



Leading Practice in Malaria Control

A study conducted by Sentinel Consulting,
commissioned by **Rio Tinto** and facilitated by **GBCHealth**



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1. Executive Summary

Recommended interventions for malaria control are well described. However, there is no single blueprint that describes the most effective combination of controls for any given programme. Malaria programmes are as diverse as the societies, geographies and operations in which they are implemented. Moreover, programmes use different strategies (tactics, philosophies, techniques) for implementing their interventions.

This study compares and contrasts implementations of malaria interventions across different businesses and regions, with the purpose of highlighting and sharing leading practice from different contexts. Analyzing data from 18 programmes run by ten different companies, the report presents quantitative data to provide a broad visual benchmark of corporate malaria control programmes. Programmes were judged successful if they showed evidence of:

- effectiveness in terms of reduced prevalence and/or incidence of disease
- a drive for continual improvement
- managers actively seeking new solutions

Common features of successful programmes

Successful, vibrant programmes, regardless of their setting, size, maturity, budget and effectiveness in absolute terms, showed several features in common.

1. Management team composition and remit

The more successful programmes were managed by well-resourced, highly skilled teams of specialists. Managers had access to internal or external, shared or dedicated specialist physicians and entomologists for advice and support. The programme managers were usually responsible for a narrow remit: often their responsibilities for malaria formed a part of a wider vector-borne or infectious disease role, but these individuals were usually not responsible for wider health programmes such as non-communicable disease or safety.

2. Corporate management support

The relationship between programme managers and corporate health managers predicted the success and vibrancy of the programme. Managers of successful programmes often reported strong support from the company's corporate health managers (or medical directors): the corporate health managers ensured that programme managers had everything they needed, and advocated on behalf of the programme's needs. Where the same corporation had more than one programme, the corporate manager coordinated provision of shared resources.

3. Communication and relationships within and outside the organisation

The most successful programmes had evidence of excellent communication and relationship building between managers, specialists, corporate management, the workers, their dependents, government and other stakeholders. Custodians of the most successful programmes consistently reported the need to consult and cooperate with a wide variety of stakeholders from an early stage in programme development. The most successful programmes guided and assisted government malaria control strategy and implementation, not *vice versa*. Programme managers reported different political obstacles to be negotiated, from philosophical disagreements regarding end-user contribution to healthcare costs, to differential targeting of voters' constituencies with government healthcare funding. However the benefits of wider cooperation, in their minds, outweighed the efforts required to facilitate it.

4. Healthcare delivery

The model of broader healthcare delivery had a major impact on malaria controls. Organisations with dedicated medical facilities (from clinics for large sites to paramedics for small exploration teams, or local volunteer malaria workers in the community) had direct channels for:

- Assessing current levels of awareness and knowledge
- Evaluating healthcare seeking behaviour
- Recording case numbers

- Accurate diagnosis and effective treatment
- Investigating cases thoroughly
- Following up cases with personalised education and ITN distribution

In contrast, many programme managers without such company-sponsored facilities cited workers and their dependents seeking healthcare independently as a major challenge to the success of their programme.

5. Earning the right to influence behaviour

Healthcare delivery models not only affected the ability of the programme managers to know what was going on within their target populations, but also appeared to influence the healthcare seeking behaviour of that population, and bolster the organisation's "right" to change behaviour. Interviewees reported that where companies had committed to providing healthcare for employees, their families and the wider communities, those people became engaged in looking after their own health, in the knowledge that they were empowered and supported to do so by the company.

6. Justifying the cost

Managers of successful programmes invariably reported that the return on investment in malaria controls was very positive, particularly in high transmission areas, acting by reducing employee sickness and also reducing absenteeism to care for sick dependents. Yet managers of successful programmes found that programme rationales based on a corporate social responsibility agenda were more intuitive, easier to argue and had more weight than a "traditional" workforce-based argument.

7. Planning, monitoring and review

The most vibrant and successful programmes all had strong review processes built into a long (e.g., 5-year) and short (e.g., 1 year) term planning cycle. Common features were:

- Planning phase input to ensure that engineering controls are built in to the construction of the site
- Evidence-based approach with thorough Health Impact Assessment, baseline studies, prevalence and vector surveys prior to operations
- Annual planning, involving all key stakeholders and 5-year planning, defining broad strategy and outline budget
- Annual review, including assessment of internal key performance indicators against targets, annual prevalence surveys in local schoolchildren and/or household surveys and annual (or more frequent) entomological surveys
- Systems for case reporting from in-house and community medical facilities

Recommendations

To run the most successful malaria program, companies should ensure that they meet the following conditions:

- The malaria programme manager has access (on staff or contractually) to highly skilled specialists
- Programme managers are given a narrow (realistic) remit—limited, for example, to vector-borne or infectious diseases rather than including comprehensive health or safety
- Central corporate medical directors/health managers see it as their role to support and advocate for the programme managers, providing them with the conditions for success
- The company aspires to excellent communication and collaboration within and outside the organisation
- Where possible, the company delivers healthcare services directly rather than indirectly via referral. Use of company health facilities makes it much easier to ensure accurate diagnosis and treatment, assess awareness and knowledge levels, record case numbers and provide effective follow-up
- The malaria programme is part of a comprehensive company healthcare approach that "earns the right" to change behaviour in the eyes of the community it cares for
- Managers justify investments in the programme as an expression of corporate social responsibility and not simply with a traditional workforce-centric (productivity-based) argument
- Company leadership makes the effort to incorporate high-quality planning, monitoring and review

2. Introduction

Following on from *Benchmarks for Malaria Prophylaxis in the Mining and Oil Industries* conducted by Sentinel Consulting, GBCHealth and Rio Tinto published in February 2011, this follow-up study highlights and shares leading practices in the *implementation* of malaria control policies.

Malaria is recognised not only as a disease that inflicts terrible human suffering on its millions of victims every year, but also as a threat to business in endemic countries.¹ Sachs and Malaney (2002) estimated that the economic losses due to malaria deaths and the disabling, chronic recurrence of severe disease amount to \$12 billion a year across Africa. These losses occur through multiple channels, including effects on worker productivity, absenteeism, premature mortality, medical costs, fertility, population growth and saving and investment.²

Children under five, pregnant women, people with weakened immune systems and people who normally reside in a non-endemic area are at particular risk. However even those who have developed semi-immunity through growing up and living for many years in an endemic area are affected – not only by the (usually) non-fatal forms of the disease to which they remain susceptible, but also through the impact of caring for their dependents.

Recommended interventions for malaria control are well described. However, there is no single blueprint that describes the most effective combination of controls for any given programme – one size does *not* fit all. Moreover, programmes use different strategies (tactics, philosophies, techniques) for implementing their interventions. The variation depends on several factors, such as:

- The malaria situation – local prevalence, malaria species, seasonality, vector behaviour, resistance
- The nature of the exposure – for example, a mine site or plant, business travellers, exploration teams
- Infrastructure – for example, medical facilities, staff living arrangements
- Climate, geography, accessibility and population characteristics
- Coordinating with and reinforcing government and NGO programmes
- Length of time operating in the location in question and the project's anticipated lifespan
- Budget and personnel available for policy implementation
- Local resources and logistical challenges

This study finds examples of highly effective implementations of malaria prevention interventions and identifies common characteristics. In addition, commonly encountered challenges are identified, and examples are presented of the most effective and/or innovative solutions to these challenges found by study participants.

3. Methods

An online questionnaire was developed, quizzing the respondent on the context of their malaria control programme, governance and collaborations, interventions in place and challenges encountered.

Candidate companies that might participate in the survey were identified and recruited by GBCHealth (formerly the Global Business Coalition on HIV/AIDS, Tuberculosis and Malaria) from amongst its membership. Representatives from eighteen programmes from ten different companies completed the questionnaire (table 1). Sixteen respondents consented to follow-up interviews.

Interview notes were sent to the interviewee for review before inclusion in the study results. The survey and interview results were analysed to provide quantitative and qualitative indicators of interventions in place. Elements of programme design or implementation that are commonly problematic were identified, and different solutions adopted by programme managers presented.

¹ Corporate Alliance on Malaria in Africa (2009), Company Management Guide. Implementing an Integrated Malaria Control Programme. Available at: <http://www.gbchealth.org/files/reports/CAMA%20Company%20Management%20Guide-Malaria%20Final%20document.pdf> Accessed 30 May 2012.

² Sachs J & Malaney P (2002) Review article: The economic and social burden of malaria. *Nature* 415, 680-685 (7 February 2002) doi:10.1038/415680a.

