine (SP) 30 days apart;
- a public education campaign on malaria and prevention strategies;
- an extensive surveillance and monitoring system to provide real-time data on the programme and to guard against future outbreaks;
- starting in 2007, the door-to-door distribution of long-lasting insecticide-treated nets (LLINs), providing coverage to more than 110 000 sleeping spaces.

The remarkable coverage achieved with these interventions by 2008 included:

- IRS every six months to more than 80% of households;
- 73% LLIN use (not just ownership) in households;
- 95% of children under the age of five years living in an IRS-treated house or sleeping under an LLIN (pre-intervention coverage had been just 4%);
- training of doctors and nurses in all health districts;
- use of RDTs and ACTs in all health posts as first-line treatments for children under the age of 15 and pregnant women;
- expansion of the IPTp programme (while it reached only 19% of women with the recommended two-dose regimen by 2008, a foundation for further growth was established).

Impact achieved

The impact of the high coverage of these interventions was remarkable (6). From 2004–2008, infection prevalence rates in children aged 2–5 years, measured by household surveys, decreased from 42% to 18%, a 57% reduction; in children of the same age group, fever rates in the four weeks prior to the surveys declined from 14% to 6%, a 56% reduction, and anaemia rates (hemoglobin < 8gm/dL) dropped from 15% to 2%, an 87% reduction.

All-cause under-five mortality fell from 152 per 1000 births before the introduction of control measures to 55 per 1000 in 2008, a 64% reduction. By that year, Bioko Island had already achieved United Nations Millennium Development Goal (MDG) number 4—a two-thirds reduction in child mortality by 2015—solely by controlling malaria (6). Other factors could have contributed to improved child survival, but the rapid drop in child mortality coincident with the malaria control programme scale-up, and the fact there was no dramatic expansion of other programmes during this interval, indicate the substantial contribution of malaria prevention to the drop in child mortality (6, 7).

In 2008, Marathon and its partners, including the Equatorial Guinea Government, announced that the malaria prevention and control project on the island would be extended for five years to 2013. In this second phase, the project has been focusing on developing capacity within the country's national malaria control programme, to ensure that local capacity and project management skills are in place to sustain the programme beyond 2013.

In addition, Marathon assisted the government in securing US\$ 26 million from the Global Fund to extend the successful Bioko Island model to the mainland. In 2006, the Marathon Oil Company Foundation made a US\$ 1 million contribution to the initial phase of the project expansion. This has enabled the government to establish one of the first nationwide integrated malaria control projects in Africa.

The incentives for such partnerships are compelling: increased revenues for both the company and the country as a whole as a result of a healthy, productive workforce; improved health among workers and their families, which improves their well-being and reduces the strain on the health system; and a reputation for social responsibility and good corporate citizenship that can have follow-on benefits in the wider marketplace.

The Marathon project has won multiple awards, including:

- the 2009 Business Excellence Award (performance measurement category), presented by Global Business Coalition;
- the 2007 World Foundation for Medical Research and Prevention Award;
- the 2007 Global Business Coalition on HIV/AIDS, TB and Malaria Award for business excellence for community intervention;
- the 2006 Africa Investor Award for best initiative in support of the Millennium Development Goals;
- the 2006 World Oil Award in the sustainable development/health, environment and safety category.

DIRECT AND INDIRECT ECONOMIC EFFECTS OF MALARIA

This chapter examines the many ways malaria and malaria control can affect businesses, both directly and indirectly

Poor health and disease negatively impact businesses and economies. Malaria, in particular, is a leading cause of morbidity and mortality globally, and is perceived as a serious threat by most business leaders in endemic countries. Records of malaria cases in Europe in the late 19th and early 20th centuries indicate the disease was a costly and severe inhibitor of economic development. Greece, Spain and Italy all experienced rapid economic growth after eliminating malaria.

But because studies to quantify the economic impact of malaria on business are both expensive and difficult to design and implement, data remain weak. Robust data on malaria morbidity and mortality are particularly hard to find. For instance, routine health-monitoring systems and post-mortem reports often attribute all deaths preceded by fever to malaria, regardless of the existence of other symptoms. An extensive review of the available literature (8) reported in 2000 that “the weakness of the literature available on the economic impact of malaria is clearly evident. No studies can be highlighted as models of good methodology.”

Nevertheless, there is a widespread perception that malaria has a strong negative effect on business. According to a 2001 study by Gallup and Sachs, the economies of countries with high malaria prevalence grew 1.3 percentage points less per year than other countries between 1965 and 1990 (9). A report published by the Global Health Initiative of the World Economic Forum in 2006 found that in sub-

Saharan Africa, 72% of companies reported a negative impact on their business from malaria, with 39% perceiving these impacts to be serious (10). A recent survey conducted in Ghana, where malaria is endemic, found that 30% of business leaders reported that the disease had a strong negative impact on productivity (10). An earlier study estimated the cost of malaria-related lost production to be between 2% and 6% of Kenya’s gross domestic product and between 1% and 5% of Nigeria’s (11).

Malaria can affect businesses both directly, through the adverse impact on a firm’s workforce, and indirectly, by damaging the economic environment in which they operate.

Malaria’s direct economic impact on business

Increased absenteeism

Most obviously, malaria is responsible for absenteeism, with patients often bedridden for several days. Illness in a spouse or child may force workers to stay at home to provide care. Adults who fall ill with malaria have been found to miss between one and five days of work per episode; they miss a similar period when caring for sick children (12). WHO reports a bigger impact, estimating that a malaria episode will cost the equivalent of 10 days of lost labour (13). In a World Economic Forum study done in Ghana (14), 63% of the 119 business leaders surveyed reported that the disease was causing absenteeism among employees.



Reduced productivity

Even after employees return to work, they are often less productive during the recovery period. Workers, especially those assigned physical tasks, may need several days to recapture previous levels of productivity. In a 2008 study in Zambia, workers reported that when returning to work after a malaria episode, they felt exhausted and less productive (15). Productivity may also be impacted by low morale, as when an employee worries about his/her health or that of a spouse or child, or even greater, when illness leads to the death of a family member.

Increased health-care spending

Malaria also affects health-care spending. Many larger companies provide health-care services to employees and their dependents. When employees fall ill with malaria, these companies bear the

cost of medical care. Even when firms provide health care to employees, a significant portion of the cost associated with taking care of an ill family member will be carried at the household level. This again can lower worker morale and impact negatively on the economic environment in which businesses operate.

Negative impact on corporate reputation

The impact of malaria on corporate reputation must also be considered. Today, companies worldwide feel a heightened pressure to behave in a socially responsible manner. Any failure to adequately respond to a malaria outbreak among its workers would not be considered good business practice and could adversely affect a firm's standing in the eyes of both the public and the market.

Malaria's indirect economic impact on business

Increased malaria transmission

Malaria may also have ripple effects on the wider economy, not just the affected company. Parasitemia among a company's employees increases the potential for transmission to the community in general, thereby affecting the economy of the region. High malaria prevalence rates will likely lower human capital and obstruct the availability of local resources.

Reduced tax revenues and public services budgets

Malaria can depress economies by preventing or depleting savings and investments, reducing disposable incomes. People who do not expect to live long, healthy and happy lives have less incentive to save and invest in the local economy. Malaria, therefore, can also contribute to lower tax revenues and potentially to lower public health budgets.

The direct and indirect benefits that companies can derive from malaria prevention and control—reduced absenteeism, increased worker productivity, decreased health-care spending, decreased community transmission and boosted local economies—have convinced

some firms to take action. Some companies have focused on reducing the effects of the disease on workers and the local community; others have worked to establish good local relationships by instigating control programmes in the communities and areas where they work. Some firms have acted alone, while others have built public-private partnerships or provided funding to public-sector prevention initiatives.

Many businesses have joined the regional and global fight against malaria to create positive health impacts while simultaneously earning a good corporate reputation that will help secure commercial relationships, alliances and markets. These businesses include some who manufacture the malaria interventions that are used around the world as well as others who work in malaria-endemic settings and understand the local, regional and global consequences of the disease. The list of companies that have invested in malaria control is long and cannot be cited in one report; instead, this report focuses on the very quantifiable consequences from some of the businesses that have made direct investment in malaria control for their workforce and the surrounding communities.



Box 2: AngloGold Ashanti in Ghana

AngloGold Ashanti built a partnership aimed at reducing malaria in Obuasi, Ghana, where its gold mining operations were located. The partnership achieved better-than-expected results, boosting the National Malaria Control Programme in Ghana and helping to secure a US\$ 138 million grant from the Global Fund to Fight Aids, Tuberculosis and Malaria to scale up interventions. AngloGold Ashanti was asked by malaria control partners in Ghana to be the principal recipient of the grant's funds, based on its past experience and successes—the first time a private company will perform the lead role for a Global Fund grant in Africa.

In Ghana, AngloGold Ashanti, a global gold producer with its headquarters in South Africa, has had to deal with the devastating effects of malaria. In 2004, malaria accounted for 22% of all deaths in the community. The municipality hospital and clinics saw as many as 12 000 confirmed and unconfirmed cases of malaria per month. The mine hospital saw 6800 malaria patients per month out of a total workforce of 8000. The cost associated with dealing with mine employees and their dependents contracting malaria was estimated at US\$ 2.2 million a year, with about US\$ 55 000 spent each month on treatment alone (16).

Figure 1.1
Map of Ghana and AngloGold Ashanti malaria control project area in Obuasi



In 2005, the company decided to implement an integrated malaria programme, one that would cover not only mineworker housing and infrastructure but also private housing and buildings in Obuasi town and surrounding villages (Figure 1.1). It was designed in partnership with the Ghana Health Service, the National Malaria Control Programme (NMCP) and the local Obuasi Municipal Assembly, acting with the approval of the Ministry of Health. It also had to be aligned closely to Ghana’s National Malaria Plan.

The programme consisted of four main elements (17):

- indoor residual spraying and long-lasting insecticide-treated net distribution, along with some limited larviciding;
- early and effective diagnosis with rapid diagnostic tests and treatment of confirmed malaria cases with artemisinin-based combination therapy;
- information, education and communication interventions in the communities;
- monitoring, surveillance and operational research.

“Ongoing surveillance, monitoring and research are key. Another critical success factor is the partnership with the relevant authorities and the local communities. The local community in Obuasi has been involved in the project from the outset. It is desirable in principle, but was particularly relevant at Obuasi: the mine’s various shafts are only a mile apart, with the town interspersed between them, making the mine and community an integrated entity.”

– Steve Knowles, manager of the AngloGold Ashanti malaria control programme

The project intervention area, which covered the Obuasi Municipal Assembly, included about 35 000 dwellings, which were all targeted for indoor residual spraying by a team of 116 operators.

The cost of the interventions was US\$ 1.7 million for the first year and US\$ 1.3 million per year thereafter. The aim was to reduce the incidence of malaria by 50% in two years.

