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

THE DYNAMICS OF MOSQUITOES AND MALARIA

July 2006

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:

EXECUTIVE SUMMARY – INTERNATIONAL

EXECUTIVE SUMMARY – LIBERIA

BUSINESS PLAN – INTEGRATED MOSQUITO AND MALARIA CONTROL
COMPRISING:
A ... BP for IMMC – INTRODUCTION SECTION
B ... BP for IMMC – THE MALARIA CRISIS
C ... BP for IMMC – HISTORY OF SUCCESSES
D ... BP for IMMC – MOSQUITOES AND MALARIA
E ... BP FOR IMMC – THE IMMC STRATEGY
F ... BP for IMMC – PORTFOLIO OF IMMC INTERVENTIONS
G ... BP for IMMC – DATA AND MANAGEMENT INFORMATION

IMMC – ORGANIZATION AND MANAGEMENT
(An Excel workbook/spreadsheet)

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

SIMULATION MODEL
(An Excel workbook/spreadsheet)

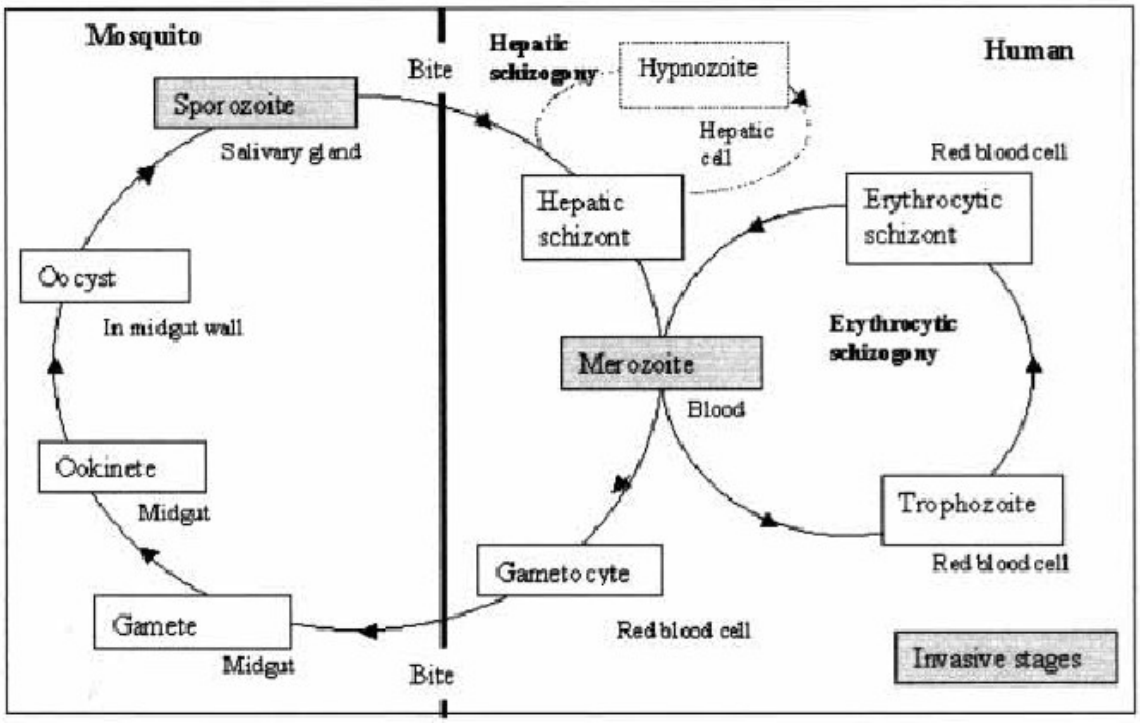
IMMC – BEHAVIOR OF COSTS
(An Excel workbook/spreadsheet)

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)

THE DYNAMICS OF THE DISEASE
MOSQUITOES, MALARIA AND IMMC INTERVENTIONS

The problem of malaria is a function of the mosquito, the malaria parasite and human physiology. The biting of a mosquito joins the three elements together.