Sector	Number of sites or projects	Total number of employees on these sites	Comment
Mining	6-10	>5000	
Mining	2-5	>5000	
Mining	6-10	1001-5000	
Mining	2-5	1001-5000	
Mining	1	1001-5000	
Mining	2-5	501-1000	
Mining	2-5	501-1000	
Mining	1	501-1000	
Mining	2-5	101-500	
Mining	1	101-500	
Mining	6-10	<100	
Mining	2-5	<100	
Oil and gas	11-20	>5000	
Oil and gas	1	>5000	
Oil and gas	2-5	1001-5000	
Chemicals	n/a	<100	Programme for the protection of business travellers visiting Sub-Saharan Africa
Chemicals	n/a	n/a	Company involved in malaria control programmes across the extractive industries
Agriculture	2-5	1001-5000	

Table 1: Survey respondents by sector, number of projects/sites and size of workforce at these projects/sites

3.1 Geographic context

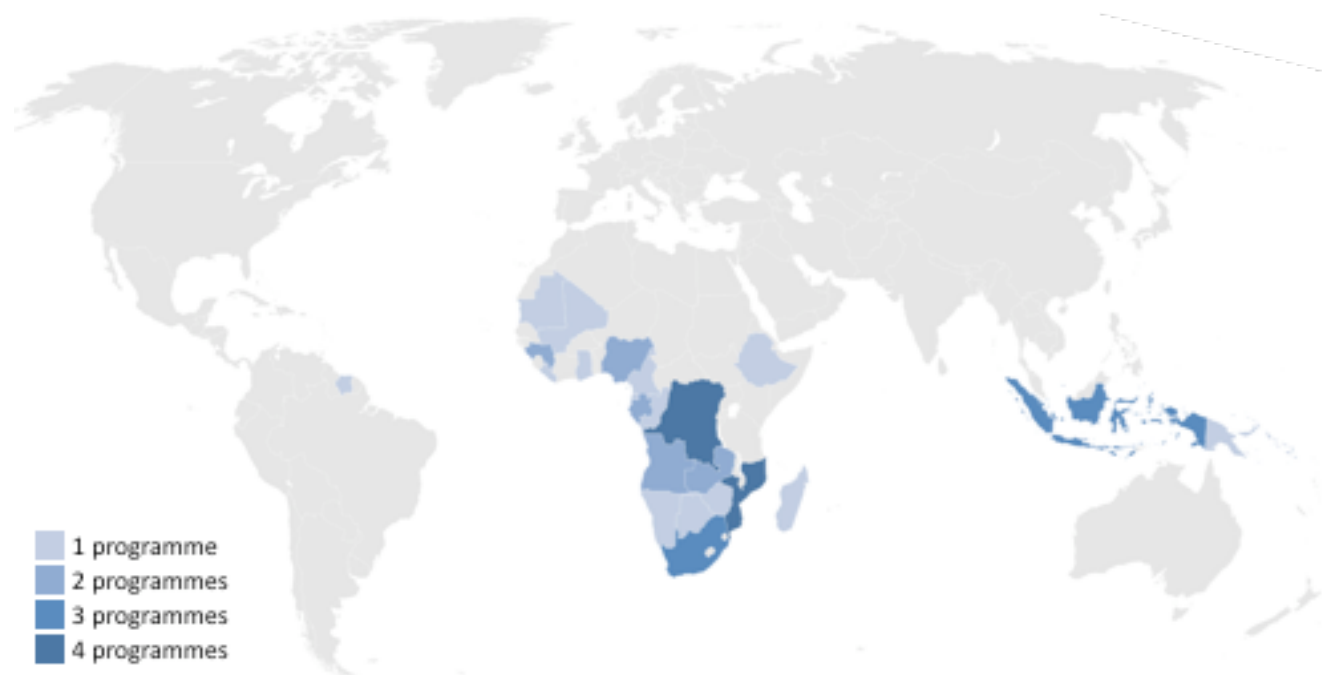


Figure 1: Geographic context of survey responses

Respondents were asked to list the countries in which they were involved with implementing a malaria control programme. Figure 1 shows the geographic spread of the programmes, and the number of responses relating to each country.

2.2 Data reporting

Quantitative and qualitative data are reported. Where quantitative data are provided the denominator is the total number of programmes for which the given measure could have been applied. For example, if it would not be possible or applicable for a programme to implement a particular intervention this programme is disregarded for this measure and the denominator value is reduced by one. Denominator values therefore vary from measure to measure.

The charts are 100% stacked columns, where each column is of equal length and represents 100% of the sample. The numbers given on the bars are the absolute values – the sum of values on each column equals the denominator for each measure.

A warning about interpreting the graphs

The quantitative data do *not* represent a score with some nominal pass mark. Different programmes have different reasons for implementing or not implementing various controls, and for organising their programmes in different ways. In some programmes lack of implementation of a particular control may be a deliberate tactic, and in others implementation may be the next stage of developing the programme. The graphs are presented to give a broad visual benchmark across many programmes.

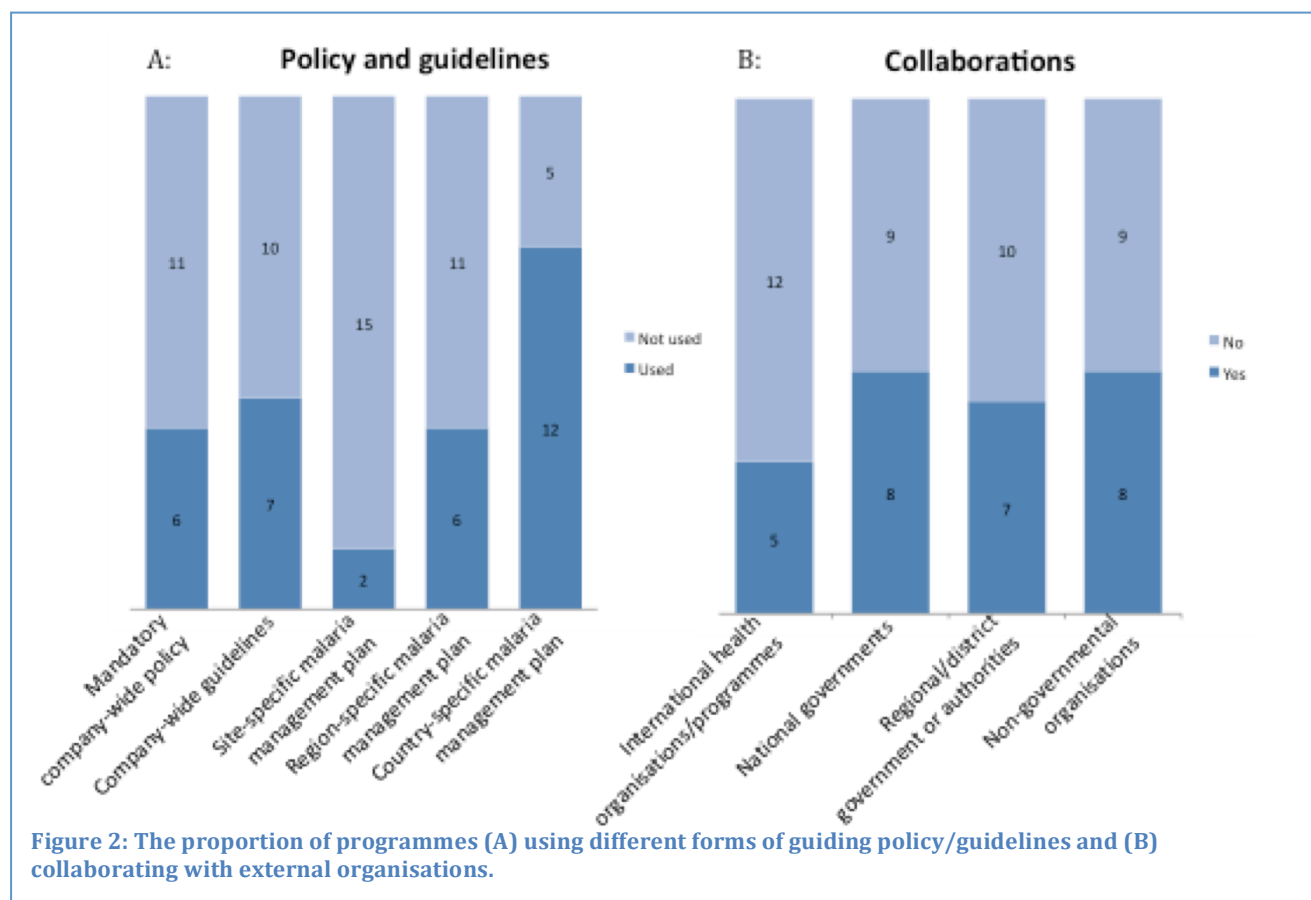
2.3 Limitations

Respondents did not necessarily hold equivalent positions in each participating organisation. There were variations in company size, sector and operating locations as well as in the level of seniority and role of the responding individual. Where possible, the respondent was asked to use one programme as an example to illustrate the area of implementation being discussed.

Participants self-selected and information was self-reported.

4. Results

4.1 Programme management



Policy and guidance

Mandatory company policies for malaria control were not widely used. Where present, they outlined a broad expectation of the end results expected from malaria control programmes. As such, programme managers were universally autonomous in the selection and implementation of their interventions. Guidelines were often available on a global, regional or country scale to aid their programme design.

Team and management structure

Each organisation had a different structure to their programme management, with variations in the exact specialist roles, whether the individual was an employee or contracted, and the number of programmes supported by each specialist. A few organisations combined some of the roles as described here. Despite this variation, some generalisations can be made, as follows (figure 3).

Programme managers were usually supported by a specialist infectious diseases physician and an entomologist, either in-house or contracted. Some programmes employed a specialist malariologist as programme director. Most programmes made use of both internal and contracted management staff. Some programmes were entirely outsourced.

The role of the company's health lead (corporate medical officer) was often described as supportive to the programme managers in their liaison with corporate and/or business unit management. Should a programme manager need practical or political support, new tools or resources or extra budget, the health lead's role was to liaise with the appropriate management to facilitate the requirement, or, for tools, commission work directly.