Impact

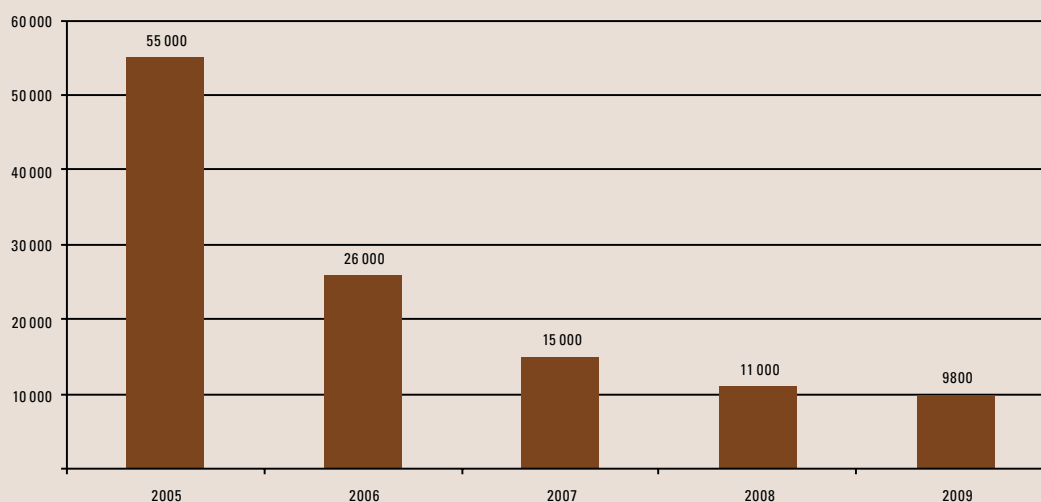
From 2005 to 2009, there was a consistent annual decrease in the incidence of malaria in Obuasi. The total number of cases reported at the mine’s Edwin Cade Hospital (which serves employees and dependents) decreased from 6600 cases per month in 2005 to 1150 cases per month in 2009. Average monthly medication costs to the company fell from US\$ 55 000 in 2005 to US\$ 9800 in 2009 (Figure 1.2). Similarly, average monthly lost days of work due to malaria fell from 6983 in 2005 to 282 in 2009 (Figure 1.3).

Figure 1.2

Average monthly malaria medication costs to AngloGold Ashanti, Edwin Cade Hospital, Obuasi, Ghana, 2005–2009

AngloGold Ashanti realized a good return on investments: five years into the implementation of its prevention activities, the monthly malaria medication costs to the company fell from US\$ 55 000 to US\$ 9800.

Average monthly medication costs (US\$)



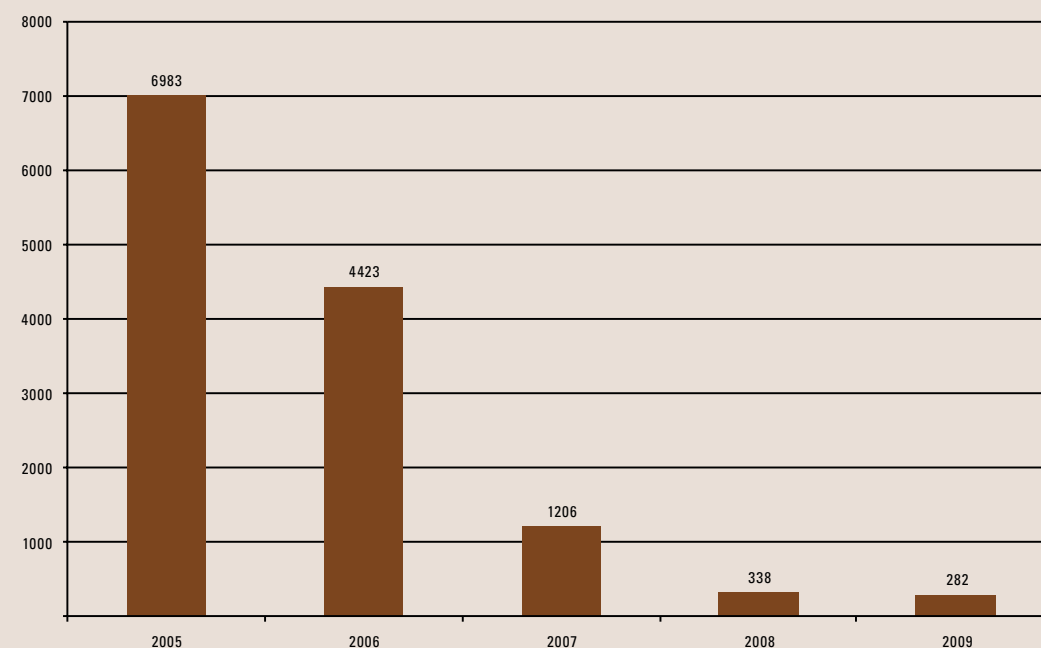
Source: Case studies: A national model for malaria control in Ghana. AngloGold Ashanti, 2009.

Figure 1.3

Average monthly days lost due to malaria in the mining operation, AngloGold Ashanti, Ghana, 2005–2009

The average monthly days lost due to malaria fell from about 7000 to 280 days.

Average monthly lost days



Source: AngloGold Ashanti annual report 2009.

Communities were involved in the project through regular committee meetings and social gatherings. Media articles, a weekly radio segment and one-on-one interaction with community leaders to obtain feedback also kept them informed. The Obuasi Community Volunteer Advocate Corps, formed in 2007, provided a vital community link. Volunteers received regular training in the causes and prevention of malaria from the AngloGold Ashanti malaria control programme staff and were paid a quarterly allowance.

The model now extends beyond Ghana's borders. The Obuasi Malaria Control Centre serves primarily as the headquarters for the Obuasi programme, but also functions as a training centre for malaria prevention and control at other AngloGold Ashanti operations and as a satellite research centre for academic and government agencies. A programme based on the Obuasi model has been developed at the Geita mine in Tanzania and the Siguirri mine in Guinea. Spray operators have been trained at the control centre on behalf of the Newmont gold mining company, which is also involved in mining activities in malaria-endemic countries. There are plans for a joint venture with the

Ghana Chamber of Mines, with participation from AngloGold Ashanti, Gold Fields, Gold Star and Ghana Manganese, using the Tarkwa mining area in Ghana as a pilot training site.

Following the success of the integrated malaria control measures at Obuasi, AngloGold Ashanti collaborated with the NMCP of Ghana in a grant application to the Global Fund to Fight AIDS, Tuberculosis and Malaria. AngloGold Ashanti will now be the principal recipient of the US\$ 138 million grant to Ghana. The money will be used to roll out the model developed at Obuasi to 40 districts in Ghana between 2011 and 2016. This is the first time a private company will play such a lead role in administering a Global Fund grant in Africa (18).

The Obuasi malaria control programme has received international recognition, including a commendation from the Global Business Coalition on HIV/AIDS, Tuberculosis and Malaria as an example of global excellence. It also won three awards at the Healthcare Initiative Awards sponsored by the South African financial institution ABSA in association with the Pan African Healthcare Congress.

EVALUATING THE IMPACT OF PRIVATE-SECTOR CONTROL EFFORTS IN ZAMBIA

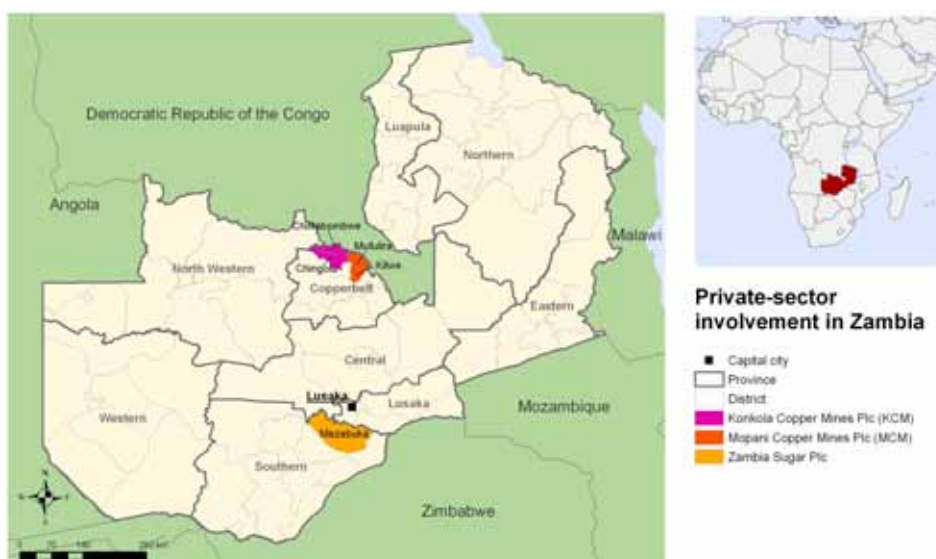
Following the methodology that is described in detail in Annex A, the costs and benefits of company investment in malaria control by three major Zambia exporters were examined and quantified. There are strong indications that, overall, company investment in malaria control has been profitable.

Zambia's private sector has historically played a significant role in malaria control. In this chapter, the activities of three major exporters—one agricultural and two mining companies (see Figure 2.1)—are examined to provide insight into

the impact that malaria and its control can have on business. All activities were carried out in collaboration with the National Malaria Control Centre of Zambia, adhering to its control guidelines and treatment protocols.

Figure 2.1

Map of Zambia and location of Zambia Sugar and mining business areas



Zambia Sugar Plc is one of Zambia's largest agricultural enterprises. Its Nakambala estate in Mazabuka District is Zambia's largest sugar plant and one of Africa's main sugar processing facilities. Zambia Sugar is listed on the Zambian stock exchange, although it is majority owned by South Africa-based Illovo Sugar Ltd, a subsidiary of Associated British Foods Ltd. In 2009, Zambia Sugar employed an estimated 3930 full-time equivalent workers.

Mopani Copper Mines Plc (MCM) is a copper and cobalt producer with operations in the Kitwe and Mufulira Districts in Zambia's Copperbelt Province. It is owned by ZCCM Investments Holdings Plc and Carlisa Investments Corporation (a joint venture comprising Glencore International AG and First Quantum Minerals Ltd). MCM employed an estimated 12 630 full-time equivalent workers in 2009.

Konkola Copper Mines Plc (KCM) is a copper and cobalt producer operating from the Chingola and Chililabombwe Districts of Zambia's Copperbelt Province. It is a subsidiary of UK-based mining conglomerate Vedanta Resources Plc. KCM employed an estimated 13 930 full-time equivalent workers in 2009.

Analysis approach

The extent to which the malaria prevention efforts rolled out by the three companies from 2001–2009 constituted a profitable investment was examined by assessing company investments in malaria control, changes in the frequency of malaria illness and associated health-care costs, and worker absenteeism and productivity during that time period. For practical reasons, the analysis presented here focuses on two direct benefits: the extent to which malaria control activities have reduced medical spending in company clinics and reduced absenteeism. The analysis used generally conservative assumptions and did not measure impact on

productivity or indirect benefits, and so results presented probably underestimate the overall impact of malaria control in these populations (more information on the assumptions can be found on page 35).

As illustrated in Figure 2.2, this analysis involves several calculation steps, all of which are described in detail in Annex A. In summary, the first step determined the number of malaria episodes averted. By multiplying the local baseline malaria incidence rate by the size of the workforce, we obtained the number of malaria episodes that would have occurred if no private-sector interventions had taken place. By subtracting the actual number of malaria episodes observed, we obtained an estimate of the number of malaria episodes averted.

