IMMC

Integrated Malaria Management Consortium

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--- Proposal ---

For cyberenvironment development for integrated malaria management (CE for IMM) and deployment of IMM surveillance, data collection and management information at two pilot locations in Africa.

About the Integrated Malaria Management Consortium (IMMC)

IMMC is a program of the University of Alabama, Birmingham (UBA) and the National Center for Supercomputing Applications (NCSA), two organizations that have world class credentials in malaria epidemiology and entomology and supercomputing applications.

IMMC also includes ADAPCO, a leading company with expertise in the use of pesticides and all aspects of vector control; West Coast Aerial Applicators with US and African experience in aerial operations and pesticide application, the Millennium Institute and the Transparency and Accountability Network (Tr-Ac-Net) with expertise in bio-economic modeling, cost accounting and management information.

An additional strength is IMMC's cooperation with Africa based organizations, including local telecenters, local non-governmental organizations (NGOs), local community based organizations (CBOs), local faith based organizations (FBOs), local scientific research institutions (such as ICIPE and KMRI in Kenya), local universities and other educational organizations, and local businesses.

The problem

The problem being addressed is the lack of quality management information about malaria control interventions needed to assess performance and plan for the optimum use of resources.

The goal the IMMC program

The overall goal of malaria control interventions is to reduce the prevalence of malaria and reduce mortality and morbidity associated with malaria.

The goal of the IMMC program is to address the challenge of achieving the maximum of malaria prevalence reduction for the least use of scarce resources. IMMC uses a combination of scientific data and accounting information in combination to build a management information matrix that shows costs, activities and results in a spatial framework and permits cross comparison between areas and combinations of interventions.

The cost

The aim is for the ongoing operational cost of an integrated data management system to be less than 5% of the ongoing operating costs, and for the initial start up costs for a new locations to be under $500,000. Before achieving these cost levels it is projected that there will be an initial two year cost of $2 million to set up the data flows, the data store, the database and the analysis routines in an integrated malaria management cyberenvironment with data feeds from two locations in Africa.

The prevailing situation

In the few years since 2000, there has been a large increase in the disbursement of funds to support malaria control interventions in Africa. The African HIV-AIDS crisis helped to focus international attention on the broader crisis of African health, and especially the issues of malaria and tuberculosis. The international community has responded with support for the new Global Fund for HIV-AIDS, Tuberculosis and Malaria (GFATM); the United States has responded with the President's Malaria Initiative (PMI); and together with others this represent more than $1 billion a year of funding for malaria control initiatives.

Existing management systems are insufficient to ensure adequate financial control and the achievement of optimum performance in use of these funds. Some of the existing systems serve well as internal controls for the organization and some serve well as the basis for internal assessment of results but there is no broad uniformity of approach that enables the critical scientific data to be shared and analyzed in the most effective way. Little management information or easily accessible data exists that ensures that the best decisions are being made to achieve optimum results.

How scientific data and management information can help

A combination of scientific data and management information helps by making it possible for non-scientific decision makers to understand the implications of their decisions and for scientists and researchers to understand the cost and value implications of their work. Though scientific data and management information are completely different in the approaches that optimize their value, they both describe the same realities, and the analysis deals with the same sets of detailed data.

Scientific data tends to have the most value when the analysis can look at a very large dataset with many variables and over a significant time period. When the behaviors from the past are understood, it then becomes possible to make improved predictions about the future.

Management information, on the other hand, has the most value when it is quick, clear, easy to understand and relevant to the decisions that need to be made now. It is sometimes characterized as the least amount of information that ensures that the right decisions are being made.

Performance (outcome) metrics

In the IMM approach, scientific data and management information look to the following outcome metrics:

1. Number of cases of active malaria,

2. Prevalence of malaria parasite in the human population,
3. Abundance of mosquitoes,
4. Prevalence of malaria parasite in the mosquito population,
5. Reduction in mortality associated with malaria,
6. Reduction in morbidity associated with malaria.

The socio-economic benefits associated with success in controlling malaria include:

1. less absence from work,
2. industries like tourism less adversely affected.

Performance (activity and cost) metrics

In the IMM approach, scientific data are compiled and analyzed to understand what it is that gets the best possible outcomes, and what is the underlying science that is driving the process. In addition, the IMM approach to scientific analysis has an element of cost analysis so that optimization does not ignore the financial and economic parameters.

In parallel, data about activities and costs are compiled so that there can be a quick, albeit crude, understanding of how much is being spent and the outcomes that are being realized. These data have the most value when the information can be used to improve immediate operations and used to improve the allocation of resources wherever resources are being used for malaria control interventions.

