

IMM

INTEGRATED MALARIA MANAGEMENT

to reduce the incidence of malaria, and other insect spread diseases.



Integrated Malaria Management to Eradicate Malaria in Africa

IMM Workbook

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IMM

Integrated Malaria Management

Introduction

Goal ...

The goal is to reduce the burden of malaria as fast as possible, as cheaply as possible and as safely as possible.

Strategy ...

The strategy is to engage everybody in the mission to reduce the burden of malaria so that the job gets done, gets to stay done and is sustainable.

Tactics ...

An integrated approach where every possible intervention is used based on its ability to reduce the burden of malaria

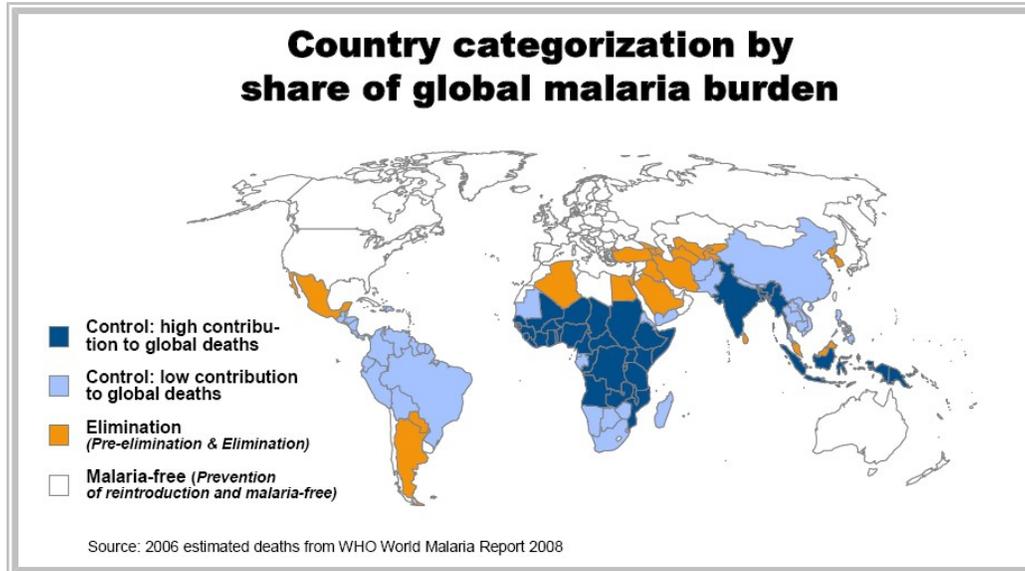
Metrics ...

Performance is measured using metrics that include cost effectiveness relating cost and results, and cost efficiency that compares actual costs to what they should have been.

Context

Most Malaria Burden Is In Africa

In broad terms, the distribution of malaria round the world is well known. Africa is the location for most malaria deaths, and it has also been the least served over the past several decades by malaria control programs. The following map shows the distribution of the global malaria burden.



Near eradication of malaria has been done in some parts of the world, but not in Africa where it remains a major health crisis and contributes seriously to poor socio-economic performance. Much of the work done in the past in Africa has been expensive and ineffective.