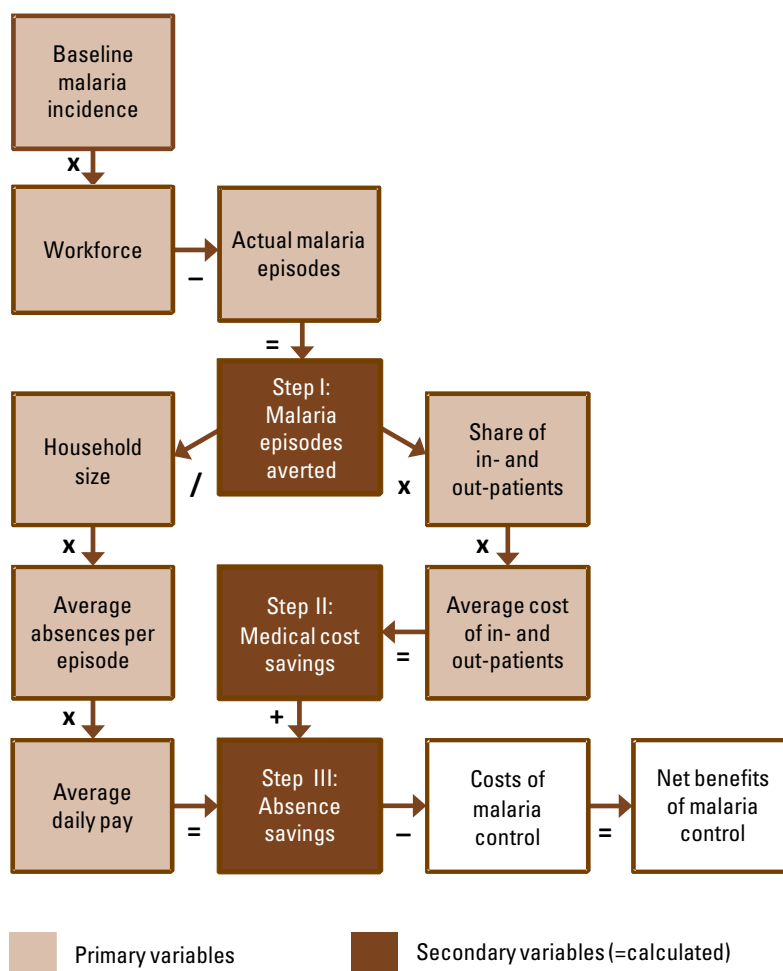
The second step assessed the medical cost savings. Knowing the costs and relative proportions of out-patients and in-patients requiring care for malaria, savings were assessed by multiplying the cost for each category of patients by the number of malaria episodes averted.

The third step determined savings related to absenteeism. This was done by multiplying average number of days of work lost per episode per employee by the average daily pay by the number of episodes averted among employees. This latest figure was obtained by dividing the total number of malaria episodes averted (for the general population living around the companies—i.e. employees and their families) by the average household size.

Having determined these secondary variables through the steps mentioned above, a cost-benefit analysis was then conducted.

Figure 2.2
Data collection and analysis sequence to examine business investment in malaria control at Zambia Sugar, Mopani Copper Mines and Konkola Copper Mines, Zambia, 2001–2009

Standard economic evaluation methods were used to examine malaria consequences in the work force and the benefits associated with company investments in malaria interventions including illnesses averted and the resulting reductions in medical care costs and worker absenteeism.



Findings

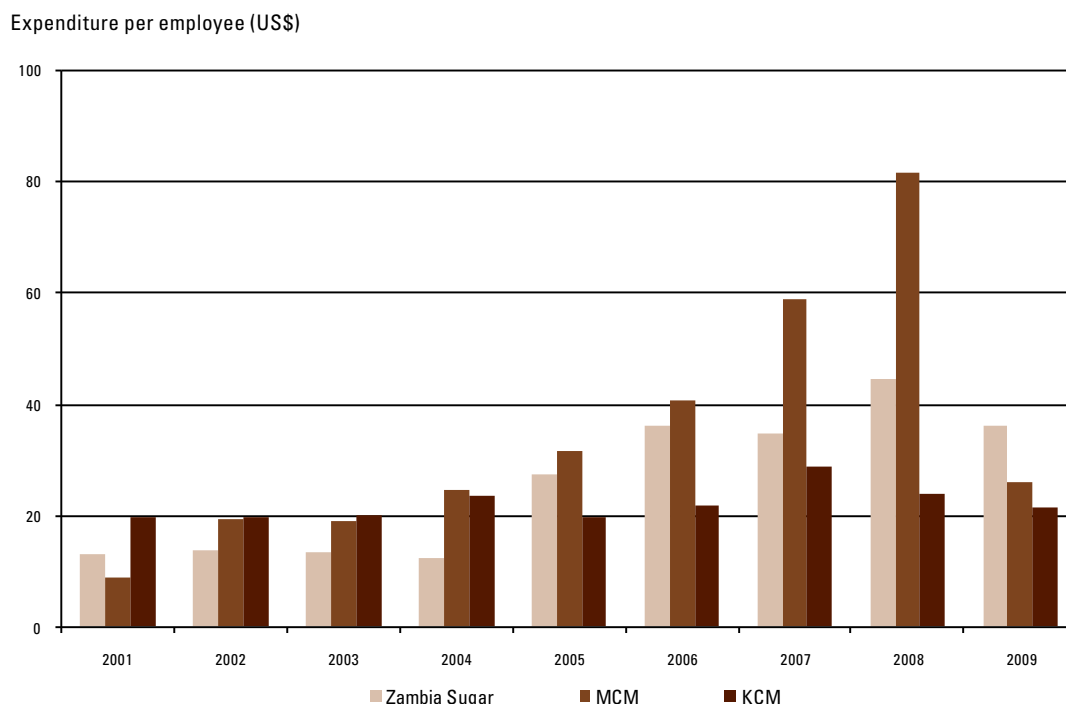
All three companies invested in malaria prevention and control. Spending associated with these activities averaged US\$34 per employee per year between 2001 and 2009, weighted according to

the number of company employees, expressed in 2009 US dollars (Figure 2.3). Spending peaked in 2008 when more than US\$ 50 was spent per employee.



Figure 2.3
Malaria control expenditures per employee at Zambia Sugar, Mopani Copper Mines and Konkola Copper Mines, Zambia, 2001–2009

Investments in malaria control per employee increased in each of the companies between 2001 and 2008, but dropped in 2009 due to regional and global economic crises.



Sources: Company data from Zambia Sugar, Mopani Copper Mines (MCM) and Konkola Copper Mines (KCM).

On average, about 70% of the companies’ malaria control budgets were allocated to indoor residual spraying. This complemented work by the public sector that supported the distribution of insecticide-treated nets in these districts.

Impact on malaria cases

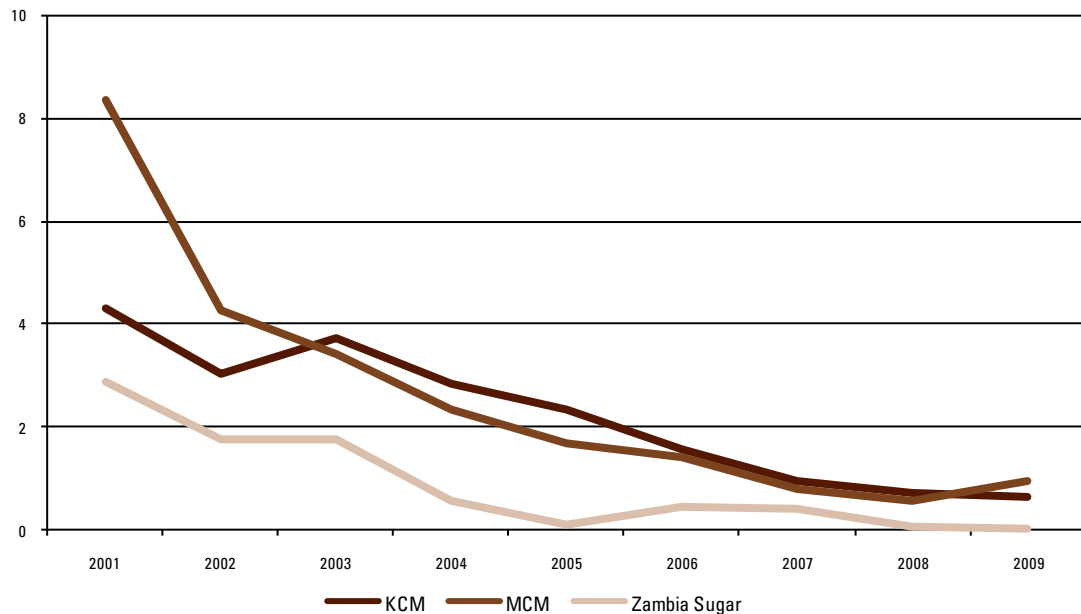
The reductions in the malaria cases recorded in the company health facilities (see Figure 2.4) eclipse the already impressive reductions (approximately 60% drops) recorded in public facilities across Zambia in recent years (6). Using the aforementioned methodology (Step I of Figure 2.2) it was concluded that more than 108 000 episodes of malaria were averted from 2001–2009 solely through the malaria prevention activities of these companies.

Figure 2.4

Yearly malaria cases reported in company health clinics for Zambia Sugar, Mopani Copper Mines and Konkola Copper Mines, Zambia, 2001–2009

The number of malaria cases dropped dramatically in each of the company health clinics between 2001 and 2009. This figure includes malaria cases of employees and dependents. Where possible, other non-employee and family cases are excluded.

Number of cases reported (thousands)



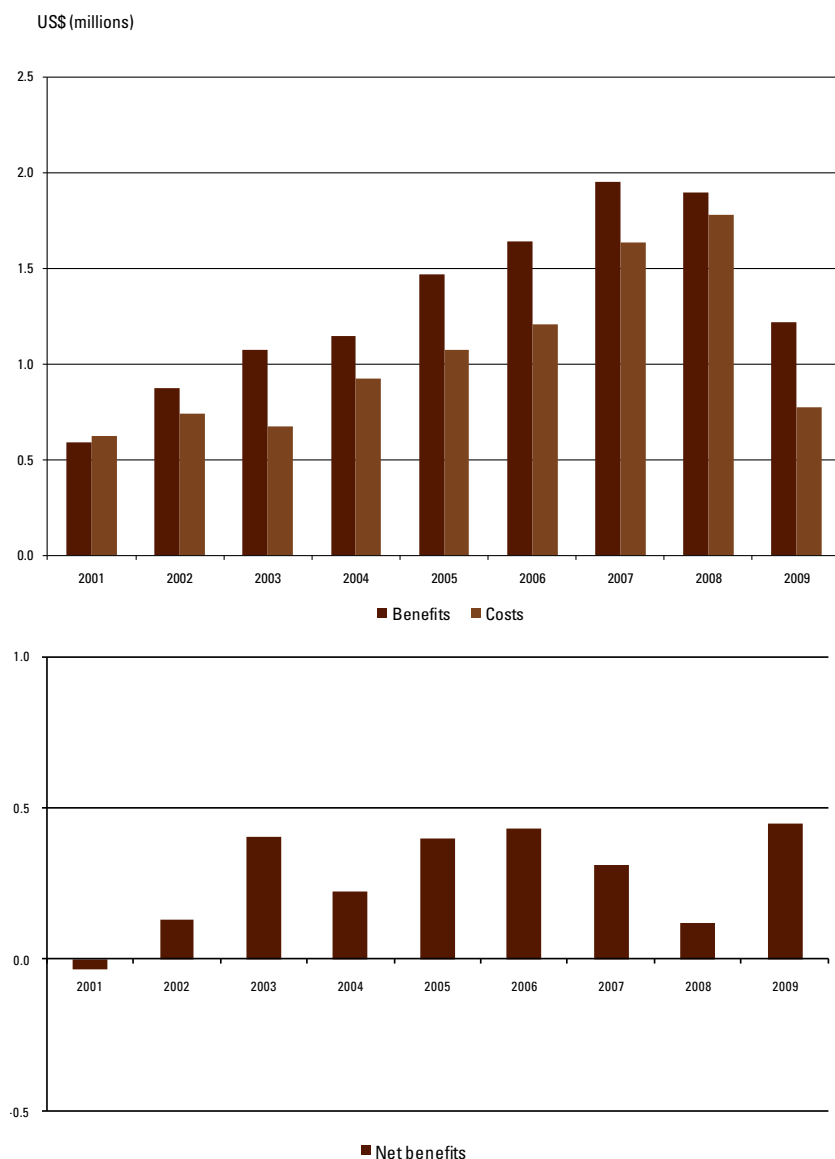
Sources: Company data from Zambia Sugar, Mopani Copper Mines (MCM) and Konkola Copper Mines (KCM).

