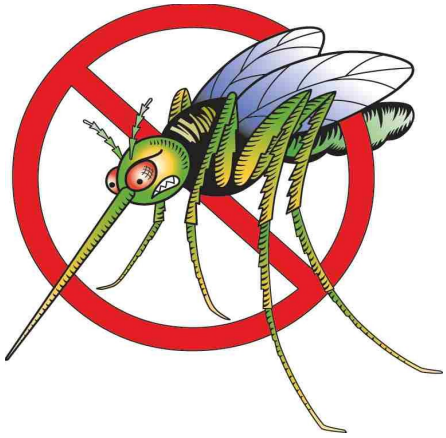
TRANSPARENCY AND ACCOUNTABILITY NETWORK



IMMC

INTEGRATED MOSQUITO AND MALARIA CONTROL

A comprehensive integrated mosquito and malaria control program to reduce the incidence of malaria, and other insect spread diseases.

BUSINESS PLAN

PORTFOLIO OF IMMC INTERVENTIONS

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DRAFT – FOR DISCUSSION ONLY

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INTEGRATED MOSQUITO AND MALARIA CONTROL CONTEXT

THIS DOCUMENT IS PART OF A SERIES THAT INCLUDES THE FOLLOWING:

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BUSINESS PLAN – INTEGRATED MOSQUITO AND MALARIA CONTROL
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IMMC – ORGANIZATION AND MANAGEMENT
(An Excel workbook/spreadsheet)

IMMC – REFERENCES, CONTACTS, ETC.
(An Excel workbook/spreadsheet)

SIMULATION MODEL
(An Excel workbook/spreadsheet)

IMMC – BEHAVIOR OF COSTS
(An Excel workbook/spreadsheet)

IMMC – FINANCIAL PROJECTIONS – MACRO OVERVIEW
(An Excel workbook/spreadsheet)
IMMC – FINANCIAL PROJECTIONS – COUNTRY VERSION
(An Excel workbook/spreadsheet)
IMMC – FINANCIAL PROJECTIONS – DISTRICT VERSION
(An Excel workbook/spreadsheet)

SLIDE PRESENTATIONS
Components of IMMC (21 slides)
History of Malaria Eradication (24 slides)
Economics of Malaria (17 slides)
Organization of IMMC (24 slides)

Introduction

Progress in the reduction of the prevalence of malaria is only going to be achieved if there are adequate physical anti-mosquito and anti-malaria interventions. The interventions included an a comprehensive IMMC strategy include the following:

(1) community awareness, education and training;

(2) neighborhood cleanup to reduce mosquito breeding places;

(3) interior residual spraying (IRS);

(4) ultra low volume (ULV) adulticide spraying to kill flying mosquitoes;

(5) larvaciding to kill larvae and stop mosquito recruitment into the population; and,

(6) personal use of insecticide treated bednets (ITN).

Community awareness, education and training

The primary beneficiaries of a successful IMMC program are ordinary people in the communities all over the areas where substantial IMMC interventions are implemented. Having the people in a community understand what is being planned to help get mosquitoes and malaria under control is an obvious step, but far too often neglected.

Care has to be taken that the priorities and the sensitivities of a community are understood and respected. While health may appear to be a priority from an outsider's perspective, this may not be how priorities are viewed in the community.

An enormous amount can be done with informal communication that is done at the convenience of the community.

Some how the community has got to become engaged, and understand the value of the program and how people in the community will benefit.

Many small steps are needed ... all going in the right direction. Eventually people will come to understand the value of the IMMC interventions and be willing to support the efforts.

A component of community awareness applies to the program itself. There should be a flow of information about the community into the management information system for the program, because it is progress in the community that is the most important metric of progress. The program wants to know how much it has cost to make progress in a community, and be able to prepare reliable comparative management information.

Neighborhood clean up

Reducing mosquito breeding places is a simple way to start getting control of the mosquito population. If the community is organized to help with clean up, and to remove places where mosquitoes can breed, it will get a lot of benefit from the reduction in mosquito nuisance and help to address the the malaria problem. This is something that needs to start at the individual level and the family, and move beyond that to the community.

Cleaning up all sorts of stagnant water is a good way to begin. These various containers are perfect for mosquito breeding.

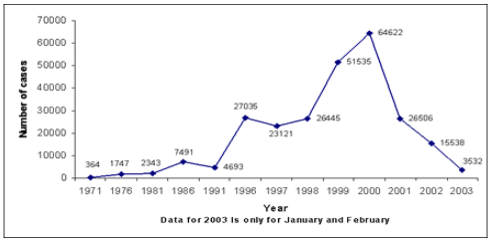
Water storage needs to be protected from mosquito breeding. How convenient for the mosquitoes and how dangerous for the people.

Cleaning up old tires is worth doing. Tires are almost always containing stagnant water suited to mosquito breeding.