Three separate phases

The phases of the IMM approach are:

1. Surveillance, data collection, and data analysis that determine what to do,
2. Intervention operations and cost benefit analysis,
3. Surveillance, data collection, and data analysis that determine the results that were achieved in this time period and their cost ... and what to do next.

What are the possible interventions?

The integrated approach originally used successfully by Gorgas during the construction of the Panama Canal had a focus on the human, the habitat and the mosquito. A similar set of interventions is the basis of IMM:

1. Medical:
    a. treatment of active malaria cases,
    b. treatment to reduce the prevalence of the malaria parasite in the human host
    c. prophylactic medication.
2. Personal protection:
    a. use of insecticide treated bednets (ITN),
    b. use of interior residual spraying (IRS),
    c. use of insecticide treated clothing (ITC).
3. Mosquito (vector) control:
    A. source control:
        a. remediation of breeding habitats,
        b. area clean up,
        c. larviciding,
            i. manual ground,

ii. vehicle mounted ground,
iii. aircraft.

B. mosquito control:
a. Ultra low volume (ULV) adulticiding,
i. manual ground,
ii. vehicle mounted ground,
iii. aircraft.

Each of these interventions has a unique cost behavior. Because of the complex biological system and limited knowledge, the results are difficult to predict with great certainty. However, the IMM approach facilitates that data about the cost and outcome from all specific interventions becomes a part of a cumulating dataset.

There are several different analysis cycles

The analysis of data needs to be done so that the results are available "in time" for the best possible decisions to be made. Thus, for example, the following needs to be done in a matter of days, or even hours:

1. A decision to do larviciding should be made in time for the larviciding intervention to be effective before the larvae become flying adult mosquitoes,
2. Identification of resistance should be made in time so that the chemical or biological agents can be changed to address the resistance issue,
3. The following interventions were done yesterday / last night ... have the expected results been achieved?

On the other hand, some scientific data analysis that is initiated now may still be ongoing in several years time. The daily, weekly or monthly accumulation of data is perpetual, and eventually the data analysis might yield real clarity about the mechanisms that drive the optimization of malaria control interventions. Periodic feedback will improve the knowledge base for decisions and improve the management models.

Surveillance and data collection

There are several different types of surveillance and data collection:

1. Building the knowledge base about the area
   A. Use of satellite imagery can reduce the time and cost of establishing a basic understanding of the area,
   B. Combining this with ground truthing can validate the interpretation of the satellite imagery and give a sound basis for planning interventions and the associated continuing surveillance,
   C. Use of basic data collection techniques to add specific information needed for IMM interventions and the associated variable data updates ... but planned based on the initial knowledge obtained from satellite imagery. Note that this can help reduce the data collection time and costs by as much as 90%.
2. Getting data that changes rapidly ... within a daily cycle
   A. Entomological data:
      a. About the adult mosquito population,
      b. About the larval habitats,

    c. About the weather conditions.
  B. Daily data about interventions:
    a. What interventions ...
      i. quantity and cost,
      ii. expected and actual results,
3. Epidemiological data,
  A. About the cases in the clinics,
  B. About the cases in the population at large,
  C. About the prevalence of malaria parasite in the human host.
4. Socio-economic data,
  A. About the socio-economic condition of the community,
  B. About the socio-economic condition of the population.

Any technique for surveillance and data collection that works and is cost effective can be used. The use of labor intensive techniques can be more reliable than the use of more high-tech approaches simply because the underlying infrastructure is not universally available. Paper based data collection in combination with local data entry into an electronic file may be the best way to optimize the data collection.

Data that are already being collected may be a good foundation for the data collection being described here. Maybe there is everything that is needed already being collected ... or maybe there are some elements that are missing or not in an appropriate format.

The progress of technology for data capture will be monitored carefully, and included in tests where appropriate and there is the potential for more cost effective and more sustainable data collection.

Data flows

Data are the most cost effective when they are used in multiple ways. In the IMM case data are used:

1. Primarily:
  A. to inform the local malaria control community using rapid local analysis and local management information techniques ... such as a wall map and colored pins, and to update a local mirror of the centralized data,
  B. to update the IMM cyberenvironment and data analysis system for cross area comparison, alternative intervention comparison, time series analysis, etc.
2. Secondarily:
  A. to update responsible government authorities about results,
  B. to update the mosquito and malaria research community about results,
  C. to update the local malaria control communities about results

Moving data is easy and very low cost when there is economical access to the Internet, otherwise it is more of a challenge. In general data flows need to be in electronic form so that they can be transmitted using the Internet.

The IMM approach is to cooperate with all available Internet access initiatives in the area, and especially the emerging telecentre community that is more and more engaged in community development initiatives.