Cost-benefit analysis

As shown in Figure 2.5, there is a positive correlation (coefficient = 93%) between costs (money spent by companies to prevent malaria) and benefits (reductions in health-care costs and worker absenteeism and productivity due to reductions in malaria cases). While causality cannot be ascertained in this retrospective analysis, the company malaria control efforts appear to have been an important driver of the observed effects.

Figure 2.5
The benefits and costs of malaria control in Zambia Sugar, Mopani Copper Mines and Konkola Copper Mines, Zambia, 2001–2009

After the first year of company malaria intervention scale-up, the benefits of malaria control exceeded the costs in each of the following eight years.



Sources: Health Management Information Systems, Central Statistics Office, Zambia; company data from Zambia Sugar, Mopani Copper Mines (MCM) and Konkola Copper Mines (KCM).

Notes: Costs included money spent by companies to prevent malaria; benefits included reductions in health-care costs and worker absenteeism and productivity (expressed in monetary terms) due to reductions in malaria cases. Net benefits equal benefits minus costs.



The magnitude and impact of the malaria control interventions are shown in Figure 2.6.

Figure 2.6
Summary of health and financial impact across all nine years and three companies: Zambia Sugar, Mopani Copper Mines and Konkola Copper Mines, Zambia, 2001–2009

Across the three companies and nine years, a conservative estimate shows that, on average, each year approximately 157 000 employees and their dependents were protected and approximately 12 000 malaria episodes were averted for a net benefit per employee of about US\$ 9. All financial amounts listed are in US\$.

Intervention data and costs	
Average number of employees protected (per year)	32 786
Average number of people protected (among employees and dependents, per year)	157 373
Malaria control expenses (per employee, per year, in 2009 US\$)	\$34.01
Health benefits	
Average number of malaria episodes averted (among employees and dependents, per year)	12 039
Average number of lives saved* (per year)	38
Financial benefits	
Number of sick days averted (among all employees, per year)	0.25
Health-care expenses averted (among all employees, per year, in 2009 US\$)	\$33.47
Total malaria control benefit (among all employees, per year, in 2009 US\$)	\$42.82
Net benefit (benefit minus cost) (among all employees, per year, in 2009 US\$)	\$8.81
Profitability analysis	
Ex ante net present value of investment opportunity (in 2000 US\$, assuming 10% discount rate)	\$926 069
Annualized internal rate of return**	28%
* Assumes WHO standard mortality rates of 0.8 deaths in 250 cases.	
** Internal rate of return (IRR) is a rate used in capital budgeting to measure and compare the profitability of investments; the higher the IRR, the more desirable it is to undertake the project.	

Between 2000 and 2009, across all three companies:

- recorded malaria cases in company clinics dropped 94% from 27 925 to 1631;
- malaria-related lost work days dropped 94% from 19 392 per year to 1133;

- malaria-related spending at company clinics dropped 76% from US\$ 1.02 million to US\$ 241 000.

Assuming that average malaria mortality rates of 0.8 deaths in 250 cases hold among company employees and their dependents, it was concluded that 108 000 malaria episodes were averted in the period 2001–2009 and more than 300 lives saved.



Business investing in malaria control offers a high rate of return

In this evaluation, both the costs (company investments in malaria control) and the benefits (company savings in reduced health-care costs of employees and family members and company savings in reduced absenteeism) are quantified in financial terms and can readily be compared in a capital budgeting analysis. This type of analysis typically involves determining discount rates that reflect the annualized rates of return on investment; it helps the business owner understand the benefit of a malaria control investment compared to alternative investments in other areas. A capital budgeting analysis also allows the evaluation of an internal rate of return (IRR), which measures and compares the profitability of different investments; the higher the IRR, the more desirable it is to undertake the project.

For these companies, limited information is available and appropriate discount rates cannot be formally calculated; however, the following can be said:

- Assuming a nominal 10% US\$ discount rate, and assuming that investments are made in the beginning of a given year and benefits are reaped at the end of the same year, the decision to pursue malaria prevention and control added US\$ 926 000 of company value from 2001 to 2009. This represents an internal rate of return of 28%.

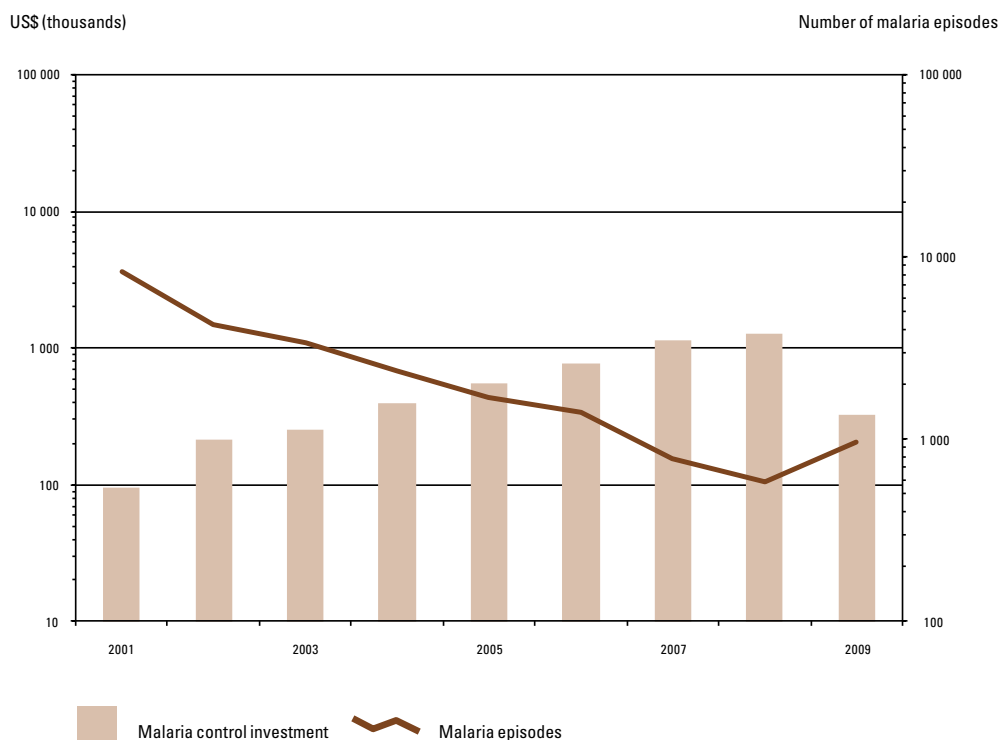
Malaria control has shown results quickly for the firms, resulting in relatively high rates of return and a low degree of sensitivity to the risk profiles and capital costs of the companies.

While it is clear that companies can quickly accrue benefits from investing in malaria prevention and control, the success achieved can be fragile and rapidly reversed. This is underlined by investment and disease data from MCM depicted in Figure 2.7.

A severe deterioration in business conditions in 2008–2009 led MCM to make drastic budget cuts, including about a 70% reduction in the 2009 malaria control budget. This coincided with an immediate increase in malaria episodes at the company clinics: cases rose from 583 to 956 in the same year, an increase of greater than 60%.

Figure 2.7
Malaria rebound at Mopani Copper Mines following a decrease in investment in malaria control in 2009

Increasing company investment coincided with reductions in malaria cases in health clinics (note the logarithmic scale); reduced investment in 2009 due to economic downturn was followed quickly by an upsurge in malaria cases.



Source: Company data.

In the case of MCM, the budget cut was a temporary measure adopted for liquidity reasons. More generally, however, the events at MCM illustrate the importance of not resting on past achievements. With the growing demonstration that malaria control efforts in African countries are leading to generally receding malaria disease, the malaria control community advocates for strategies to evolve and incorporate a stronger surveillance component and more emphasis on breaking the transmission cycle. Thus, both public- and private-sector investment will need to stabilize and further reduce transmission to prevent malaria resurgence, thereby moving beyond the inherently fragile initial steps in malaria control scale-up.

This analysis has deliberately erred on the conservative side when presented with alternative assumptions. For instance, it was assumed:

- No malaria control benefits accrue to the companies beyond those related to health-care costs and absenteeism.
- No benefit was accrued to the broader surrounding community (beyond employees and their families) by the companies' investments.
- In the absence of private-sector malaria control, malaria cases in private clinics would have fallen at the same rates that can be observed in areas where the public sector engaged in malaria control.



- Malaria cases within the household never cause an employee to stay at home and care for sick family members.
- Workers can be immediately replaced with other equally skilled workers in case of illness.
- Expenditures incurred in years for which data are missing are equal (in nominal US dollar terms) to the highest expenditures recorded in the same company in any other year.

Several other, no less plausible, assumptions might have been considered. For instance, constant malaria incidence could be used as a baseline. This would greatly amplify the benefits

of malaria control efforts, yielding over 220 000 malaria episodes and 730 malaria deaths averted over the 10-year period, a more than two-fold greater reduction in both episodes and deaths, and an internal rate of return of 56%—a doubling in profitability. It is also worth noting that because Zambia Sugar did not admit patients to their health facilities, the benefits in reduced in-patient care are not included in the analysis. Hence, the net benefits estimated in this study are conservative and likely underestimate the full benefit of malaria control in these communities and for these companies.



Box 3: Mozal and the Lubombo Spatial Development Initiative

Malaria had hampered the construction of the Mozal aluminium smelter and the company's daily operations in southern Mozambique since 1998, the year it was being built. In response, parent firm BHP Billiton launched a malaria prevention partnership to protect its operations and employees. An effective regional programme was born, which demonstrated success that enabled it to leverage funds from the Global Fund to Fight Aids, Tuberculosis and Malaria and national governments. BHP Billiton is still financing malaria prevention activities to protect its business and staff, enhance its corporate reputation and boost economic development.