Programme managers would often report to a Medical Director (physician), who would report to the site or project HSEC lead.

In addition, programme managers often made use of community specialists, usually internal to the organisation, to engage the wider community in malaria control programmes. Maintenance or site safety teams were engaged for daily tasks such as puddle elimination and maintenance of screening.

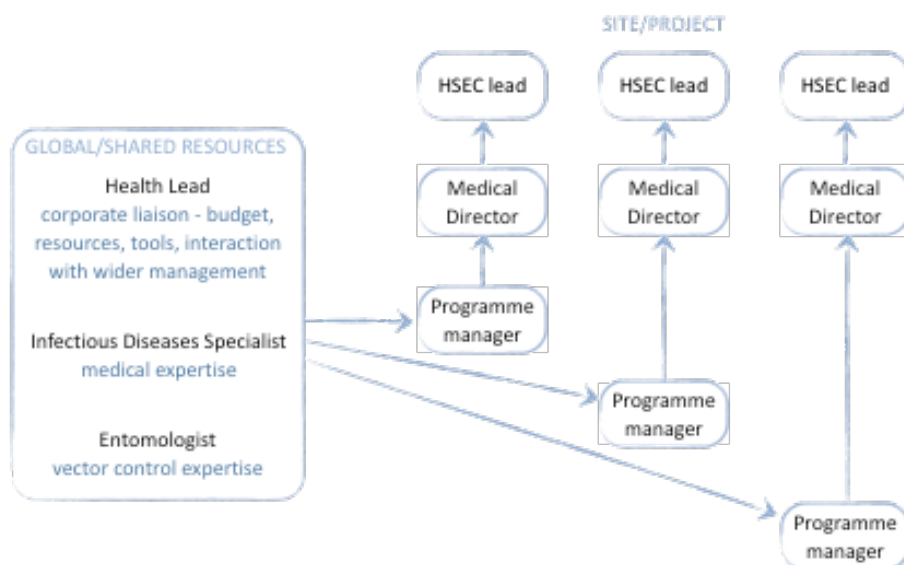


Figure 3: Programme management structure

Three projects effectively split community malaria control away from site controls, with close liaison “across the fence”. In two of these cases the community programmes took the lead, passing advice and recommendations back to the site programmes as necessary. Two corporations with multiple business units structured their malaria control programmes so that malaria prevention for business travellers was a programme in its own right (see figure 4).

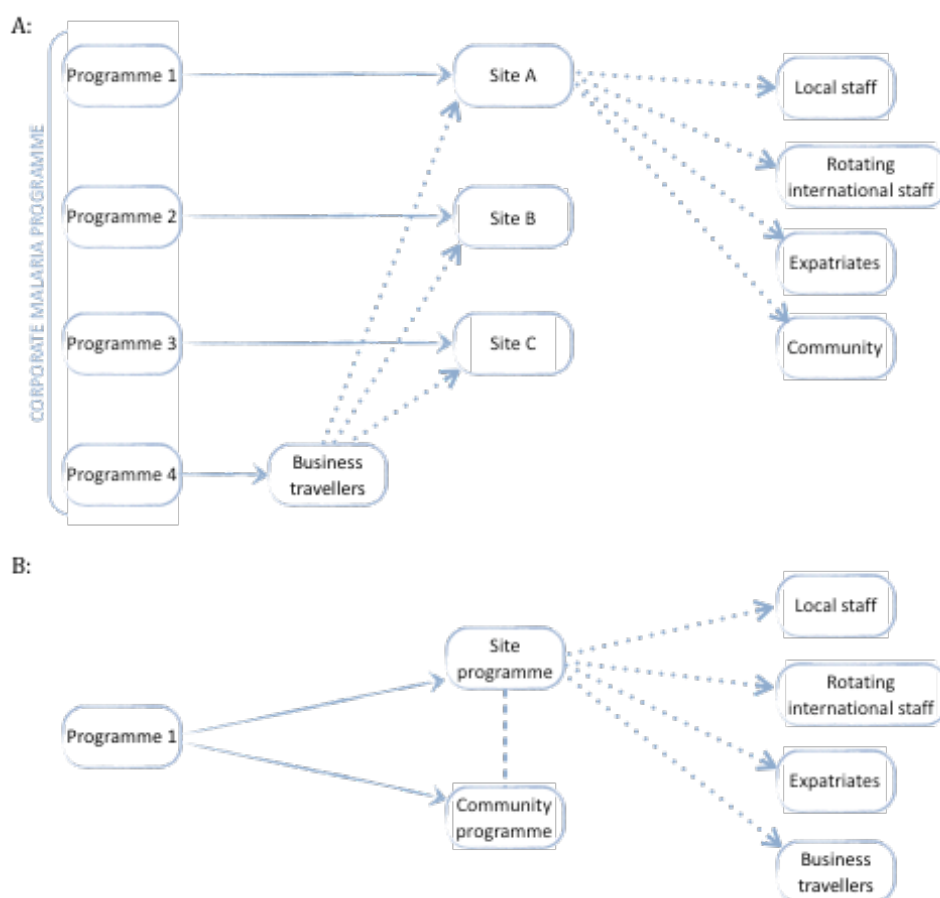


Figure 4: Programme remits. (A) Some corporations had a separate programme for business travellers. (B) Some programmes separated site and community programmes. Some programmes shared features of both (A) and (B).

Collaborations

Most programmes collaborated or coordinated their efforts with international agencies, governments and/or non-governmental organisations. The nature of the relationships between the stakeholders varied – some programmes acted as advisors, some acted in partnership, some used their services, some just co-existed.

Avoiding dependence and building capacity

Cooperation with government was often cited as essential for programme success, but several companies expressed concern that they neither should nor could take over the role of government in protecting the general population, particularly with regards to funding of national malaria control programmes. There were several approaches:

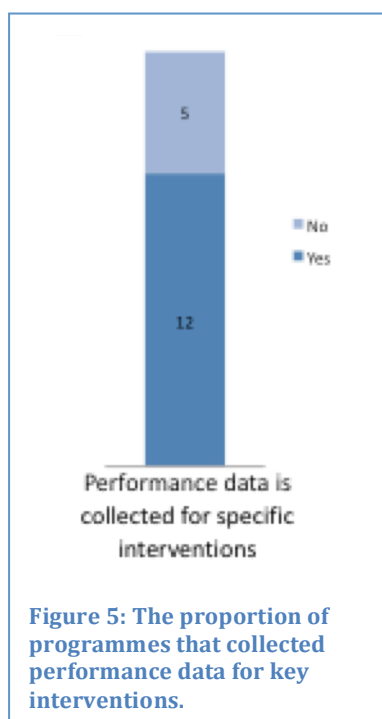
- Build a technical agency which attracts funds from its corporate creator, government and international funding agencies – capacity building/handing back to government can be built into the remit of the agency, and from the outset the agency is not entirely dependent on the corporation as the only source of funding.
- Draw clear lines in the sand – the corporation defines clearly what it will and will not fund/do, usually in terms of employees/non-employees and/or geographic areas. The problem with this approach is that if government efforts fall short of what would ideally be in place, the corporation suffers the effects.
- Provide technical, logistical and/or training expertise to the government programme, but no funding. A programme encountered in this study that used this approach found itself increasingly pressured to maintain its support function for longer than initially envisaged due to uncertainty of the government's future funding sources.
- Provide support to specific organisations or efforts, coordinated via the government. For example, providing education and Insecticide Treated Nets (ITNs) for the country's army. Army personnel then disseminate these efforts across the country when they return to their own communities.

Programme evaluation and monitoring

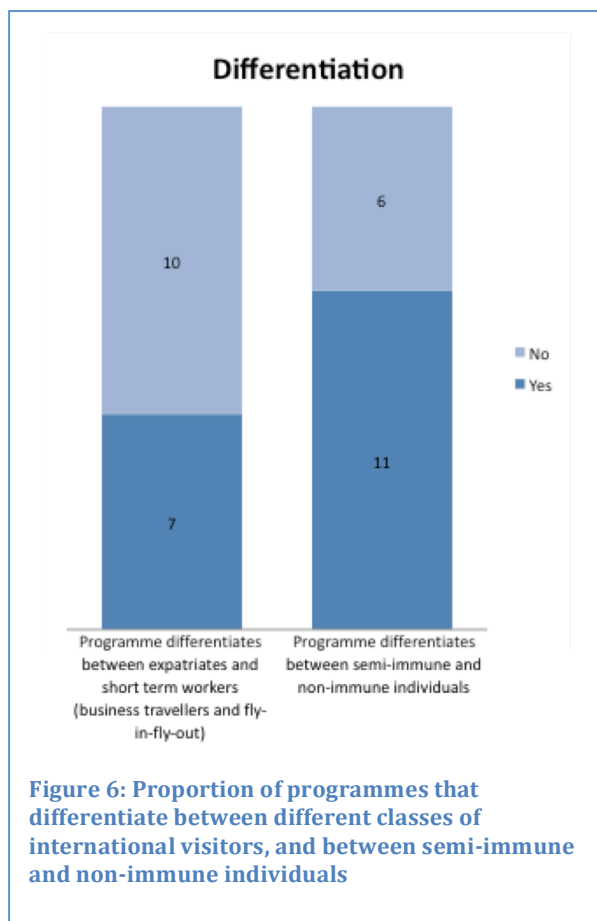
Many respondents identified programme evaluation as critical to ensure continual improvement. Moreover many respondents were mindful of the changeable nature of the malaria threat, resistance, and environmental and demographic changes as key reasons to be fully informed of programme performance.