From:

The malaria parasite

When a mosquito bites an infected person, it ingests microscopic malaria parasites *(Plasmodium vivax)* found in the person's blood. The malaria parasite must grow in the mosquito for a week or more before infection can be passed to another person. If, after a week, the mosquito then bites another person, the parasites go from the mosquito's mouth into the person's blood. The parasites then travel to the person's liver, enter the liver's cells, grow and multiply. During this time when the parasites are in the liver, the person has not yet felt sick. The parasites leave the liver and enter red blood cells; this may take as little as eight days or as many as several months. Once inside the red blood cells, the parasites grow and multiply. The red blood cells burst, freeing the parasites to attack other red blood cells. Toxins from the parasite are also released into the blood, making the person feel sick. If a mosquito bites this person while the parasites are in his or her blood, it will ingest the tiny parasites. After a week or more, the mosquito can infect another person.

The mosquito life cycle

The female *anopheles* mosquito carries and transmits the malarial parasite during blood feeding at the adult sexual stages. The mosquito is an uninterrupted individual feeder and is predominantly a night biting insect. The *anopheles*

mosquito lays eggs that hatch in shallow, warm, slow moving or relatively still water. Any site that holds rain water or permanent standing water for one week or more is ideally suited for breeding. In the context of Liberia and particularly Monrovia, nature could not have invented a more desirable environment for the mosquito to thrive.

The gestation period is approximately twenty to twenty-one days. In dry conditions, eggs may last up to five years, waiting for water to trigger the larval and pupal stages. One report concluded that, in an area the size of a football field, over one million eggs can be found. The number of mosquitoes in relation to the number of human targets is overwhelming. Mosquito broods may peak during any season and the vector's ability to strike is continuous, chronic, and acute.

To add to the challenge, malaria can be imported into the control area. An adult mosquito riding on slight breezes can travel up to fifty miles from its point of origin. People carrying malaria can migrate into the area, bringing with them new parasites to add to the vector's source of infected hosts. The combination of many factors makes the malaria situation an epidemic by any standard, and the situation will be resolved only by all-out intervention.

THE MALARIA PARASITE LIFE CYCLE

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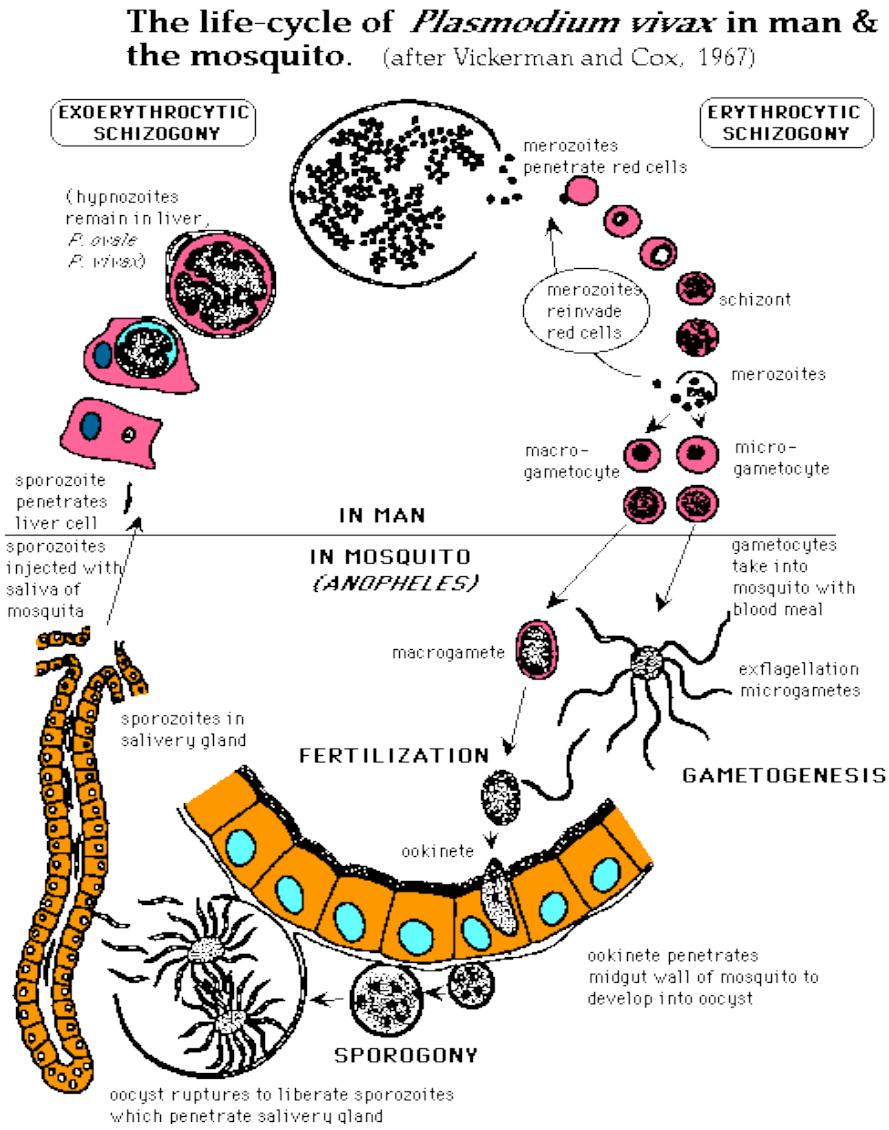