When the Mozal aluminium smelter was being built, Mozambique had only recently emerged from 17 years of civil war that had devastated the economy and restricted malaria prevention and control. At the time, the nation suffered more than three million malaria infections annually (19).

Malaria control in Mozambique was severely limited in the southern part of the country due to substantial personnel and financial constraints. As such, data on the extent of the malaria problem around Mozal were limited. It was not until parent company BHP Billiton began building the smelter plant that the scale of the malaria problem in the region and its impact on business became apparent (20).

A baseline malaria survey conducted in southern Mozambique in December 1999 showed that infection rates among children in the area surrounding the Mozal plant exceeded 85% (19, 21). Malaria plagued the new plant's construction as evidenced by the nearly US\$ 2.7 million in malaria costs incurred while it was being built, a figure that included productivity losses through absenteeism and sickness, and medical costs. BHP Billiton reported 6000 malaria cases, 300 medical evacuations and 13 fatalities during a construction period of about two years. The company's ability to attract and retain expatriate employees with specific areas of expertise in this environment was also at risk.

BHP Billiton's desire to ensure the plant's long-term sustainability and maintain its commitment to sustainable economic development prompted the company to join the Lubombo Spatial Development Initiative (LSDI) in 2000.

Figure 2.8
Map of Lubombo region



LSDI is a cross-border public-private partnership focused on reducing the malaria burden in Lubombo, an area spanning three countries: South Africa, Swaziland and Mozambique (Figure 2.8). The partnership aims to improve the health and economic viability of the region by (20–22):

- supporting regional indoor residual spraying of insecticides;
- ensuring early effective treatment of malaria cases by implementing rapid diagnostic tests and artemisinin-based combination therapy;
- monitoring and evaluating malaria control activities;
- ensuring the sustainability of malaria control through capacity development, fundraising and integration of activities within the provincial health systems.

For the first two years, financing for LSDI came entirely from private-sector sources. LSDI now has many public- and private-sector partners, including BHP Billiton; The Business Trust; the South African Medical Research Council; the South Africa, Mozambique and Swaziland health ministries; and the University of Cape Town.

“The company realized that something had to be done and it had to be done on a regional basis (beyond the Mozal community) ... but we grappled with where the boundary of responsibility lay—government or corporate. We acknowledged that the control of malaria was not BHP Billiton’s core business but realized that we needed an integrated approach. Malaria doesn’t recognize boundaries and we had to address a broader geographic malaria agenda to ensure a sustainable future for our operations.”

– Carlos Mesquita, Mozal general manager

The partnership has achieved remarkable progress:

- LSDI has completed spraying in a region spanning 100 000 square kilometres of contiguous control area, resulting in protection for about 4.7 million people.
- It has ensured effective malaria diagnosis with rapid diagnostic tests and treatment with artemisinin-based combination therapy progressively expanded to health posts with full ACT roll-out completed in 2006.
- Spraying and effective treatment efforts in the three-country project area have resulted in reducing malaria incidence by almost 80% across the project area.

Quantifying impact

BHP Billiton's ability to quantify its significant positive impact has helped to ensure continued overall support in the community in which the company operates. Within three years of implementing its indoor residual spraying programme, the company recorded remarkable impact:

- Malaria infections fell from 625 per 1000 population to fewer than 200 per 1000 in the area covered by BHP Billiton's malaria control programme (21).
- Reductions in malaria incidence from 2000 to 2004 translated into fewer recorded cases (from 6000 to 997), medical evacuations (from 300 to 40) and fatalities (from 13 to 1) among the company's employees and their dependents (23).

For the LSDI partners, it was critically important to have a pre-defined set of measures to

evaluate outcomes and progress against LSDI objectives, making it possible to monitor and improve programme performance. In addition, demonstrated positive health outcomes have enabled the South African Medical Research Council, responsible for implementation, to secure additional funding from outside sources.

"It is critical that we are able to measure the impact [of LSDI activities]. We have worked hard to ensure that we have the proper methodologies in place ... it has been essential to building government support but also to ensure engagement with a results-based private sector."

– Dr Brian Sharp, malaria director of the South African Medical Research Council and principal investigator of the LSDI

BHP Billiton and The Business Trust were founding contributors and have continued their support. The initiative's demonstrated success has resulted in additional government financing and, in 2003, a five-year US\$ 22 million grant from the Global Fund to Fight AIDS, Tuberculosis and Malaria (19–20). The excellent results generated by that grant led to the award of a follow-on grant of US\$ 25 million from the Global Fund in 2006.

To date, BHP Billiton and its subsidiary Mozal continue their support of malaria prevention and control. The parent company donated US\$ 600 000 to assist with efforts in the city of Maputo. It is also sponsoring activities of the Medicines for Malaria Venture, an international collaboration to develop drugs for the effective treatment of malaria. BHP Billiton, because of its mining and smelting operations in malaria-endemic regions, has both a social and an economic interest in trying to reduce the burden of malaria.



THE WAY FORWARD: DISCUSSION AND CONCLUSIONS

With strong business practices and competencies, vital infrastructure and often broad geographic presence, the private sector is ideally positioned to help implement malaria prevention and control strategies. The companies profiled in this report initially became involved in malaria prevention to protect their employees and operations. They soon realized that the benefits were greater than expected. Thinking broadly, partnerships evolved to extend these prevention strategies, sometimes scaling up to the national level.

Private companies can have a significant leveraging effect, applying their strengths to secure funding from external donors and jump-starting scale-up interventions that would not have taken place otherwise.² In Equatorial Guinea, Ghana and the Lubombo area in southern Africa, partnerships initiated by private companies played an active role in securing external funding from the Global Fund to Fight AIDS, Tuberculosis and Malaria

to scale up malaria prevention. This approach works particularly well when national control programmes are not robust enough to offer a sufficient operational structure upon which to develop and expand with additional human and financial resources. Alternatively, in areas with reasonably strong national programmes, businesses can choose to boost operations by providing funding, human resources and expertise, and also by playing an advocacy role.

Malaria prevention is cost effective. With a modest outlay, a business can soon achieve significant health and economic gains, and a high return on that investment. Additional benefits that cannot be measured in an economic analysis—an enhanced corporate profile and reputation, for example—come at no extra cost. The examples of the companies discussed in this report show that developing a malaria prevention strategy makes sound economic sense.

² Businesses interested in exploring or starting an employer-based malaria control programme could benefit from studying the World Economic Forum's Global Health Initiative report, *Guidelines for employer-based malaria control programmes* (2006), available online (24).

Businesses do not have to be large to be strong partners in the fight against malaria. Diverse effective interventions and skills are needed and there are numerous opportunities for both large and small businesses to make useful contributions in the fight against malaria:

- They can collaborate with local implementers (district health services or nongovernmental organizations) to expand the delivery of interventions.
- They can partner with a larger company's malaria control programme through a cost-sharing agreement. Several small enterprises can also pool resources to achieve a scale of operation similar to that of a large company.
- Some interventions, such as insecticide-treated nets, can be delivered on a relatively small scale with a modest amount of resources. Guidance should be sought from local partners.

Businesses function more efficiently when operating in a malaria-free environment. National public-sector efforts to create that malaria-free environment can clearly benefit the general population and provide an economic incentive for business development. Businesses operating in a malaria-transmission setting can form joint efforts with the national and local public health sectors to dramatically reduce malaria's impact in the community and provide direct financial benefits to the companies.

Controlling malaria is a good business practice. Implementing employer-based malaria control programmes in collaboration with local partners or helping to scale up national activities are major contributions—with considerable benefits—that the private sector can and should make. Regardless of how private firms choose to become involved, this report clearly demonstrates that substantial positive outcomes can flow from participation—for the company, its employees and its operations, as well as for the local, national and global communities.



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ANNEX A. METHODS TO ASSESS THE BENEFITS OF PRIVATE-SECTOR CONTROL EFFORTS IN ZAMBIA

This annex describes the methodology used to examine the health and economic benefits of the malaria control efforts made by three large Zambian companies.

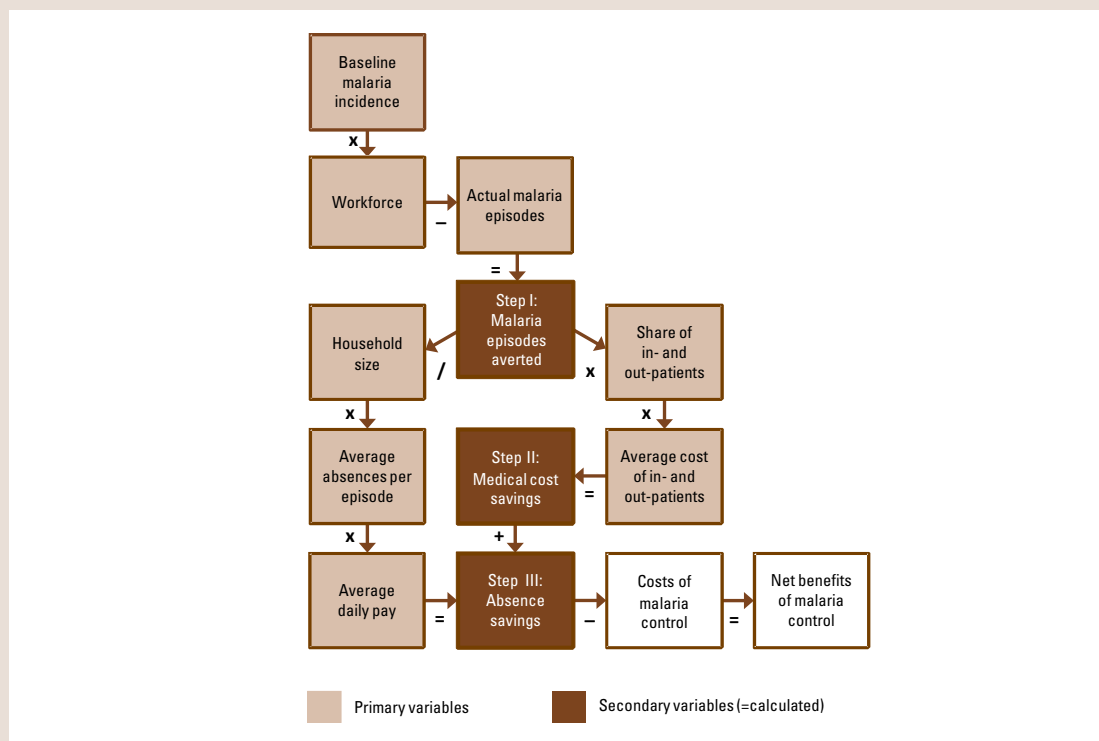
Extensive work was done with financial managers and health staff in each of the three companies to compile the data from 2000–2009 required to conduct the analysis. The companies provided health services for their employees and family members and had maintained good record keeping of health events and of the costs of these events over that time period. The companies also had consistent records of production and per-employee production and costs and profits over this time. Finally, the companies maintained good records of their costs for malaria control work in staff homes and nearby communities. These records

were reviewed by independent observers with the permission and support of the companies, and summaries were developed for this report.