Most programmes collected key performance indicators for some or all of their interventions and most had a systematic review process combining continual and periodic programme assessments. Some programmes called upon external experts to comment on the findings of their internal reviews.

Some larger programmes had extremely sophisticated systems feeding epidemiological data back into day-to-day programme management decisions, as well as longer-period reviews.



Programme definitions



Whereas some programmes differentiated between short term visitors (staff on rotation or business travellers) and long-term visitors (expatriates) there was rarely any evident consequence to this differentiation in terms of the interventions applied to each group.

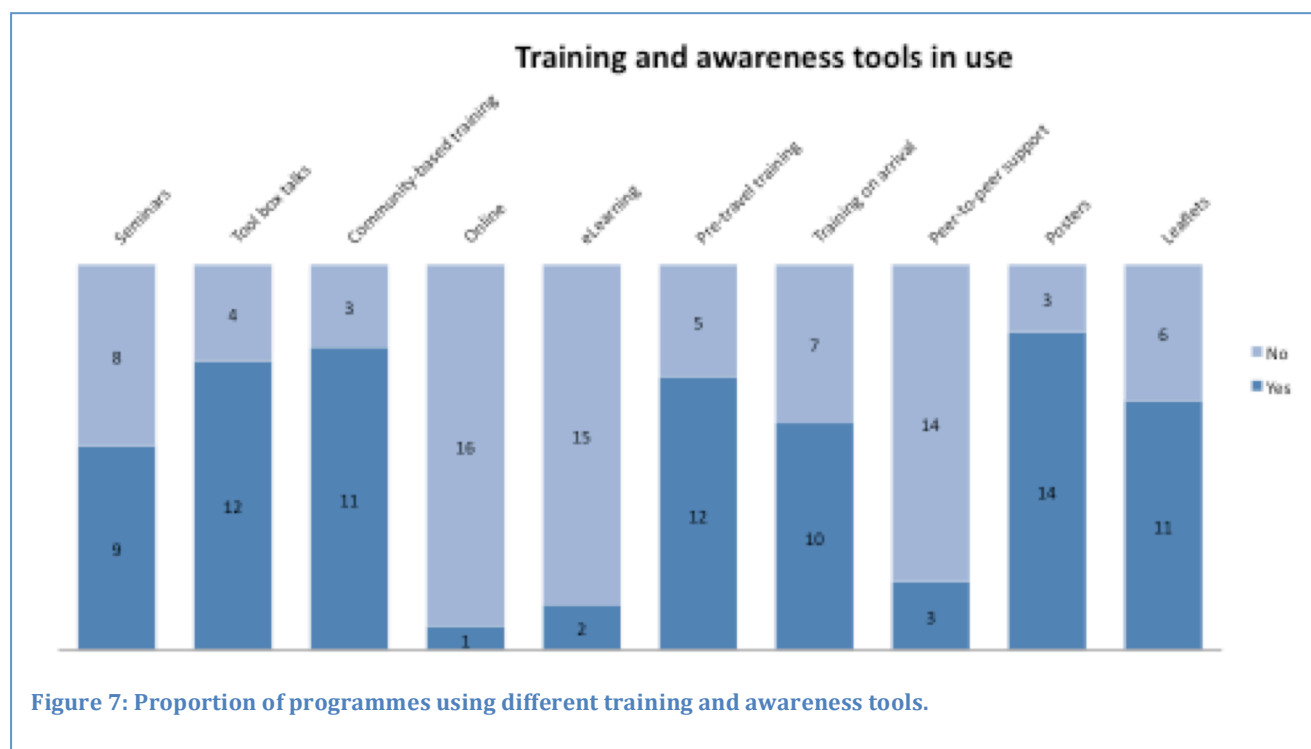
Many policies differentiated between semi-immune and non-immune individuals. This differentiation was used to inform:

- Selection of training and awareness tools
- Chemoprophylaxis requirements
- The patient's (and the clinician's) index of suspicion

There was no consistent definition of semi-immunity. Most programmes defined a semi-immune individual as someone who had been born and brought up in an area with similar malaria risk as the area in question, but did not define that more specifically. One programme defined all expatriates, whether from a malaria endemic country or not, as non-immune. One confined semi-immune status to natives of one particular part of the country only. Most definitions also included a reference to losing semi-immunity if an individual leaves their country of birth for a period of 12 months or more or becomes pregnant.

Most programme managers acknowledged the difficulty of providing a specific and sensitive definition and where there was doubt as to an individual's likely immune-status, a judgement was made by a clinician on a case-by-case basis.

4.2 Training and awareness



Workforce

Education for the workforce was usually a continual process, with some programmes increasing their efforts in line with seasonal peaks in transmission or according to epidemiological forecasts or surveillance data. Most programmes trained local staff through tool box talks and/or seminars and by inclusion of malaria in site inductions. Tool box talks sometimes covered a malaria-related topic on a weekly basis. Seminars were often delivered annually.

International staff were all subject to some form of pre-departure training. The delivery platform ranged from one-on-one education via clinic appointments through to online or eLearning, or being emailed an information pack. Business traveller programmes sometimes integrated raising a requirement for malaria education with travel bookings.

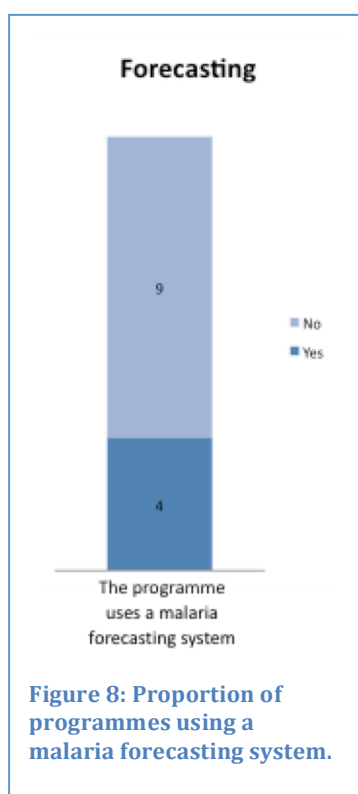
Training on arrival was usually a part of site induction, although one programme included malaria training in the welcome given by the in-country travel team. One programme also routinely included training on departure for expatriate families.

Community

Most programmes made use of community specialists to deliver training to the local community in effective and culturally appropriate ways. The programme manager's role here was to ensure that the technical/medical input was accurate, and that the goals of the engagement were clear to the community team. Delivery mechanisms included:

- Engaging community leaders in conversations surrounding the programme
- Asking community leaders to nominate volunteer community champions who are trained in peer education
- Radio campaigns
- Educational theatre
- Culturally appropriate literature, cartoons, story boards and flipcharts
- Education provided by spray teams during IRS operations
- One-on-one counselling following case detection at the clinic
- Education via antenatal clinics

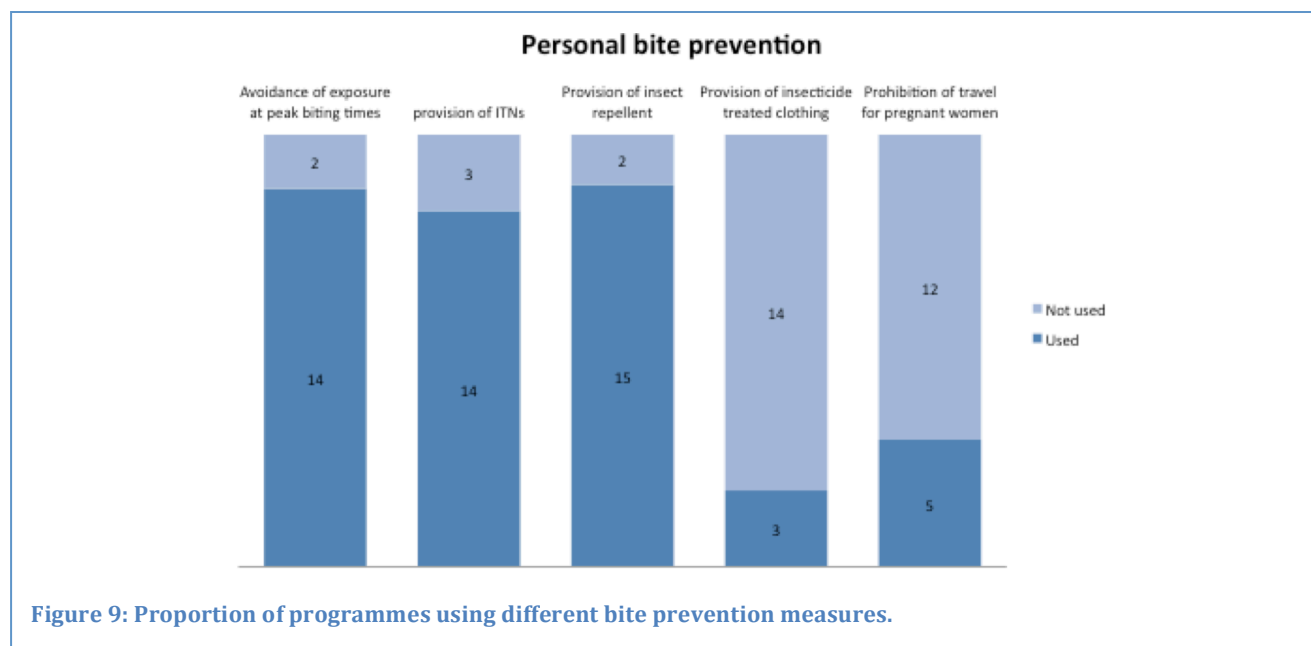
One programme subsequently reviewed and improved materials with feedback from specially convened focus groups of users and healthcare providers.



