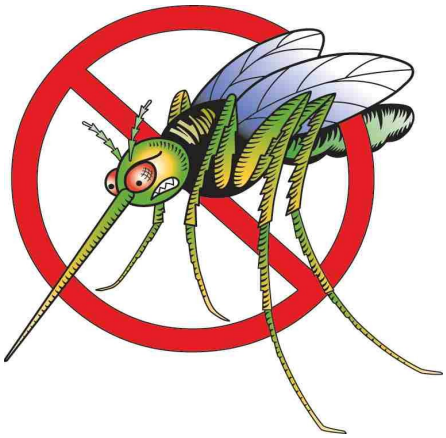
TRANSPARENCY AND ACCOUNTABILITY NETWORK

IMMC

INTEGRATED MOSQUITO AND MALARIA CONTROL



BEHAVIOR OF COSTS
MEASUREMENT OF PERFORMANCE

March 2006

DRAFT – FOR DISCUSSION ONLY

Tr-Ac-Net Inc.
c/o Ecologia Virtual Foundation,
PO Box 268, Middlebury,
Vermont, 05753 USA

Peter Burgess
212 772 6918
peterbnyc@gmail.com
www.tr-ac-net.org

Strengthening the management information dimension of the relief and development sector

Introduction

Integrated mosquito and malaria control (IMMC) is thought to be the most cost effective way of reducing the negative impact of malaria on society. This exercise has been done to understand the cost and value implications of modern IMMC interventions, and to start a process to improve management of IMMC so that the best results are achieved at least cost.

The present work is an interim product and a work-in process. It is being shared as a work-in-progress to encourage dialog about cost and value and the underlying interrelationship with science and technology.

Management information

Management Information is the smallest amount of information that allows good decisions to be made with almost 100% reliability. Good management information usually has both accounting and operational elements. It answers the questions of “How much?” in terms of dollar cost, “How many?” in terms of the outputs, “When?” to put time around the work, “Why?” in terms of justifying whether the cost is justified relative to the value that will be created, and “How?” in terms of selecting the best way. Good management information is timely and used within a feedback framework to facilitate decision making for continuous improvement.

Cost behavior and measurement of performance is a critical component of management information. The purpose for understanding cost behavior and measuring performance is to make it possible for better decisions to be made. High performance is achieved when durable value substantially exceeds the expenditures used to achieve the results. Low costs do not necessarily give good performance, but rather a good relationship between expenditure and related results.

Data collection, data analysis and feedback into operational decisions

An operation can only be efficient if there is practical timely data collection, data analysis and feedback into operational decisions. The model of analysis described in the charts suggests the tremendous importance of understanding costs and at the same time understanding what is accomplished as a result of operational expenditures both in mosquito control and malaria parasite control.

It is very clear that the interaction between cost and entomology and medical science is complex, but though it is complex, it is also powerful. The type of data collection and the type of analysis and decision making will be critical determinants of success. Cost and value information is needed as weall as data of a scientific nature in order to get optimum performance.

Cost and value model for IMMC

A preliminary cost and value model for IMMC has been developed. It is contained in two Excel spreadsheets. The following are brief descriptions of the two sets of information contained in the spreadsheets.

A Cost and Value Model for IMMC

SET 1

The first set of charts sets the stage by showing some of the variability in costs between some of the key components of the program.

Introduction

What does management information need to do? Two charts show the relationship between costs and value on a per month basis, and on a cumulative basis. The key point is that short term value may be lower than cost per month, but that long term value needs to be more than cumulative cost. These are not simple relationships and the management information needs to be based on a combination of accounting, entomological and medical information.

Chart 1

The variability in costs is demonstrated in Chart 1. The chart shows the variability in cost between different approaches to mosquito control. It also shows how the impression of cost changes depending on how the cost is expressed ... for example: by acre or by hour. The chart also shows the many cost elements that make up the total cost.

The chart shows information about cost, but it does not relate cost to output or value, and cannot in this form be used as a metric for performance.

Charts 2A to 2C – The cost of various control interventions

This series of charts show the various elements of cost for a specific malaria control intevention expressed per area and per time.

The charts show the total cost as well as the various elements of cost:

- Chemical cost
- Equipment cost
- Labor cost
- Fuel cost
- Admin costs that vary with time
- Admin costs that vary with area

Chart 2A – The cost of aerial spraying – ULV (Dibrom)

ULV (ultra low volume) spraying is a relatively new technological innovation that enables the spreading of a very very fine spray. The droplets are around 50 microns, and so small that they are small even relative to a mosquito. These droplets hardly reach the ground, and remain mainly in the air.