The three steps mentioned in Chapter 3, leading to the determination of the number of malaria episodes averted, the medical cost savings and the absence savings (Figure A.1; same as Figure 2.2) are described in detail in this annex. They are essential steps in the calculations needed to determine the actual net benefits of malaria control by the private companies.

Figure A.1

Data collection and analysis sequence to examine business investment in malaria control at Zambia Sugar, Mopani Copper Mines and Konkola Copper Mines, Zambia, 2001–2009



Step I: Malaria episodes averted

The first step determined the number of malaria episodes that were averted through private-sector interventions. To do this, we estimated the number of malaria episodes that would have accrued in company clinics had the companies not invested in malaria control (baseline episodes). From this counterfactual baseline, we then subtract the malaria episodes that were recorded in reality (actual episodes) to arrive at the malaria episodes averted.

It would not be reasonable to assume constant incidence rates as a baseline because the public sector also undertook substantial malaria control efforts during the study's time frame. Zambia has experienced an incidence reduction of about 66% over recent years, according to its National Malaria Control Programme data, and this benefited the companies, regardless of their own malaria control measures.

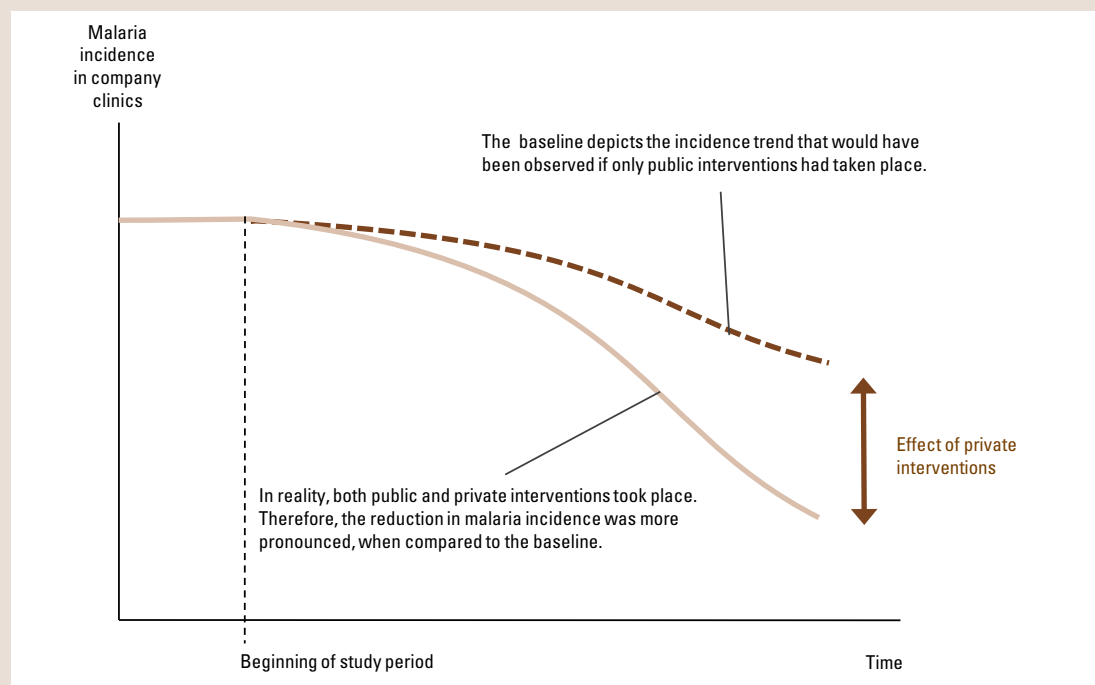
We, therefore, conservatively assume that the effects of private-sector malaria control are limited

to the difference between a baseline trend (in which a company's malaria incidence falls no further than it did in local public clinics) and the actual, observed trend in which malaria incidence fell at higher rates because of additional, private-sector interventions. The difference between the two is illustrated in Figure A.2.

Note that a less conservative scenario would assume constant baseline incidence as a counterfactual. Given the relative weight of private and public malaria control expenditures in the districts where the companies operate, this would be an equally plausible assumption. Of note, much of the population in Mazabuka District is directly affiliated with Zambia Sugar operations and the dramatic and sustained drop in malaria cases in the community was probably greatly affected by the malaria control programme implemented by the company; thus, the use of the malaria rates in non-company population as baseline is particularly conservative for the Zambia Sugar estimates.

Figure A.2

Illustrative example of the calculation of the effects of private-sector malaria control interventions

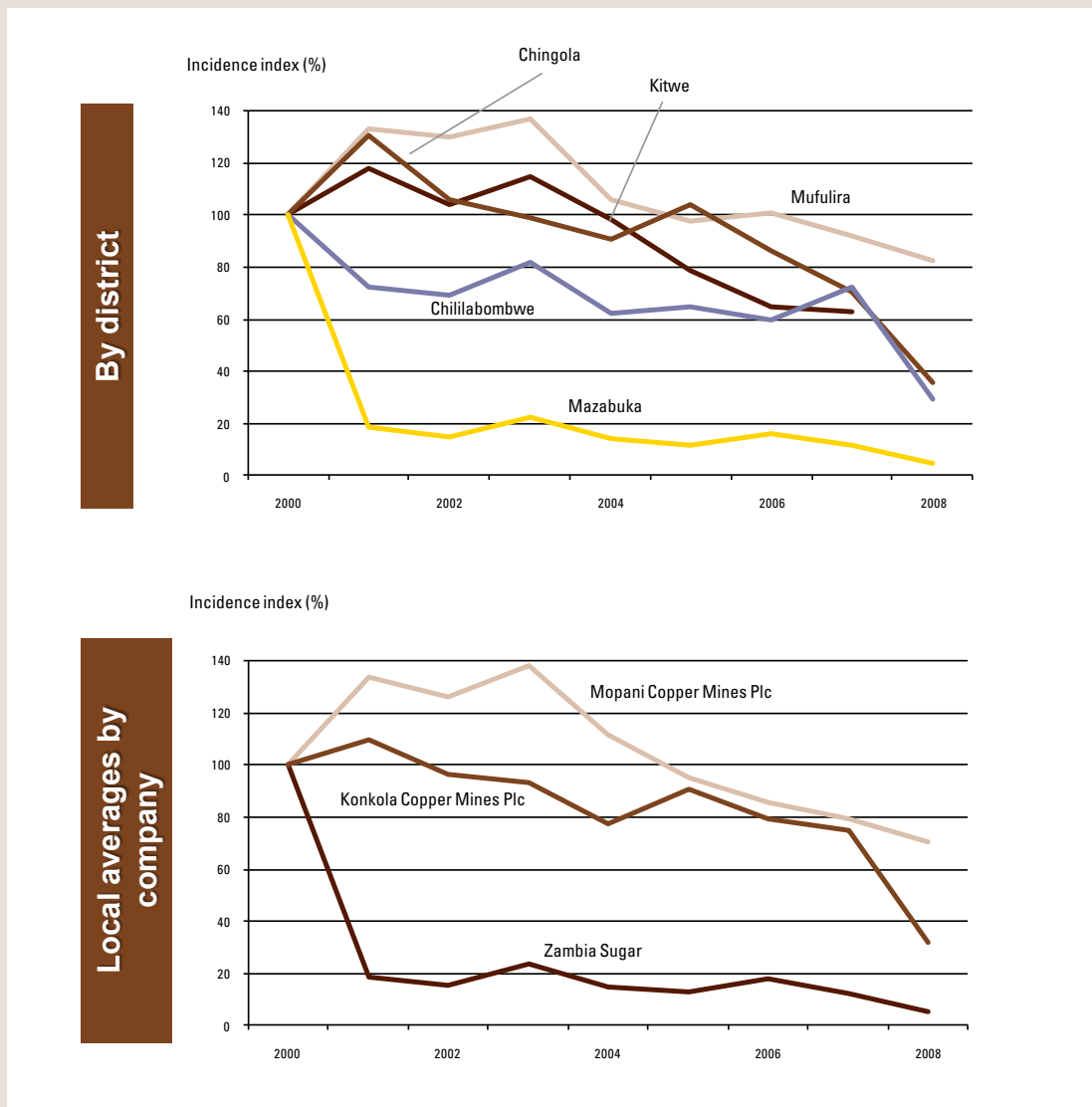


Note: These are hypothetical data for illustrative purposes.

Figure A.3 displays annual district-specific malaria trends and illustrates how local baseline incidence is calculated for each company.

Figure A.3
Local malaria case rates in the districts where the companies were operating and in the company health facilities

Mufulira and Kitwe district malaria case rates are pooled to construct a local baseline index for Mopani Copper Mines (MCM); Chingola and Chililabombwe district malaria case rates are pooled to construct a local baseline index for Konkola Copper Mines (KCM); and Mazabuka district malaria incidence is used as the local baseline index for Zambia Sugar (ZS).

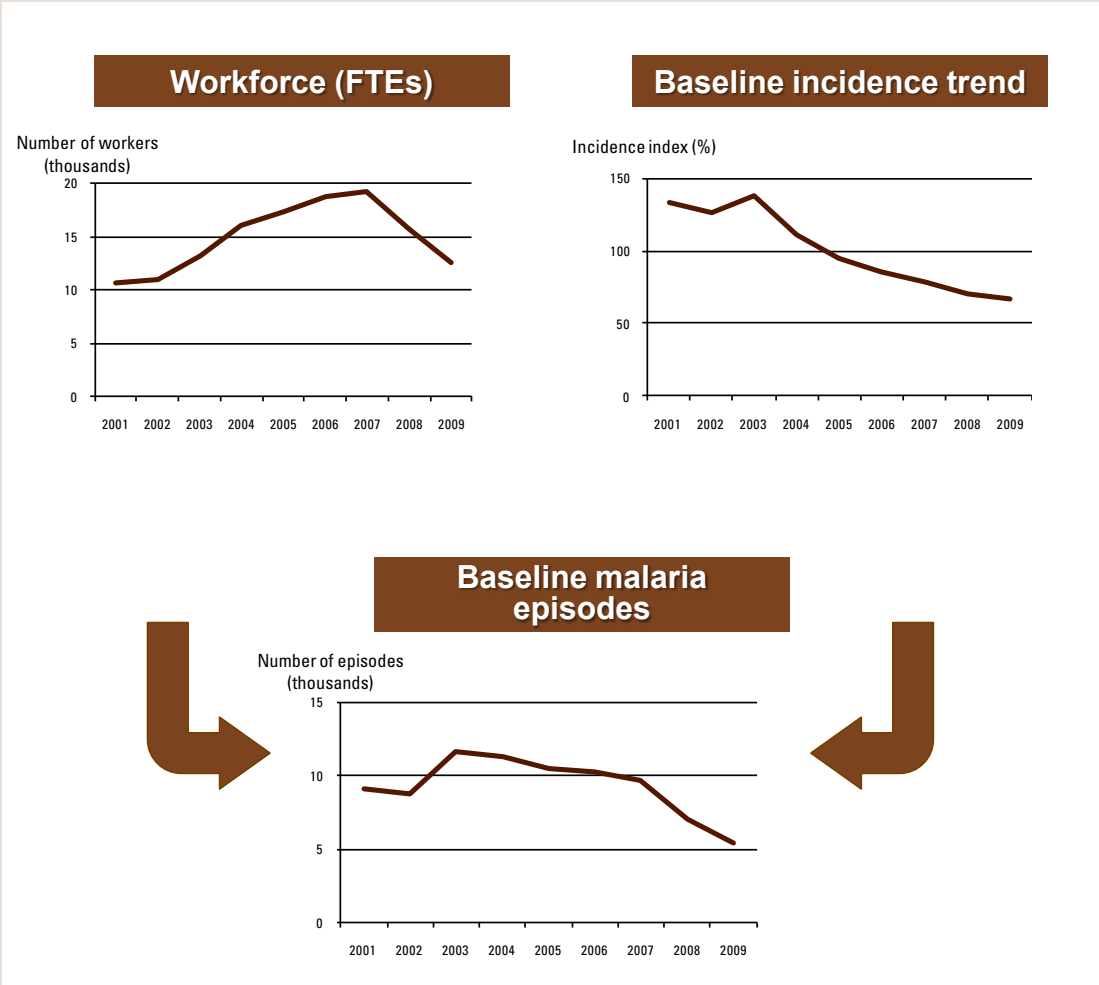


Sources: Health Management Information Systems, Central Statistics Office, Zambia; company data.