Forecasting

Forecasting systems, where present, were used to ensure that interventions were stepped up in anticipation of increased malaria threat. Sentinel surveillance was most frequently used; long-range forecasting and vector susceptibility mapping were also employed.

4.3 Bite Prevention



Most programmes distributed insecticide-treated nets (ITNs) to workers, their families and in many cases the wider community. There were generally two strategies for distribution, running in parallel:

- Continuous ad hoc distribution
 - To clinic attendees
 - On arrival on-site or in country
 - As requested
- Mass distribution events, often coordinated with World Malaria Day

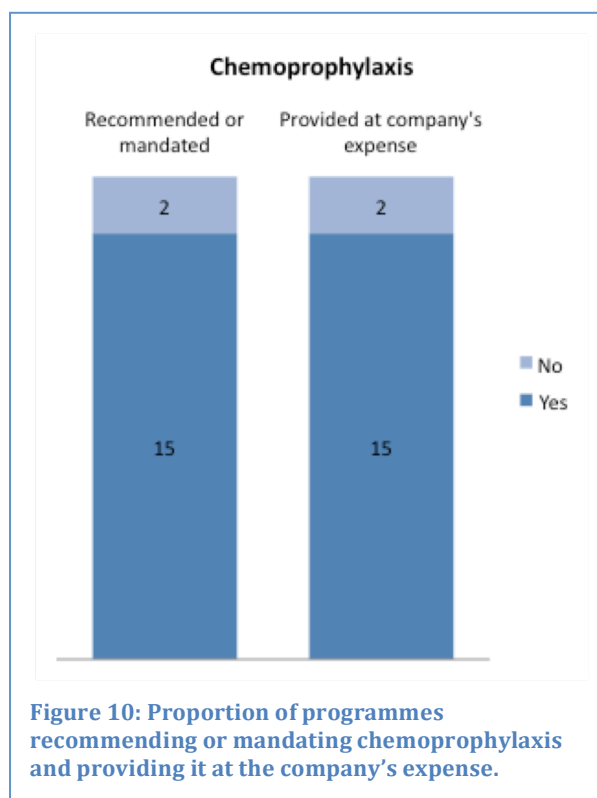
Several programmes commented that their own logistics chain was superior to that of the Ministry of Health in their country. No programme repaired or retreated nets in preference to replacing them. One programme had a close relationship with a bed net manufacturer, and was used by the manufacturer for field trials of new products. One programme, in addition to replacing nets, regularly retreated nets on-site every three months.

No programme reported issues with compliance to insect repellent use or preference for one product over another. DEET-based repellents were widely used and accepted.

Avoidance of exposure at peak biting times was a widely adopted strategy, and many programmes required long sleeves and trousers as routine. Some programmes coordinated meal times indoors with peak biting times. Many interviewees reported that “covering up” was strictly enforced and that there was good compliance.

Some programmes reported that prohibition of travel to malaria endemic areas for non-immune individuals during pregnancy was perceived as discriminatory. The programmes with the most success with this policy were those where individual consultations with a physician occurred routinely prior to travel.

4.4 Chemoprophylaxis



Almost all programme managers cited chemoprophylaxis as the single most important intervention for non-immune individuals. No programmes currently measured compliance. In general, programme managers felt that compliance to chemoprophylaxis recommendations was good for business travellers on short trips, but sub-optimal for rotating staff (fly-in-fly-out) and expatriates. It was generally felt that compliance in rotating staff and expatriates was initially good, but dropped off according to the length of stay. The main reasons cited were:

- Mistrust of the safety of long-term use (misinterpretation of relative risk of chemoprophylaxis vs. contracting malaria).
- “Herd behaviour” (or “no-one else is taking it, why should I?”)
- Unpleasant side effects
- Vector control efforts being so successful and cases so infrequent that the risk of transmission is perceived to be minimal

Where compliance was reported to be universally poor, the most frequently cited reason was lack of support

for the policy by senior managers. A cultural opposition to one’s employer dictating one’s medical choices – or even having any input into “personal” medical decisions – was cited by three programme managers.

There were two broad approaches to improving compliance:

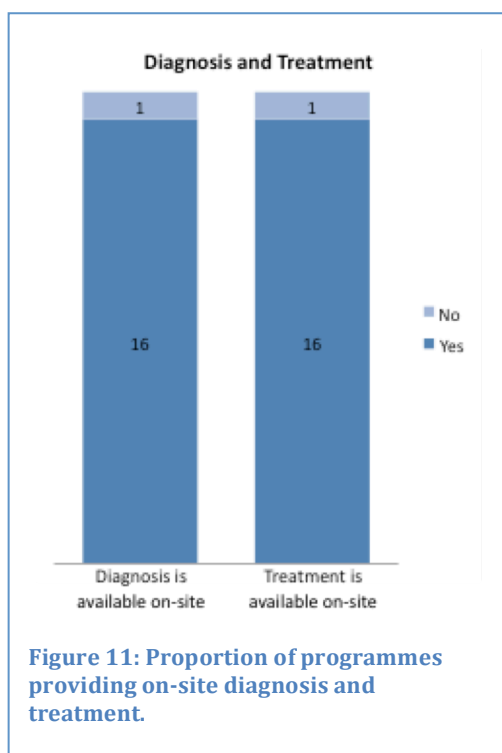
1. Mandate its use. Where the individual is unwilling to comply, they are relocated to a non-malarial area. This strategy was adopted by two programmes.
2. Accept that chemoprophylaxis will be unpopular for long-term use and ensure there is:
 - Focussed education with the opportunity for detailed discussions with a physician, in order to dispel the common myths and demonstrate the evidence base for the relative safety of long-term chemoprophylaxis compared to risk of disease – individuals are then at least making an informed decision;
 - Medical review and the option to switch to an alternative medication readily available;
 - Extra effort to ensure that bite prevention and vector control interventions are rigorously applied;
 - A high index of suspicion so that individuals seek medical advice early in response to illness.

Most programmes ensured that individuals were able to acquire chemoprophylaxis easily, without having to reclaim expenses or visit a pharmacy.

One programme manager reported that a particular team of locally employed workers had had a particularly high incidence of malaria due to the nature and location of their work, and as a result the entire team had been recommended chemoprophylaxis, regardless of their probable semi-immunity.

3.5 Diagnosis and Treatment – Healthcare Delivery

Many of the interventions, but particularly the method of implementing immediate diagnosis and treatment, were closely linked to the general methodology for the provision of primary care to the workforce, their dependents and the wider community. This in turn was linked to the arrangements for accommodating the workforce. There were, broadly, five delivery methods that were not mutually exclusive, each with its own intrinsic benefits and drawbacks (see table 2).



Different projects chose different combinations of these delivery methods, primarily associated with the nature of their operation and the expected longevity of their presence. One programme issued self-diagnosis and treatment kits for use under the supervision of an on-line doctor where employees were likely to be in remote locations away from professional medical assistance.

Programmes that supported local medical services did so through close liaison with government. There were two models for provision of this support:

- Support through the existing network of public clinics – provision of technical, logistical, financial and/or training support;
- Training and support for volunteer community malaria workers, working in villages not serviced by public clinics.

One programme used diagnosis and treatment as its key component, employing an Early Diagnosis and effective Treatment (EDAT) strategy using trained community volunteers in every village from which local workers were recruited. This strategy is described further in section 4.2 below.