Chemicals are the biggest element of cost both per acre and per hour. This is because aerial spraying is very efficient and a lot of area is covered in one hour. This is also a strong indicator of potential good cost effectiveness because it is the chemicals that are the cause of results.

The second biggest element of cost is the admin cost that varies per acre. This is a critical cost and important to manage. There is a need for data and analysis so that the use of aerial ULV is based on good science and the operations are planned to get the best results at the least cost.

Chart 2B – The cost of aerial spraying – Larvaciding
Larvaciding is a valuable technique for the control of the mosquito population, but is very costly per acre, primarily because the bio-chemical agent is very expensive. However, as part of an integrated program, the use of aerial spraying of larvacide agents can be very cost effective and key to sustaining a low mosquito population at low cost. The effectiveness of larvaciding depends more on the data and decision making than on the component of cost.

Chart 2C – The cost of ground spraying – Mechanized ULV (Pyrethrom)
The cost of ground spraying is lower per hour than aerial spraying, but much more expensive per acre. Furthermore, there are practical issues relative to ground access that add to the difficulties of doing ground spraying efficiently. There are situations where ground spraying is an important component in the integrated program, but its use is generally more expensive than aerial application.

Charts 3A and 3B – The variability of cost

The variability of cost is a key parameter in implementing a cost effective and high performance program. All costs do not vary in the same way, and cost and performance optimization requires different approaches to the different components of the program.

Chart 3A – Per hour cost variability
Per hour, the cost of aerial ULV is very high and ground (mechanized) ULV is very low. However, in terms of mosquito control, the per hour cost is of small importance.

Larvaciding is much more costly than aerial ULV operations because (1) the biochemical agents are very expensive; and (2) the agents require slow and careful and costly aerial procedures. In the right places, larvaciding is an efficient way of controlling the mosquito population and can be a valuable procedure even though it is expensive.

Chart 3B – Per acre cost variability
Per acre, the cost of aerial ULV (Dibrom) is around half the cost of ground ULV, assuming that ground ULV is practical. In many cases ground access is not possible using mechanized techniques and only hand held equipment can be used. In these cases, aerial ULV is far and away the most cost effective.

The per acre cost of larvaciding is high. It needs, therefore, to be used in the right place and at the right time. For this good entomological data are essential.

Charts 4A to 4C – The variability of cost

The variability of cost is depends on may factors. The rate of utilization is one key parameter.

Chart 4A – Relationship between population density and per capita cost of mosquito eradication
The cost per acre is a very useful intermediate cost parameter, but the cost relative to the population is even more valuable. As the population density goes up, the cost per capita goes down.

This is a simple relationship, but there are complex issues that must be addressed in practice. Most real geographic areas have a mix of low density empty space and high density built up areas, and the best practice depends on how mosquitoes behave under these circumstances.

Chart 4B – Relationship between the use of the aircraft and the hourly operating cost of the aircraft

The capital cost of an aircraft is high, but, with proper use and maintenance, lasts a long time. The hourly cost of use is relatively low as long as the plane is used for a high proportion of the total time.

Chart 4Bi shows the cost variability as use goes from very low to some 500 hours a year, and Chart 4Bii shows the continuing reduction in hourly cost as the use increases to 1,000 hours per year.

Chart 4C – Relationship between the pilot's flying hours and the hourly pilot cost

If the pilot is paid by the month, the cost per hour of flying drops as the number of hours flying increases. If the flying time is low, the per hour cost can be very high.

Charts 5A – Cost per 1,000 of population

This set will eventually document how much it costs to have an effective intervention using the various techniques that are available, and the combination of techniques. They will also provide a way of presenting the effectiveness of interventions in having an impact on the people and the society.

Chart 5A – Cost per 1,000 population

This chart shows the wide divergence in apparent cost for four different interventions: Interior residual spraying (IRS) with DDT (IRS/DDT), aerial ULV spraying, insecticide treated bednets (ITN) and IRS using non DDT compounds. The chart shows the cost, and adjusts this base cost to reflect the notion of effectiveness in contributing to a durable solution.

The critical importance of getting good data and good metrics about effectiveness needs to be stressed. Getting the data and doing the analysis needs to be an integral and well structured part of the program and should include not only the scientific data but also data about costs and the results being achieved and the socio-economic value of the results.

SET 2

The second set of charts starts to describe the dynamic of an integrated mosquito and malaria control program, and then starts to link this dynamic with the cost components.

Charts 7A and 7B – Mosquito population dynamics

These charts are a first attempt to describe the relationship ... the cause and effect ... of mosquito and malaria control interventions.