Note: The incidence index is presented as a ratio compared to the baseline, where in the year 2000, the initial rate was set at 100%.

By pooling the company-specific incidence trends from Figure A.3 with each company’s workforce over time, baseline malaria episodes can be calculated, as outlined in Figure A.4, an example from Mopani Copper Mines.

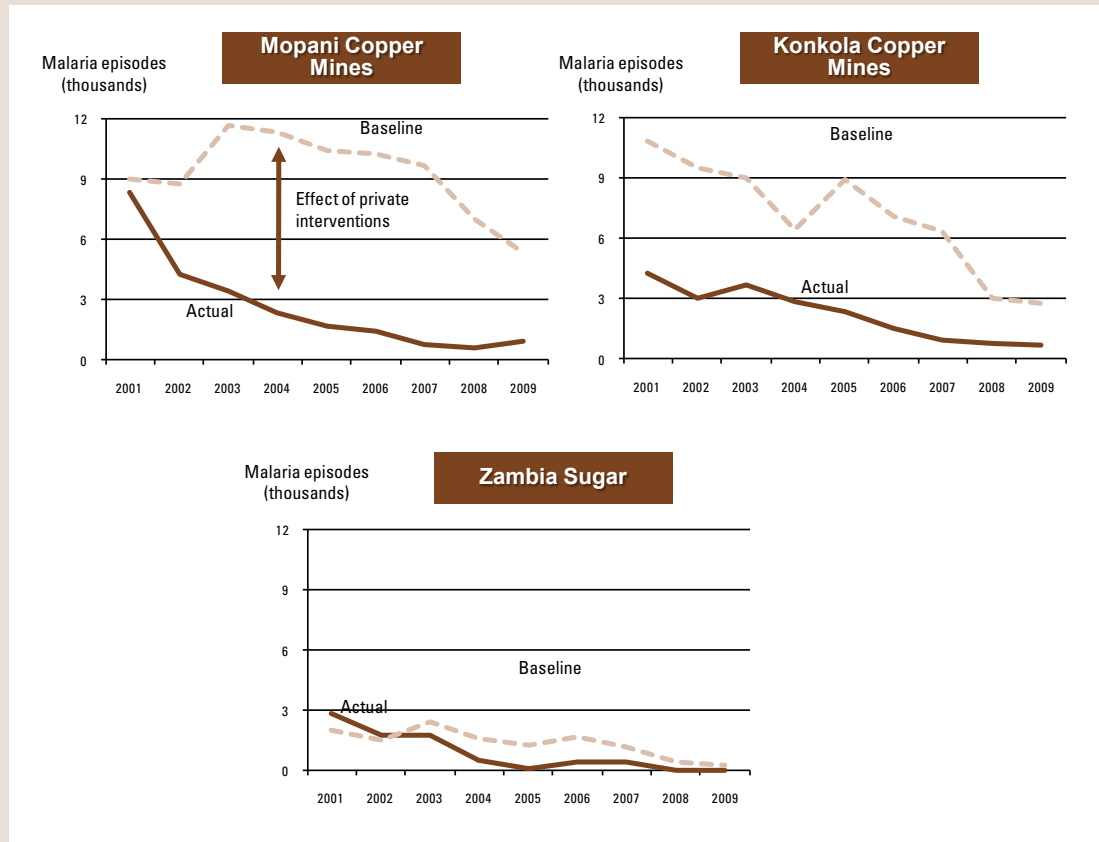
Figure A.4
Calculation of the expected annual baseline malaria episodes at Mopani Copper Mines, Zambia



Sources: Health Management Information Systems, Central Statistics Office, Zambia; company data.

Figure A.5 illustrates the malaria episodes averted by each company.

Figure A.5
Estimated malaria episodes averted for Mopani Copper Mines, Konkola Copper Mines and Zambia Sugar



Sources: Health Management Information Systems, Central Statistics Office, Zambia; company data.

Company clinics recorded greater reductions in malaria cases than public-sector clinics. That is, actual malaria cases fell at higher rates than baseline malaria cases. This difference is less dramatic in Mazabuka District (Zambia Sugar) where much of the population is affiliated with the company and the company-based control effort affected a higher proportion of the population overall.

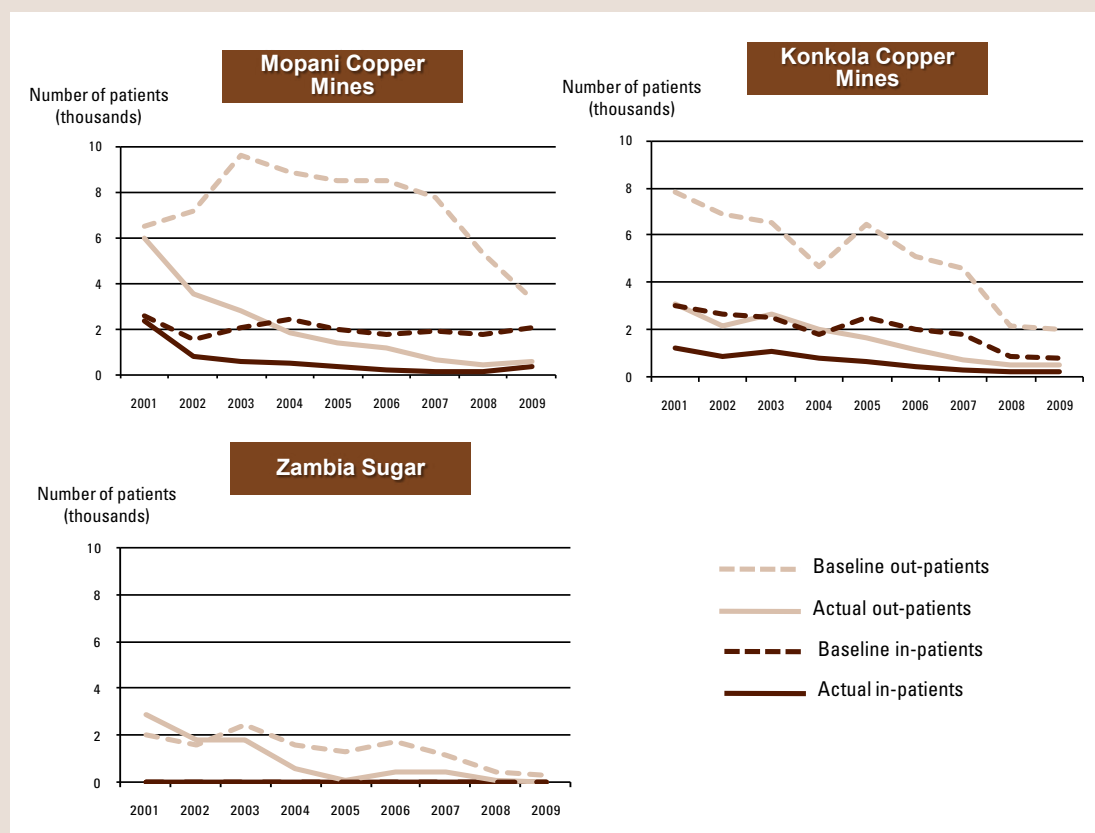
Step II: Medical cost savings

In order to calculate health-care cost savings associated with malaria prevention, averted

malaria episodes were divided into in-patient and out-patient cases. It was assumed that the ratio of in-patients to out-patients was not affected by private-sector interventions.

Separate data on in-patients and out-patients were not available at Zambia Sugar. It therefore was assumed that no in-patients were admitted at Zambia Sugar. That is, all malaria episodes were considered to be (less challenging and less expensive) out-patient cases. Using the baselines from Step I, the in-patient and out-patient trends displayed in Figure A.6 were derived.

Figure A.6
Malaria patients in company clinics at Mopani Copper Mines, Konkola Copper Mines and Zambia Sugar



Sources: Health Management Information Systems, Central Statistics Office, Zambia; company data.

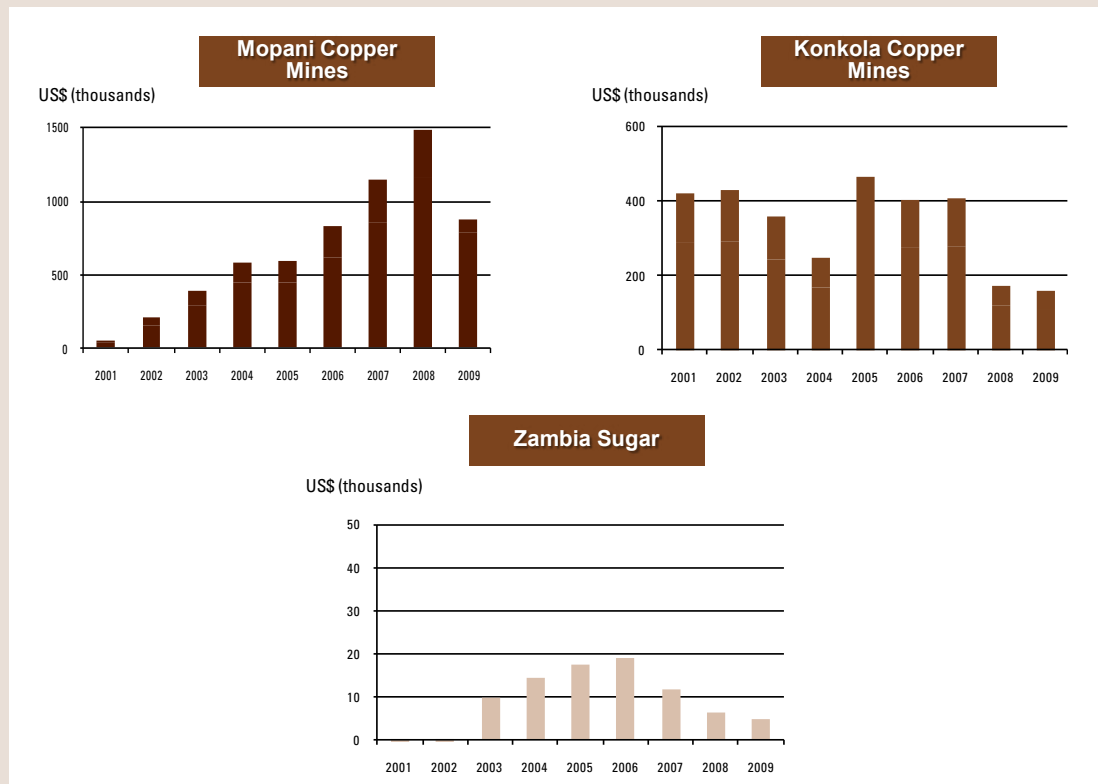
Malaria cases that were treated in the company clinics triggered expenditures. The following health-care cost categories were identified:

- salaries of health staff;
- costs of materials and medication;
- health-facility running costs and administrative overhead;
- capital expenditures associated with maintaining health-facility infrastructure.