Returning travellers

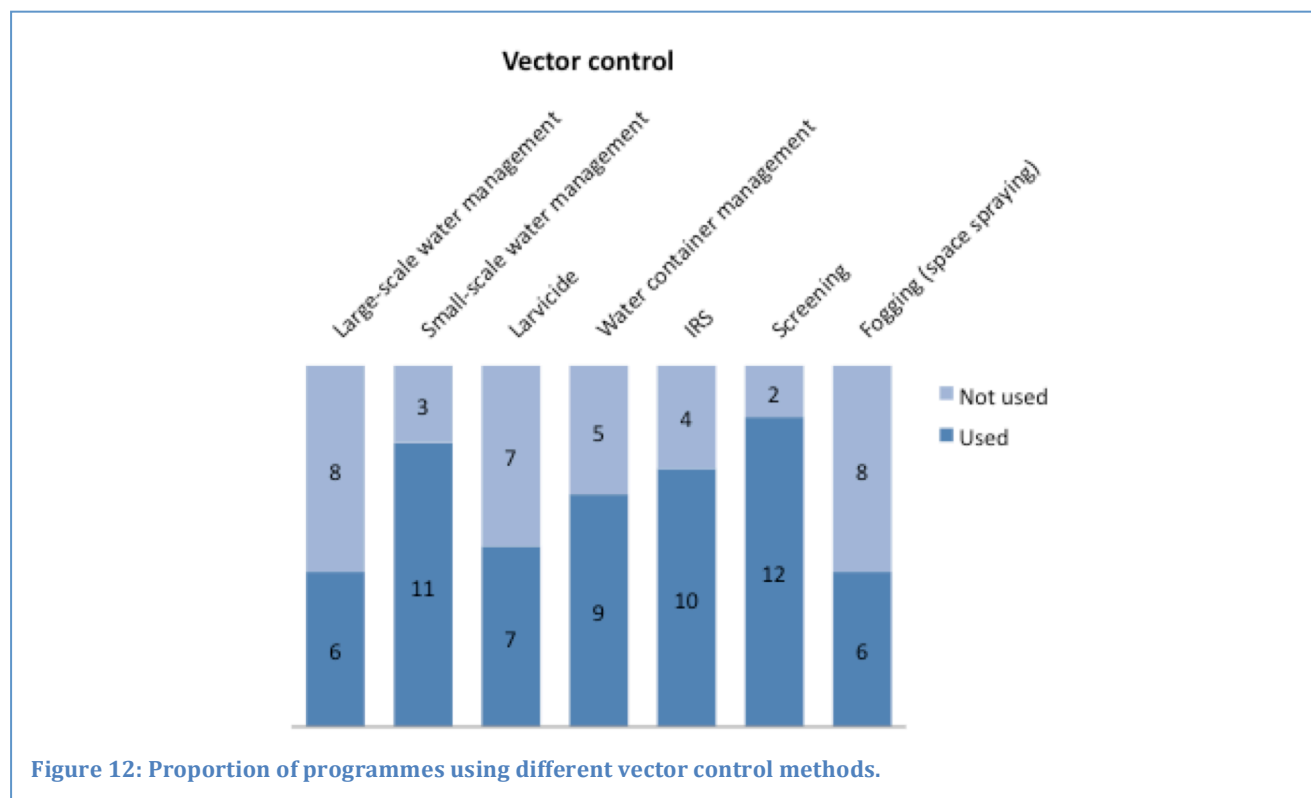
Many programme managers highlighted the situation of an individual returning to a non-endemic country following a visit or stay in an endemic area as having a risk of sub-optimal case management due to an inappropriately low index of suspicion of malaria by doctors unfamiliar with the disease. Mitigation strategies included:

- A company-wide 24-hour malaria hotline linking the individual or their next of kin directly to an in-house malaria specialist who could advise the treating physician;
- Routine post-travel questionnaires and consultations and direct access to the company health director for advice;
- Only allowing individuals to use one of a pre-selected list of specialist travel clinics during a defined period following their return to a non-endemic country, no matter what their presenting complaint;
- Daily check-in with a manager for a defined period on return;
- Issuing all returning individuals with a credit-card sized “note to attending physicians” advising them of the holder’s malaria risk and the appropriate diagnostic steps;
- Including the risk of sub-optimal case handling by physicians in non-endemic countries in malaria awareness training.

Table 2: Advantages and disadvantages of different methods of healthcare delivery to workers, their dependents and the wider community. Methods were not mutually exclusive

Healthcare delivery	Advantages	Disadvantages
On-site clinic providing care to workers	Control over services provided and quality of care; good case reporting and review possible; follow-up education and tailored intervention plans possible.	Cost; site must have a long anticipated production time to justify investment; no service to wider community or dependents therefore no protective effect of reducing community prevalence; no wider CSR benefit.
Company clinic(s) servicing dedicated workers' village(s)	Control over services provided and quality of care; good case reporting and review possible; follow-up education and tailored intervention plans possible; workers' dependents also cared for; potential to reduce prevalence in both work and home settings; some CSR benefit.	Cost; site must have a long anticipated production time to justify investment; no service to non-employee community therefore no protective effect of reducing wider community prevalence; CSR benefit does not extend to population at large; only practicable if dedicated workers' villages exist.
Health insurance scheme so that workers +/- their dependents used local state or private medical facilities at the company's expense	Minimal overhead costs; workers' dependents may be cared for; provides care where workers and their families are spread amongst a non-employee community; some CSR benefit.	Case reporting and review may not be possible; variable control over ancillary services e.g. follow-up education and tailored intervention plans; no service to wider community or dependents therefore no protective effect of reducing community prevalence; no wider CSR benefit.
International health assistance service for business travellers	Business travellers have facility to seek immediate advice and local care when required, regardless of their location; good quality advice is guaranteed and care provision pre-vetted; language issues circumvented.	Case reporting and review often not possible.
Support for local medical services (financial, technical, logistical, training)	Reaches wider non-employee community and has the potential to decrease local prevalence; suitable for inaccessible communities; good CSR benefit; lessons learned may be replicable across a wide area not directly affected by the site.	Support must be maintained, and services must be self-sufficient by the end of the life of the site; standard of service provision may not ever be as good as an in-house clinic; case reporting and review often not possible; complex liaisons between agencies required.

4.6 Environmental controls



What interventions were selected?

Almost all programmes were built upon vigorous vector control efforts, particularly within the wider community. Vector control was carefully integrated into the wider programme ensuring that efforts were coordinated with education, bite prevention and case management.

Programmes could be placed in one of three categories:

1. Vector control within the site only
2. Vector control within the site and in designated “controlled areas”
3. Vector control efforts both within the site and across the entire community

Vector controls were often different within the site and across the wider community. On-site controls included tight controls on standing water and water containers, larvicide use, indoor residual spraying (IRS) and screening. Several programmes also used daily knock-down space sprays, primarily targeting nuisance-biting mosquitoes. One programme included vehicle interiors in this space spraying regime.

Vector controls for the wider community were typically built around IRS.

One highly-successful, mature programme deliberately omitted community vector control efforts, as it was logistically too difficult to achieve high enough coverage in the programme’s area of operation, a remote area with many difficult-to-reach villages. This programme instead was based upon a strategy of Early Diagnosis and effective Treatment (EDAT), using trained community volunteers (see section 4.2 below).

Who actually did the work?

Managers often used safety team workers or maintenance staff to implement day-to-day controls such as elimination of puddles, tyre ruts, etc., building these tasks into their daily routine.

In some smaller programmes these same staff had been trained in IRS, although usually these more technical elements of vector control were sub-contracted to local specialist service providers.

Larger programmes had dedicated malaria control teams, tasked full-time with malaria control efforts, often including activities on-site, in dormitory villages and in the wider community. These larger programmes usually had their own IRS operatives, often trained by the IRS chemical provider.

Entomology and resistance management

During the course of this study, a vector control expert remarked, “where there are entomologists, there is resistance”. It is usually too late to initiate a resistance prevention programme – management of resistance is more important.

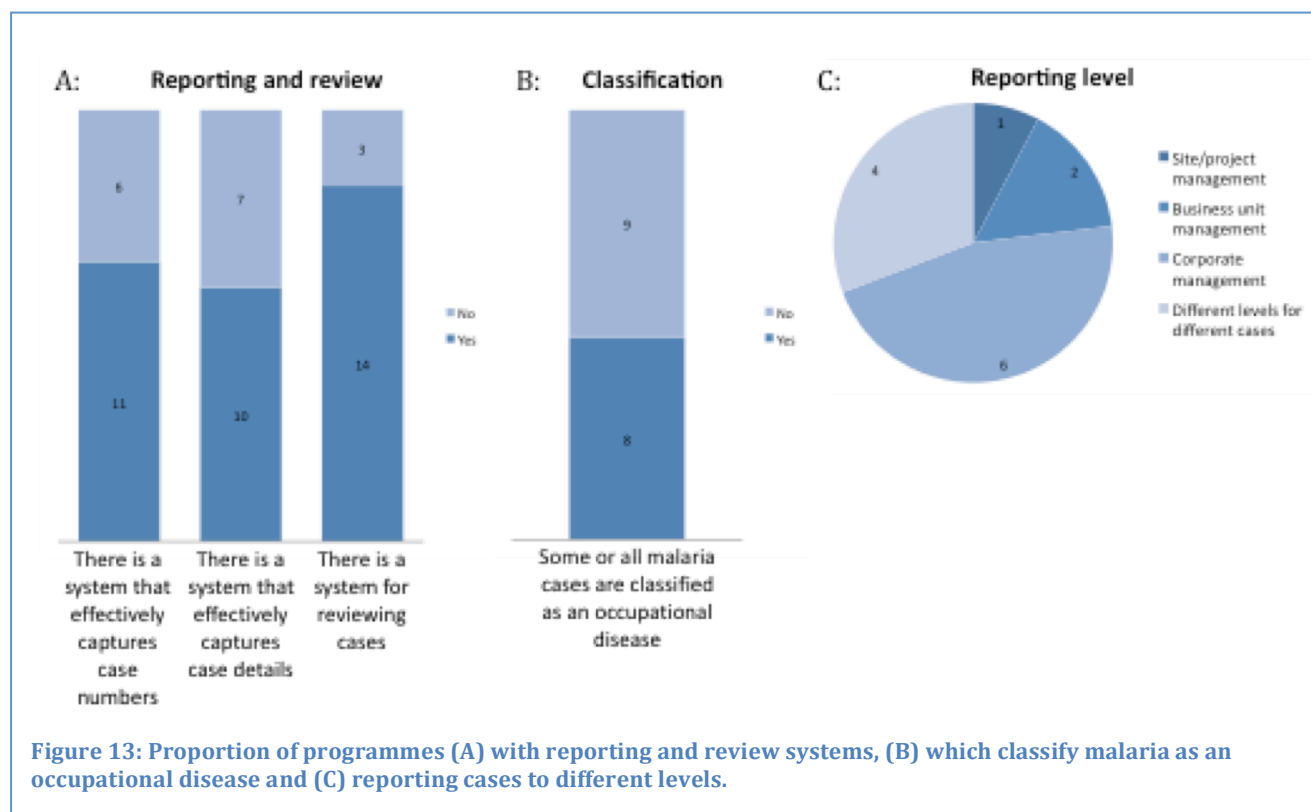
IRS chemicals must be rotated to remain effective, alternating non-cross-resistant chemicals every two to three years. Entomological surveys should be incorporated into the programme from the outset and repeated approximately yearly – the precise schedule will depend on the programme’s context. Tools and resources for effective resistance management are available and will continue to be effective in coming years with the development of new chemical products.