Interior residual spraying (IRS)

The use of interior residual spraying (IRS), sometimes referred to as interior residual house spraying (IRHS) has been successful in many different settings, from South America to South Asia, in the Mediterranean region and in South Africa.

IRS is most effective when DDT is used as the pesticide, but DDT use is controversial. The graphic below shows what happened In Kwa Zulu Natal, South Africa, when IRS with DDT was stopped. Malaria cases increased dramatically, but cases were brought under control again when IRS with DDT was once more used. More than 40,000 cases in 2000 reduced to around 1,500 three years later Similar results were obtained in neighboring Swaziland and in the south of Mozambique.



IRS requires workers to enter houses and do the spraying according to a protocol that is safe for residents and the spray teams.

IRS works through three mechanisms: (1) there is a repellent action that keeps mosquitoes out of the house; (2) there is an irritant action that makes a mosquito leave a house quickly after entering; and, (3) a toxic action that kills the mosquito if it chooses to rest in the house. Broadly speaking, the size of the mosquito population is not affected by an IRS intervention, but behavior is modified so that there is less human blood meal taking by the mosquitoes. In an area where there is a substantial IRS intervention, the mosquito population moves outside, where it can be effectively subject to adulticide control.

The use of DDT for IRS has been controversial since the 1970s when the US Environmental Protection Agency banned DDT use in the United States. This was mainly a result of excessive use of DDT in US agriculture and concern about the persistence of DDT in the food chain. Other countries followed the US lead

and use of DDT for any purpose was banned in a number of countries around the world including Canada and several countries in Europe including Norway and Sweden.

The ban on DDT use has been a significant factor in the failure to control malaria. It has increased the cost of IRS by a factor of around 4, and other chemicals were not as effective. IRS still works, but is much less effective when DDT is not used ... perhaps 10 times less effective. In practical terms Africa has had to stop doing malaria control because of cost and budget constraints, and no countervailing initiatives from the donor community to make malaria control a priority.

Ultra low volume (ULV) adulticide spraying

The purpose of adulticide spraying is to kill adult mosquitoes. The ULV approach kills mosquitoes mainly when they are flying, and the micron sized droplets attach to the mosquitoes legs.

All pesticide use must be done under controlled conditions with strong safety protocols in place. Used in the manner intended, the pesticides and biological agents used are highly toxic to mosquitoes, but safe for humans, animals and the environment. Compared to many of the chemicals used in treatment of malaria and other human diseases, the pesticides have low human toxicity.

The method chosen will always be the one that is most suited to the conditions. For example, while mosquitoes in the mangrove swamp will be killed through aerial spraying, ground fogging from vehicles will be used along urban roads. Hand carried spray units will be deployed in areas not accessible by vehicle.

Adulticiding can be done using vehicle mounted equipment or from the air. It is a safe way of reducing the mosquito population and used regularly around the world under protocols that ensure safety for people, animals and the environment.

The following are typical aircraft used for ULV spraying. They are very maneuverable, and suited to flying with very precise positioning and they are also equipped with spray equipment that enables them to generate very small spray droplets just microns in size.

Adulticide treatment is commonly used where public health authorities are concerned about the possibility of insect borne disease. In the USA, large areas

where sprayed in the aftermath of Hurricane Katrina, and similar interventions have been used after other devastating hurricanes in the USA. Spraying is widely used when West Nile Virus is detected in US communities. Spraying has a role in getting control of mosquito vectors in malaria endemic areas.

The effectiveness of spraying depends on many variables, but it can be anticipated that there will be over 80% kill of mosquitoes in the first weeks of operation. While this is very important, it is not sufficient for enduring success. A mosquito population will reestablish itself very quickly, if the environmental conditions are favorable, and the malaria vector will return to a dangerous status very rapidly unless the program addresses all the relevant issues.

Specially designed aircraft that are able to fly safely at low altitudes will be used. Several hundred of these aircraft are routinely used in the United States for crop spraying and insect control. They will be equipped for the Monrovia work with modern spray systems that make it possible to use an especially low spray density with ultra fine droplets (about 50 micron) that are highly effective against airborne mosquitoes.

Larvaciding and environmental control

Mosquito population control is best when mosquitoes are never recruited into the flying adult population. Mosquitoes lay eggs in stagnant water, and in a matter of days eggs become larvae, become pupae and then adult flying mosquitoes. The picture below shows what larvae look like, and how they attach themselves to the surface of the water. The examples hanging vertically are probably Culex larvae. The Anopheles larvae attaches itself horizontally to the surface of the water as shown in the right hand image.

Community level efforts to reduce mosquito breeding places is valuable. These can be organized through schools, churches, women's groups either as independent efforts or as part of a comprehensive set of activities. This is a useful part of a comprehensive effective program. Breeding places can also be treated with larvacides to kill the larvae before they grow into adult mosquitoes.