Given the near decade-long period of analysis, it was assumed that all of these costs were variable in nature and that a reduction in morbidity would result in a proportional reduction in health-care costs.

The three companies provided cost estimates for in-patient and out-patient cases, based on the framework illustrated above. Their estimates varied widely, from US\$ 55 per in-patient case and US\$ 17 per out-patient case at Zambia Sugar, to US\$ 465 per in-patient case and US\$ 36 per out-patient case at MCM (in 2009 US dollars). According to interviews with controllers at the firms, this discrepancy can be explained by the elevated capital costs associated with the urban referral hospitals operated by the copper mine companies.

Applying these company-specific estimates to the company-specific in-patient and out-patient cases averted, the health-care cost savings are illustrated in Figure A.7.

Figure A.7**Estimated health-care cost savings at Mopani Copper Mines, Konkola Copper Mines and Zambia Sugar**

Sources: Health Management Information Systems, Central Statistics Office, Zambia; company data.

Step III: Absence savings

When an employee falls ill with malaria, he or she is absent from work. This is costly to the employer; either the sick employee gets replaced, resulting in an increase in expenses from paying an additional salary, or the employee's work does not get done, ultimately resulting in a loss in revenue. Such losses are subsequently referred to as absence costs.

In order to measure absence costs, the person-days lost in the actual and baseline scenarios were quantified. Lacking reliable data, absence related to caring for ill dependents was ignored and it was conservatively assumed that only employee illness triggered absence. Furthermore, it was assumed that malaria risk was evenly distributed within the household and that all true malaria cases had been recorded at the company clinics.

Not all company clinics systematically recorded whether patients were employees or dependents. In order to quantify malaria episodes suffered by employees, the total number of malaria episodes recorded in company clinics was divided by the average household size. The average household size of 4.8 members was used, as reported in Zambia's 2008 Malaria Indicator Survey for urban households.³

Next, employee malaria episodes were multiplied by the average number of sick days per malaria episode. According to MCM, recovery time exceeded treatment time and, on average, almost six work days were lost per malaria episode. No data were available from the other firms. We rounded down to five work days and applied this number to all three firms. This yielded the trends displayed in Figure A.8.

³ Zambia national malaria indicator survey 2008. Lusaka, Zambia, Ministry of Health (<http://www.nmcc.org.zm/files/ZambiaMIS2008Final.pdf>, accessed 1 February 2011).

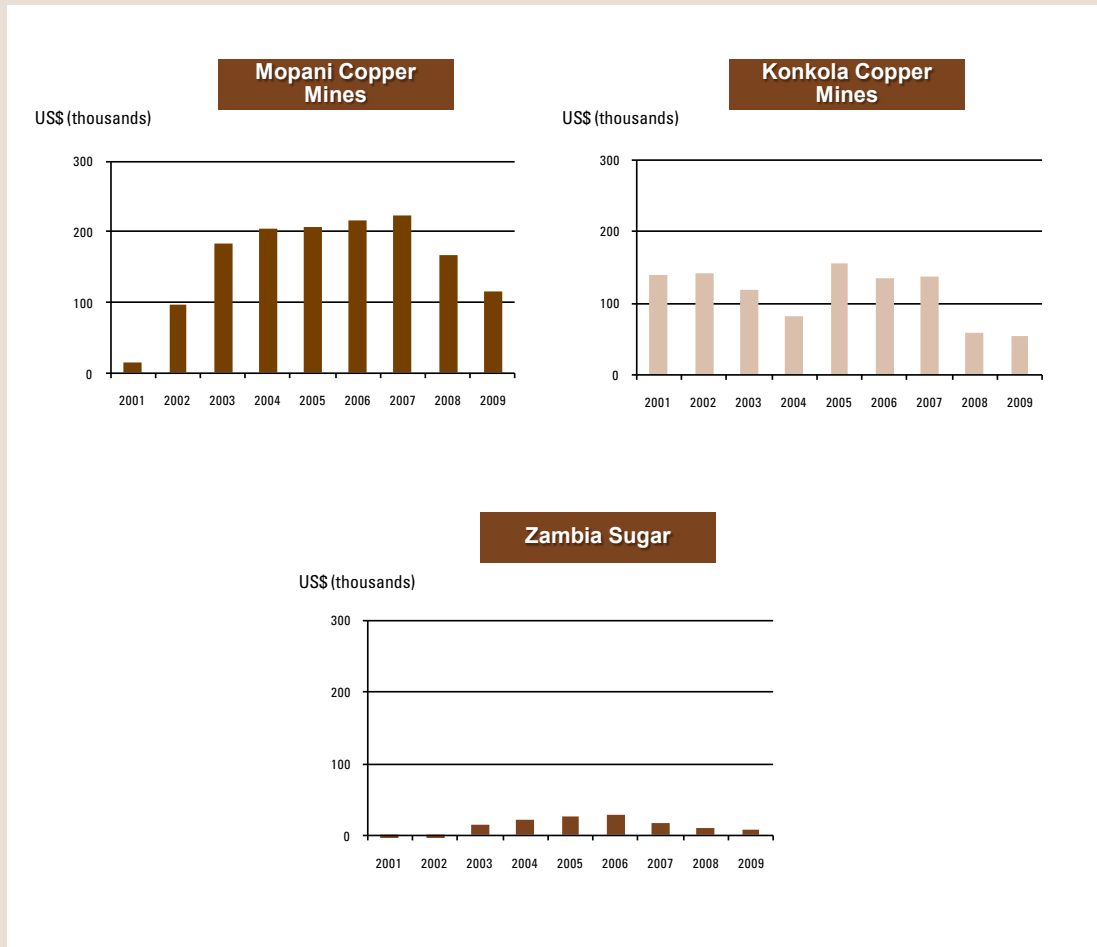
Figure A.8
Estimated person-days lost to malaria at Mopani Copper Mines, Konkola Copper Mines and Zambia Sugar



Sources: Health Management Information systems, Central Statistics Office, Zambia; company data.

To calculate compensation per work day, it was assumed that sick workers can be immediately replaced and that the cost to the company as a result of their absence was limited to their daily compensation. This amount was about US\$ 36 at Zambia Sugar and US\$ 37 at MCM and KCM. Applied to each company’s person-day savings, the resulting cost savings are displayed in Figure A.9.

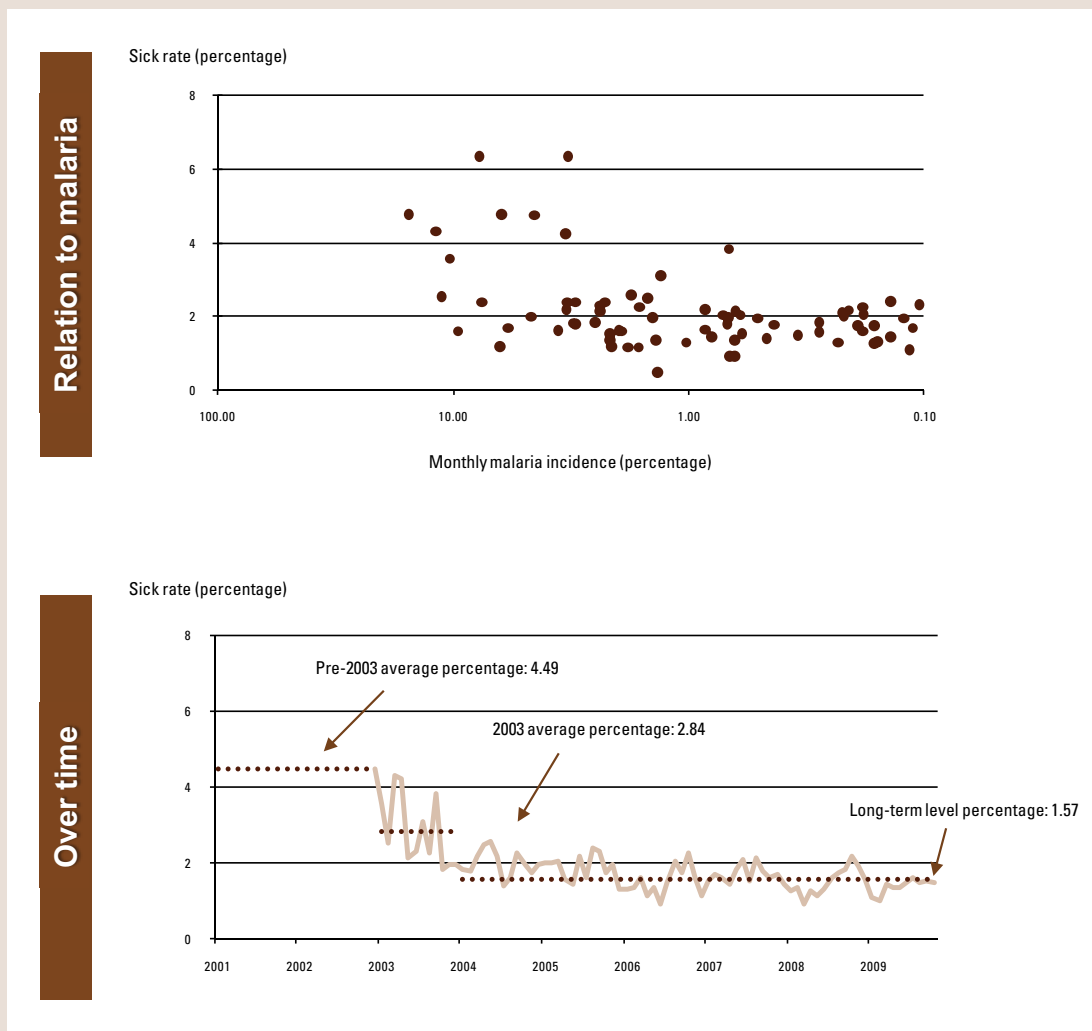
Figure A.9
Absence cost savings at Mopani Copper Mines, Konkola Copper Mines and Zambia Sugar



Sources: Health Management Information Systems, Central Statistics Office, Zambia; company data.

Zambia Sugar collected detailed absence data that allowed for a further plausibility check. As displayed in Figure A.10, the rates of absence (sick rates) were indeed positively correlated with malaria incidence and the reduction in malaria coincided with a reduction in absence. Over the past decade, all-cause sick rates appear to have fallen by nearly two thirds, converging towards a long-term level of 1.57%.

Figure A.10
Sick rates (average daily absence due to malaria illness) at Zambia Sugar 2001–2009



Source: Company data.

Note: The long-term level is defined through an autoregressive model.



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