Most programmes had access to entomology expertise to guide the management of these issues. Larger programmes tended to have their own in-house entomologists who were often in overall charge of the daily running of the programme. Smaller programmes usually contracted in entomologists on a regular basis.

Acceptability

Education and information for the recipient populations about vector control operations was regarded as highly important. One vector control expert remarked that combining control of malaria vectors with general pest control (cockroaches, rodents etc.), focussing on increasing living standards, was not only efficient but also tended to increase the acceptability of the interventions.

4.7 Case reporting and review



Case numbers and details were most frequently accurately captured where care was provided by an on-site clinic or community clinic provided by the company. Three programmes had developed effective systems to capture case numbers and details for individuals seeking primary healthcare in independently-run community facilities. In these cases, development of community healthcare was central to the community malaria control programme, and effective reporting and review had been incorporated into the model from the outset.

These programmes used different models for collecting the data – one had sentinel sites with near-real time reporting, and the other collected data and samples monthly for retrospective analysis and verification of clinical diagnosis. Another programme had an informal system of gathering monthly data in return for donating near-expiry drugs and rapid diagnostic tests.

The majority of programme managers felt that accurately capturing case numbers and details to enable review was essential for programme success. One programme manager was informally tracking a positive change in healthcare seeking behaviour associated with increased acceptance of the company's role in providing healthcare for workers, their families and the wider community.

Some programmes were unable to effectively review cases due to the sheer number presenting at their medical facilities. Where case numbers had reduced to a manageable level, cases were invariably reviewed on an individual basis, sometimes with full epidemiological investigation. One programme manager reported a concern that the detailed nature of the review deterred reporting due to a mistaken fear by workers that a malaria case would reflect badly on their personal work history.

Malaria as an occupational disease

Approximately half of programmes classified malaria as an occupational disease. This was always conditional on case investigation determining a high likelihood of transmission having occurred in a “controlled” area where protective interventions were in force, or the case being in a non-immune individual travelling to a malaria-endemic area during the course of his/her work.

The principle reasons *for* classifying malaria as occupational centred on the need to notify cases to senior management and therefore maintaining malaria control as a top priority.

The principle reasons *against* classifying malaria as an occupational disease were:

- Difficulty in ascertaining the location of disease transmission (except non-immune travellers);
- No perceived benefit in the classification – classifying malaria as occupational would not achieve anything, apart from additional paperwork;
- Concern that classifying malaria as an occupational disease would discourage healthcare seeking and reporting, as statistics were linked to performance related pay.

4.8 Future developments for malaria control programmes

Programme scope and management	<ol style="list-style-type: none"> 1. Support to extend the geographic reach of the programme 2. Collaboration with government and NGOs to expand the area of control 3. Financial support for baseline health surveys 4. Access to multilateral funding agencies and other potential partners to assist with community malaria control programmes so that the cost is not borne solely by the company 5. Tools for sophisticated economic evaluation of malaria control programmes 6. Access to global benchmarks and cooperative networks 7. Government commitment to improving local medical facilities and their own malaria control programme, especially with regard to surveillance 8. More support from senior management
Awareness and education	<ol style="list-style-type: none"> 9. Provision of posters and leaflets for improved awareness 10. Tools to increase awareness of larviciding in the local community 11. Expanding resources and tools for education 12. Additional staff to coordinate peer education programmes 13. Developing online training tools and a method of evaluating the effectiveness of training
Bite prevention	<ol style="list-style-type: none"> 14. Increasing the scope of distribution of bite prevention kits
Chemoprophylaxis	<ol style="list-style-type: none"> 15. Studies on risk of long-term chemoprophylaxis 16. Management support for mandatory use of chemoprophylaxis
Diagnosis and treatment	<ol style="list-style-type: none"> 17. Better diagnostic tools and treatment options 18. Research into mass screening and mass drug administration 19. Access to more cost-effective laboratory testing including PCR for diagnosis and ELISA for resistance testing and vector characterisation 20. Improving the availability of malaria rapid diagnostic tests in the local pharmacies
Environmental controls (vector control)	<ol style="list-style-type: none"> 21. Establishing a community-based vector control programme 22. Research into new chemicals for vector control 23. Improving our entomology and resistance management 24. Expanding resources and budget for vector control

Table 3: Answers given to the question "When you consider your next steps in development of your malaria control programme, what tools or resources do you feel you will need?"

Respondents were asked to describe the tools or resources they felt they would need for the next steps in developing their malaria control programmes. Their answers are described in table 3. The most striking aspect of these responses is the wide variety given. Although some responses are similar in sentiment, every programme manager had a unique set of requirements to push their programme forwards.

Most frequently the response related to a managerial or financial consideration. There was a broad desire for support and cooperation, both from internal management and from external umbrella organisations. Some programme managers felt that their main constraint was in the science of malaria and development of more sophisticated or cost-effective tools.

5. Discussion

5.1 Common features of successful programmes

The success of the programme is independent of its size, maturity or budget. Programmes were judged subjectively by the researchers as being successful if there was evidence of:

- Effectiveness in terms of reduced prevalence and/or incidence of disease;
- A drive for continual improvement, and;
- Managers actively seeking new solutions.

Successful, vibrant programmes, regardless of their size, maturity, budget and effectiveness in absolute terms, had several features in common. All of the features described here were evident in more than one of the most successful programmes. However not all of the features were evident in all of the successful programmes.

Management team composition and remit

The more successful programmes were managed by well-resourced, highly skilled teams of specialists. Managers had access to internal or external, shared or dedicated specialist physicians and entomologists for advice and support.

The programme managers were usually responsible for a narrow remit: often their responsibilities for malaria formed a part of a wider vector-borne or infectious disease role, but these individuals were usually not responsible for wider health programmes such as non-communicable disease or safety.

Corporate management support

The relationship between programme managers and corporate health managers predicted the success and vibrancy of the programme. Managers of successful programmes often described their interaction with corporate health managers as being supportive – corporate health managers ensured that programme managers had everything they needed, and advocated on behalf of the programme's needs. If the programme manager required an increased budget, the corporate health manager approached the appropriate budget holder on behalf of the programme manager, even if that budget holder was within the programme manager's own business unit. Where the same corporation had more than one programme, the corporate manager coordinated provision of shared resources.

Communication and relationships within and outside the organisation

The most successful programmes had evidence of excellent communication and relationship building between managers, specialists, corporate management, the workers, their dependents, government and other stakeholders.

One respondent described his regular interactions with business travellers as his "best source of intelligence", providing not only a sentinel population but also subjective opinion on the effectiveness of the entire range of interventions both corporation-wide and on individual sites. Gathering and exploiting this source of information required regular open communication between the respondent and his business traveller community – a large, mobile and widely dispersed group of people. He achieved this through regular presence at education events, informal gossip, formal feedback mechanisms and hard epidemiological data gathering.

Again and again, the custodians of the most successful programmes reported the need to consult and cooperate with a wide variety of stakeholders from an early stage in programme development. The most successful programmes guided and assisted government malaria control strategy and implementation, not *vice versa*. Programme managers reported various different political obstacles to be negotiated, from philosophical disagreements regarding end-user contribution to healthcare costs, to differential targeting of voters' constituencies with government healthcare funding. However the benefits of wider cooperation, in their minds, outweighed the efforts required to facilitate it. Most programme managers felt strongly that a vibrant community programme not only had immediate benefits to the local population but also would confer a protective effect on the workforce via reduced transmission.

The most successful strategies for community engagement and education employed community specialists to find and exploit locally appropriate channels for malaria messages. These channels varied widely.

Healthcare delivery

The model of broader healthcare delivery had a major impact on malaria controls. Organisations with dedicated medical facilities (from clinics for large mine sites to paramedics for small exploration teams, or local volunteer malaria workers in the community) had direct channels for:

- Assessing current levels of awareness and knowledge
- Evaluating healthcare seeking behaviour
- Recording case numbers
- Accurate diagnosis and effective treatment
- Investigating cases thoroughly
- Following up cases with personalised education and ITN distribution

Many programme managers cited workers and their dependents seeking healthcare independently as a major challenge to the success of their programme.

Earning the right to influence behaviour

Healthcare delivery models not only affected the ability of the programme managers to know what was going on within their target populations, but also influenced the healthcare seeking behaviour of that population, and the organisation's "right" to change behaviour.