While there is a high natural mortality in the stages between egg and adult mosquito, natural mortality can be supplemented by larvacide control measures to stop all the recruitment from the water body. For larvaciding to be effective, there needs to be accurate and timely knowledge about the water bodies and the status of the mosquito larvae ... and interventions to control the larvae need to be scientifically suitable and timely.

The following are two typical larvaciding interventions:

Some bodies of water are difficult to access, and larvaciding can be done by air. In some places helicopters are used for very precise delivery of treatment.

The value of larvaciding has been demonstrated over and over again, but it requires a lot of organization. Precise data are needed, timely intervention and well trained staff. The success of larvaciding is determined in large part by the entomological data that is collected and the analysis of this data to design effective interventions.

The environment makes a big difference to the recruitment of mosquitoes into the population. The data shows man-made construction has a big role in creating the sort of environment that encourages mosquito breeding. Natural water is often associated with natural vegetation that seems to inhibit mosquito breeding. While the mechanism is not known, the idea that mosquito breeding varies spatially argues for precise information about the spatial entomological situation, and the precise interventions for each place.

Malaria case management

There are many millions of malaria cases in Africa every year. Many Africans get malaria several times a year. Only relatively few of the malaria cases in Africa get any form of professional treatment. Data that only comes from clinics is a subset of data that is not representative of the population as a whole. With 400 million at risk, it is difficult to comprehend that each case has a human face. This child got to a clinic, but the clinic had no medicine. The child died.

Quinine was found to be a useful treatment for malaria in the 19th century and was used as part of the Panama Canal anti-malaria campaign in the early 1900s. In the post WWII years Chloroquine became the most widespread malaria treatment, both as a prophylactic and for treatment, but many malaria strains have now become resistance to Chloroquine.

Other treatments have been developed. Fansidar is now widely used but it has significant side effects, and resistance has emerged.

Artemesin based combination therapies have been developed, but cost a lot more than earlier treatments, and supplies are limited from available natural artemesin sources.

Concern over the development of resistance and side effects from anti-malaria treatments are valid, and as long as endemic malaria in the environment prevails, there will have to be ongoing leap-frogging of medical science and resistance development. This of course, argues for an anti-malaria strategy that addresses the environment and the endemic malaria.

A malaria vaccine has not yet been developed. Malaria is not an easy disease to control with a vaccine, but it is scientifically possible. Whether there is an enabling economic environment for vaccine development and deployment is questionable, and needed political support is also problematic. For the purposes of this IMMC program a malaria vaccine is “in the future”. However, the understanding of the parasite may help in accelerating treatment so that the environment can be improved by more rapid treatment to minimize parasite prevalence.

There has to be aggressive use of effective anti-malarial medications as well as vector control. Reduction of the malaria parasite in the human host is a key to long term success. When the malaria parasite is under control, the biting of mosquitoes becomes an irritant, but not as much a danger. The program initiatives to reduce the mosquito as a vector helps to control reinfection until such time as the parasite is brought under control. The assumption is that

mosquito population can be rapidly reduced, but that it will rapidly reemerge ... while the parasite will take much longer to disappear from the host, but then can be kept very much under control. The program aims to be effective in both areas of intervention.

Bednets and insecticide treated textiles

Bednets, insecticide treated nets (ITN), are another intervention that should be part of a comprehensive anti-malaria campaign. The model being used for IMMC planning has not been able to demonstrate that bednets on their own are as cost effective as other IMMC interventions, but they do have a favorable impact for the people who choose to use bednets.

The model suggests that bednets in fact have a potential value to help reduce the transmission of malaria from infected humans to others, and could be used to facilitate a form of quarantine for infected patients.

Long lasting insecticide treated bednets have been introduced in Africa since around 2003. These nets retain their effectiveness for about 5 years. The bednet shown below is being used in Uganda.

Data regarding the effectiveness of bednets seems to show that a bednet reduces the risk of malaria infection for the users of the bednets, but has no appreciable impact on the community as a whole that does not have bednets. This is in contrast to IRS, where the community at large seems to benefit from an IRS program, even where less than all the houses are sprayed.

Insecticide treated textiles can be used to manufacture clothes. The technology has been used already for military uniforms for soldiers being deployed in malaria endemic areas. The approach might be used in an IMMC program for uniforms for “Malaria Control Teams” as well as for the various uniformed services of countries in malaria endemic areas.

Use of long lasting impregnated bed nets may be very helpful in reducing the transmission of malaria for two reasons: (1) in the first case merely to reduce the incidence of mosquito bites and the associated transmission of disease; and, (2) to help keep mosquitoes away from people with the malaria infection. They cost around $8 to manufacture, and with delivery and storage the delivered cost will be around $10 each (assuming local and national governments do not impose duties or taxes on the import and purchase of the nets).