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THE MOSQUITO LIFE CYCLE

The mosquito life cycle

http://www.acroloxus.com/slideshow_1.html

Email: m.jackson@acroloxus.com

IMAGE TO COME

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It has been reported for many years, at least since the early 1950s, that the Liberian mosquito population includes *Anopheles melas*, a salt water breeding malaria vector. This vector is present in large numbers within about 2 miles of salt water. This is especially true during the dry season. This mosquito, as well as the *An. gambaie,* is known to feed as readily outdoors as indoors. The breeding of *An. melas* in salt water makes the mangrove swamps and tidal marshes in Monrovia critical for successful mosquito and malaria control. The inaccessibility of these areas makes aerial application of larvacides indispensable in any malaria/mosquito control operations.

There are two peak seasons for the transmission of malaria for Monrovia and Liberia as a whole. One is July through August and the other October through November. The control problem is aggravated in Liberia because of the year-long tropical climate that allows different populations of mosquitoes to be in different stages of their life cycle at any and all times of the year.

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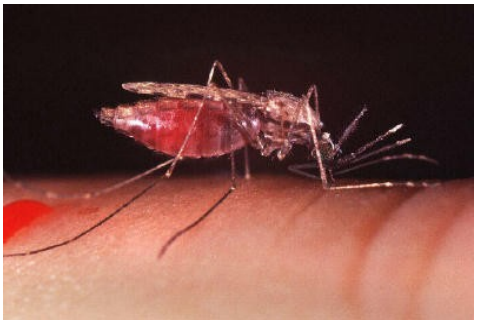
It is also worth noting that the *An. melas* is an extremely efficient vector of filariasis or elephantiasis. While the goal of this project is malaria control, the control of the mosquito will certainly have a positive impact on the incidence of filariasis which is a terrible, disfiguring disease.

THE HUMAN COMPONENT

Impact on humans

Humans get malaria from the bite of a malaria-infected mosquito. Mosquitoes need blood meals in order to reproduce. The challenge is to stop this cycle of continuing re-infection in a cost effective way that does not have damaging side effects either in the human population or in the environment.



Over the years there has been a lot of research about mosquito behavior and its life cycle. There has also been a lot of work done to learn about the malaria parasite and its life cycle. Rather little of this research has been translated into management information that can easily be used to make planning decisions about the way in which an integrated mosquito and malaria control program should work.

One of the ways in which this IMMC initiative is different from others is that it has a focus on science, data and analysis within a management system that can access the most relevant intervention for the prevailing situation, and can change as needed as the situation evolves.

Impact on human beings

Malaria can easily kill children who have not yet developed any sort of immunity against the malaria parasite. Also pregnant women with low levels of immunity have a higher incidence of contracting the disease, and many die. Placental parasitemia causes not only lower birth weights, but entire lives of increased susceptibility to illness.

Exposure to malaria during childhood seems to provide some immunity to the disease in adults. Some scientists express concern that successful programs to control malaria during childhood will reduce adult resistance to the disease with seriously adverse consequences unless there are perpetual control programs for mosquitoes and malaria.

Organizing for effective intervention

The IMMC Organization has a management information component that includes: (1) data collection and analysis; (2) feedback. planning and decision making; and (3) an organization that can implement decisions effectively. The organization includes the following units: (1) a global international unit; (2) a

series of country units; (3) one or more regional units, mainly to optimize aerial operations and logistics; (4) district units; and, (5) community activities.

An IMMC program is going to be successful when data, decisions and IMMC activities are coordinated in the most efficient manner. A preliminary planning model has demonstrated that the various possible IMMC interventions require significantly different scale and organizations in order to optimize the costs and the efficient deliver of results. The physical IMMC interventions include: (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).