Chart 7A – Mosquito population dynamics

This chart describes the impact of a high frequency aerial ULV spraying intervention on the mosquito population. There is a rapid drop in population as the ULV takes effect, but a rapid rebuild of the population takes place rapidly.

With repeated interventions, the mosquito population declines over time until it

reaches a low level. Data can be compiled to show the actual experience in any specific situation.

Chart 7B – Mosquito population dynamics
This chart describes the impact of a lower frequency of aerial ULV spraying intervention on the mosquito population. In this case there is a rapid drop in population as the ULV takes effect, with population building back again it reaches again a high stable level.

Though there are multiple interventions, they are rather widely spaced in time, and the mosquito population does not trend down but continues to return to a high stable level. This is a situation where the mosquito population can become resistant to the interventions.

Charts 9A to 9D – Mosquito / malaria dynamics

The goal is not simply to reduce the mosquito population, nor to treat more malaria patients, but to reduce the negative impact of malaria on society in a durable manner. There is a complex interaction between mosquitoes and malaria which can result in a major reduction in illness and death from malaria and is thus a key determinant of cost effectiveness and performance.

Chart 9A – Mosquito / malaria dynamics
In this chart the blue line represents untreated malaria, and the green line represents a reduction in malaria arising from some medical treatments.

The maroon line represents the reduction in the mosquito population as a result of a high level of mosquito control intervention.

Chart 9B – Mosquito / malaria dynamics
This is similar to the previous chart with the addition of a further red line that represents the level of reinfection taking place in the human community.

Because the mosquito population is significantly reduced, the rate of reinfection drops. This is a critical measure for a durable success.

Chart 9C – Mosquito / malaria dynamics
In this case there is no mosquito control intervention, the mosquito population stays the same, and even though malaria prevalence can be reduced by heavy intervention in treatment, the reinfection index is high, and a long term durable reduction in the negative impact of malaria on society is impossible.

Chart 9D – Mosquito / malaria dynamics
Comparison of the reinfection index between the case WITH mosquito control and the case WITHOUT mosquito control suggests that durable progress will be achieved with a combination of mosquito control AND malaria treatment including initiatives to minimize reinfection through life-style changes such as insecticide treated bednets (ITN) and interior residual spraying (IRS).

Charts 10A to 10C – Cost and value

The relationship between cost and value is the critical factor in measuring the preformance of an integrated mosquito and malaria control program. The absolute cost of interventions is not important on its own.

Chart 10A – Value of lives saved
The value of lives saved is a critical concept. This chart looks at this considering how much value is associated with lives saved at various values per life saved from a low of $100 to a high of $10,000. These numbers are small in relation to the value that US juries place on lost life in civil suits such as medical malpractice which often get multi-million dollar valuations.

Chart 10B – Cum cost versus cum value with IMMC
This chart which reflects a simple model for five years shows how an effective IMMC has a high cost in the early stages, but delivers a very much higher value over time.

Chart 10C – Cum cost versus cum value without IMMC
This chart shows how very much lower cost program can be implemented, but without much long term impact, and essential a lower cost that still exceeds by far the value being derived from the expenditures.

Chart 10D – Period cost versus value with IMMC
This chart shows how costs exceed value for the initial periods, but how value subsequently exceeds cost.

The chart also shows how in the long term the value drops, but so also is cost lower for a sustainable situation.

Chart 10E – Period cost versus value without IMMC
In contrast this chart shows costs exceeding value both for the initial periods and ongoing into the future.

Endnote

Ongoing development
These charts are continuing to be developed so that they are a better representation of the process. The goal is to build a model that reasonable well reflects the costs and the behavior of mosquitoes (entomology) and the costs and behavior of treating the malaria parasite (medical science).

This model can be used to help define the important parameters of the program and what is needed to get the best possible results. This is not merely an academic exercise, but an initial attempt to define the management information needed to manage IMMC in the best possible way.

Need for cooperation
There is need for cooperation. The information about costs and performance that is presently available easily is inadequate for effective management of the resources being used for mosquito and malaria control. Getting key operational data and the essential scientific information to measure results is critical and a valuable though costly component of the program.

Acknowledgements

Thank you
Many people have contributed to this exercise. Some, but not all, the contributors are listed below (in alphabetical order).

Peter Burgess

Bill Nesler

MORE TO COME

PLEASE

If you get a copy of this report, and are able to make a contribution to its improvement, please contact me at the contact address below. Please also indicate whether you want to be included in the acknowledgement list or not, and whether your organizational affiliation should be mentioned or not.

THANK YOU

Peter Burgess

peterbnyc@gmail.com

212 772 6918