Optimizing performance

The IMM approach to optimizing performance is to use existing or establish surveillance and data collection of all the key information needed to have both scientific data and management information. This latter has a focus on:

1. How much things have cost?
2. What results have been achieved?
3. What results the scientific data model suggests will be achieved?
4. What changes are needed to optimize the cumulative cost and the cumulative result?

Strategy for sustainability

The IMMC strategy for sustainability has two components:

1. A commitment to low costs:
   a. training so that local people can do the essential work at local salary and wage rates in perpetuity,
   b. scale so that computer analysis of data is extremely low cost per data transaction.
2. A commitment to getting results that have substantial tangible economic value:
   a. reduction in morbidity so that economic activity is not constrained by recurrent bouts of malaria,
   b. reduction in the prevalence of malaria in both human host and the mosquito so that the need for perpetual high cost interventions is reduced, and
   c. ongoing analysis so that there can be minimum cost interventions that sustain progress.

A strategy of cooperation and collaboration

The malaria control sub-sector has many organizations involved. Some of the many organizations involved include:

1. Funding organizations like:
   a. The President's Malaria Initiative in the United States,
   b. The malaria component of the Global Fund for AIDS, Tuberculosis and Malaria,
   c. The international corporate community operating in Africa,
   d. The philanthropic community such as the Bill and Melinda Gates Foundation.
2. Governmental organizations engaged in malaria control activities like:
   a. Ministries of Health, and their malaria control activities,
   b. Hospitals and clinics providing malaria case management.
3. International non-governmental organizations engaged in malaria control activities like:
   a. RTI - Research Triangle Institute,
   b. PSI – Population Services International,
   c. Merlin,
   d. MSF – Doctors Without Borders.
4. Academic and Research Institutions like:

a. North American and European Universities,
b. African Universities,
c. African research organizations like ICIPE, KEMRI, etc.

5. Community organizations like:
   a. Mosquito and vector control districts in the USA,
   b. Community based organizations,
   c. Faith based organizations ... churches,
   d. Local governance organizations.

All of these organizations can gain benefit from a low-cost high-performance scientific data analysis and management information system that is developed and deployed specifically to address the issues of the malaria control sector.

Accordingly the IMMC plans cooperation with the various actors to provide an information service that is useful for the participants. The exact form of cooperation will depend on the circumstances of an individual country and community, though the underlying data flows, data analysis and management information will not change much, and the ability to do cross location comparisons will not usually be compromised.

A strategy to supplement local capacity

The IMMC strategy envisions having an effective local capacity for any mosquito and malaria control intervention that will optimize results. This comes after a first step that seeks to make the best use of resources that are already deployed in the area. An optimized program needs to be structured so that whatever is needed for a comprehensive program of mosquito and malaria control interventions is available in time, and at an economic cost from a reasonable local location.

Projected activities and costs for two years

The projected activities for two years include:

1. Cooperation between the University of Alabama at Birmingham (UAB) and the National Center for Supercomputing Applications (NCSA) to develop an operating prototype of a CE for IMM,
2. Establishing the necessary baseline data and data flows:
   a. for local community management decisions,
   b. for updating the CE for IMM database,
   c. for analysis feedback to the community, the country level research community and the country authorities.
3. The costs of supplementary surveillance required to provide the data required including:
   a. incremental training if required,
   b. surveillance equipment,
   c. two years of operating costs.
4. The costs of program administration and oversight.

The funding required for this program for a period of two years is $2.0 million. This is based on an initial deployment in Zanzibar followed by deployment in the Mbita area of Kenya (near Kisumu).

The following table summarizes the funding requirement:

Table – Summary Two Year Funding

	Year 1	Year 2	Total
UAB and NCSA CE for IMM Development and operations	$950	$250	$1,200
Establishing baseline data, dataflows, and training	$150	$50	$200
Establishing incremental surveillance including training, equipment and supplies	$100	$100	$200
Program administration, oversight and overhead expenses	$300	$100	$400
TOTAL	$1,500	$500	$2,000

Anticipated outcomes

This initiative will have the following outcomes:

1. An operational cyberenvironment for integrated malaria management with the capability of scaling as needed from the pilot phase of two locations in Africa to an unlimited number of locations.
2. A scientific modeling capability that has the flexibility and power to analyze complex multi-variable time series and to provide cost effectiveness predictions based on cost accounting data and scientific behaviors.
3. A cadre of better trained Africans that understand the IMMC modalities for surveillance, data collection and the use of the data for local decision making, central analysis and cyberenvironment modeling.

It is also expected that there will be opportunities for the surveillance, data collection and cyberenvironment modeling modalities to be used in cooperation with existing initiatives so that their performance can be optimized using IMM style management information.

It is expected that IMM management information will show that there are significant opportunities to improve the cost effectiveness of the many initiatives that are presently funded and operational.