Where companies had committed to providing healthcare for employees, their families and the wider communities those people became engaged in looking after their own health, in the knowledge that they were empowered and supported to do so by the company. Healthcare seeking behaviour improves when people know that they will be treated well and without prejudice, not only in relation to malaria but also across other health issues.

Several programmes in this study demonstrated that where a company fundamentally provides enough resources to keep staff and their families healthy, they earn the right and influence to change that target population's behaviour in the eyes of that population. The malaria policy is not just papering over the cracks, but is built upon and complements an effective health infrastructure.

Justifying the cost

Managers of successful programmes invariably reported that the return on investment in malaria controls was very positive, particularly in high transmission areas, acting by reducing employee sickness and also reducing absenteeism to care for sick dependents. No programme manager reported detailed quantification of this return on investment.

Several managers of successful programmes found that arguments based upon a Corporate Social Responsibility (CSR) agenda were more intuitive, easier to argue and had more weight than a "traditional" workforce-based argument:

- The reputational benefits of active community programmes, both locally and internationally – providing effective prevention tools, testing and treatment generates a lot of goodwill in the community but is also intuitively "good" in the eyes of shareholders;
- Ensuring that there was solid evidence of the company's responsible actions (e.g. decreased local prevalence of malaria) in case of a challenge from opponents;
- Ensuring that a mechanism was in place to detect and remediate any negative impact of the operations on the local populations and environment, particularly as physical disruption to the environment and population movements caused by the operations had the potential to provide conditions for explosive outbreaks of malaria in many locations.

Planning, monitoring and review

The most vibrant and successful programmes all had strong review processes built into a long and short term planning cycle. Two leading programmes identified their monitoring and evaluation systems as being absolutely critical to their success, with considerable effort and budget expended in this area.

Common features were:

- Planning phase input to ensure that engineering controls are built in to the construction of the site
 - E.g. accommodation and sanitation layout, office and storage space for the malaria control team and equipment
- Evidence-based approach with thorough Health Impact Assessment, baseline studies, prevalence and vector surveys prior to operations
- 5-year planning, defining broad strategy and outline budget
- Annual planning, involving all key stakeholders
 - Plans often reviewed or commented upon by an external independent expert
 - Defines detailed activities and targets
- Annual review
 - Often conducted internally by malaria programme managers and then ratified by an external independent expert
 - Includes:
 - Assessment of internal key performance indicators against targets
 - Annual prevalence surveys in local schoolchildren and/or household surveys
 - Annual (or more frequent) entomological surveys
 - Results of review inform the following year's plans.
- Systems for case reporting (monthly incidence) from in-house and community medical facilities

5.2 Innovations

The following are examples of innovative implementations encountered during the course of this study.

Education through ATMs

In [country W in sub-Saharan Africa], [company A] engaged with government at an early stage and encouraged the government to set up meetings with private companies drawn from different sectors. During one such meeting [company A] met with the company responsible for running the ATMs (automatic cash dispensers) in [country W], and one of [company A]'s community engagement practitioners suggested using the ATM screens and tickets as a conduit for health messages – a mutually beneficial initiative that could then be exploited for rotating health messages.

That process involved several different partnerships – internally with the community engagement team, and externally with government and another private company. The [company A]-banking company partnership was generated through [company A]'s encouragement of the government to engage with the private sector and facilitate such meetings.

Multilateral collaboration and cutting edge research

In [country X in sub-Saharan Africa], [company B]'s community malaria control project is steered by a technical advisory group composed of an NGO, academics from the London School of Hygiene and Tropical Medicine, the Liverpool School of Tropical Medicine, Yale, Texas A&M and other academic institutions and input from the National Malaria Control Programme. The project is currently funded by the Global Fund, USAID and similar organisations, with substantial contributions from private sector partners operating in the same location.

The project has a unique position in that there is strong academic and research input. It is used as a research ground by the project's academic partners and the project is continually seeking and developing new partnerships with top research organisations. This permeates a strong philosophy of continual improvement, innovation and evidence-based actions.

Employing a community based Early Diagnosis and Effective Treatment strategy

The strategy of [company C]'s control programme in [country Y in Southeast Asia] is to reduce the parasite reservoir in the local human population by providing Early Diagnosis And Effective Treatment (EDAT). EDAT prevents development of gametocytes in the patient and therefore results in a reduction in malaria transmission. Vector control in the local communities is therefore of diminished importance and has not been carried out. The reduction in malaria prevalence in villages around the plant site

created a low-risk buffer zone. The ongoing community programme is key to ensure that the critical decrease in prevalence is maintained.

Volunteer malaria workers were recruited and trained following a process of engagement with local community leaders. These local champions, often women, are trained in simple protocols to make a clinical diagnosis and treat malaria effectively. The patient makes a small payment to the volunteer worker for providing this service, which serves to motivate and reward. The immediate availability of effective treatment via this delivery mechanism has been very popular.

The workers have been trained to take blood smears, which are logged against a case record. On a monthly basis a visiting malaria technician collects the slides and records and sends them to the company malaria lab for analysis, providing a mechanism for monitoring programme effectiveness.

Repeated surveys have shown that prevalence has decreased from 12% in 2003 to less than 1% in 2011.

To further protect the operations, there is a process of routine screening (microscopy) on entry to the plant-site at the beginning of their rotation for all workers who have been in an endemic area for more than 5 days during their “off” period. Individuals found to have a positive blood smear are treated regardless of whether they are symptomatic, and are also warned to be vigilant for the onset of symptoms and seek treatment immediately should they occur. Vector control is also carried out in and around the plant-site.

Harnessing hi-tech

[Company D] makes a wide array of training resources available to programme managers including videos and instructor-led training. Tools currently under development include a Smartphone app information awareness platform, online training and pocket reference guides.

Creating a risk map

[Company E] in [country Z in sub-Saharan Africa] has created a map of transmission risk by plotting the GPS coordinates of the home of every positive case. Areas are classified as high (red), medium (amber) and low (green) according to their incidence rate. This risk map is used by the clinicians to trigger a higher index of suspicion of malaria in a patient presenting from red areas. In addition, although international employees and visitors tend to stay in green areas, a major tourist attraction lies adjacent to a red area. The map is used to educate international employees and visitors to be extra vigilant visiting that tourist attraction.

6. Conclusions

There is no such thing as a *one size fits all* malaria programme. However, successful programmes share several features:

- Well-resourced highly skilled teams of specialists comprising or supporting the programme management
- Programme managers with a narrow (realistic) remit
- Excellent support and advocacy from corporate health managers
- Excellent communication and collaboration within and outside the organisation
- A direct model of healthcare delivery that can be used as a channel for assessing and delivering a variety of malaria interventions
- A comprehensive healthcare programme that “earns the right” to change behaviour in the eyes of the community it cares for
- Investment justified in terms of corporate social responsibility as well as a traditional workforce-centric argument
- Excellent planning, monitoring and review

7. Future research

- Quantifying compliance to chemoprophylaxis recommendations by business travellers, fly-in-fly-out staff and expatriates
 - Mapping knowledge, attitudes, behaviour, barriers and enablers to compliance with chemoprophylaxis recommendations
 - Identifying key interventions, tools or resources to change behaviour
- Defining success in malaria control
 - Identifying key performance indicators (KPIs) currently used by private sector malaria management programmes
 - Identifying leading practice in KPI evaluation
 - Benchmarking targets across industry
- How are malaria controls integrated into horizontal approaches to health improvement?
 - How are multiple vertical health strategies coordinated into a unified programme of community engagement and service delivery?
 - How can this coordination be optimised to maximise return on investment?

8. References

Corporate Alliance on Malaria in Africa (2009), Company Management Guide. Implementing an Integrated Malaria Control Programme. Available at:

<http://www.gbchealth.org/files/reports/CAMA%20Company%20Management%20Guide-Malaria%20Final%20document.pdf> Accessed 30 May 2012.

Rozendaal J (ed) (1997), Vector control: methods of use by individuals and communities. Geneva: WHO.

Howells I et al (2011), Benchmarks for Malaria Prophylaxis in the Mining and Oil Industries. New York: GBCHealth. Available at: <http://www.gbchealth.org/report/2351/> Accessed 30 May 2012.

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10. About the authors

Naomi Roberts MA VetMB MRCVS

Naomi's first degree in veterinary science ignited an interest in zoonoses and then the broader area of human-animal interactions and health. This subsequently developed into a special interest in human infectious disease and she has recently completed a postgraduate diploma in infectious disease at the London School of Hygiene and Tropical Medicine. Naomi works as a consultant to corporations operating in resource-poor or remote settings at Sentinel Consulting Ltd, specialising in research projects. She is passionate about the role of the private sector in public health.

Dr Dick Mayon-White MBBS FRCP FFPH

Dick currently works at the Oxford University division of Public Health and Primary Health Care, specialising in Global Health and Infection and Immunology research projects. He has over 30 years experience as an infectious disease epidemiologist in the National Health Service and the Public Health Laboratory Service (now the Health Protection Agency). He also chairs the Oxford Tropical Research Ethics Committee.



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Rio Tinto sees its employees as its most important assets, so promoting and enhancing their health and wellbeing is as vital as protecting their safety. Supporting this project was one way Rio Tinto could help build knowledge to improve the health and wellbeing of its people working in environments where malaria is present.

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