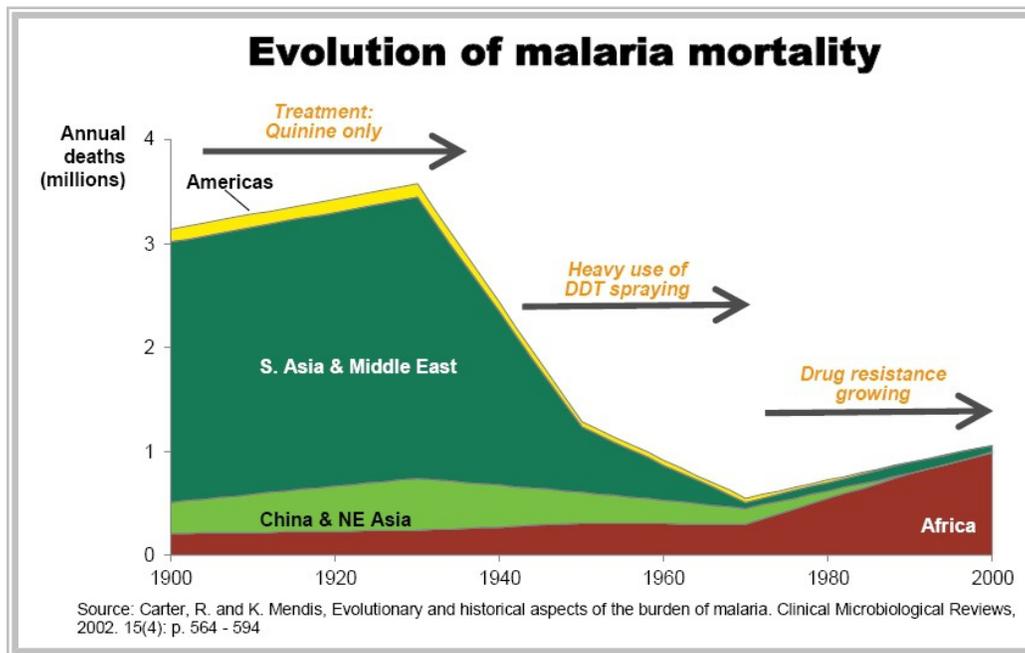
The problem of malaria in Africa is part of a bigger problem ... Africa is a rich continent in terms of natural resources and potential ... but the potential has been exploited up to now in ways that have not inured to the benefit of Africa. There are systemic problems that make it difficult to address critical problems in an effective way ... and health and malaria is one such problem. The combination of international corporate exploitation, an educational and technical deficit, donor driven development assistance agenda and weak national governance has been a lethal combination. The good news is that this can change and is changing.

Malaria Reduction is Not an Impossible Dream

A lot is known about malaria. Much of the malaria in Africa that is lethal is also preventable or curable. The challenge is not the science ... but rather the dysfunction of the health system and the broader economy. The IMM best practice is a way for the malaria situation to be improved as well as the situation for other critical diseases, especially acute respiratory illness of children, diarrhea and reproductive health to be improved as well.

Malaria is not an intractable problem. Malaria has been known since ancient times, and was prevalent not only in the tropics, but also in temperate climates. In the temperate climates of Europe the malaria burden diminished as organized agriculture spread but it was not until the early 20th century that malaria became better understood and vector control was introduced to limit the transmission of the disease. The success of Colonel Gorgas's malaria control program

during the construction of the Panama Canal is well known. It comprised vector control, personal protection and treatment ... an integrated approach. Vector control districts were established in the United States early in the 20th century because of the high prevalence of malaria in the country. The following graphic shows how successful malaria control was from around 1935 to 1970.



Source: WHO-RBM image in the Global Malaria Action Plan of 2008.

This summary data shows that there was great success in reducing the burden of malaria, and that, with the exception of Africa, malaria is a much lesser burden now than it was 80 years ago. These data suggest that old techniques for malaria control were very successful, and that there may be important lessons from this era.

The malaria situation in Africa is shown in the above graphic as deteriorating from 1970 to the year 2000. The trend of malaria mortality in Africa may be significantly mis-stated due to the appalling lack of reliable data. There has been an improvement in the dataflow of health information which means more mortality is reported. It is known that there has been a decrease in the effectiveness of the most widely used anti-malaria drug *chloroquine*, and malaria control interventions were underfunded ... but what this aggregate information does not show is that there have been successful programs in Africa to reduce the malaria burden in specific locations where good integrated malaria management practices have been used.

It is worth remembering that much of the United States had malaria until sometime after WWII, and that the problem was eliminated by vector control and medical treatment using the science available up to that time. Europe was a malarial area for much of history ... but largely eliminated as development progressed ... and finally eliminated using aggressive vector control in the 1950s.

A New Era ... Much More Funding

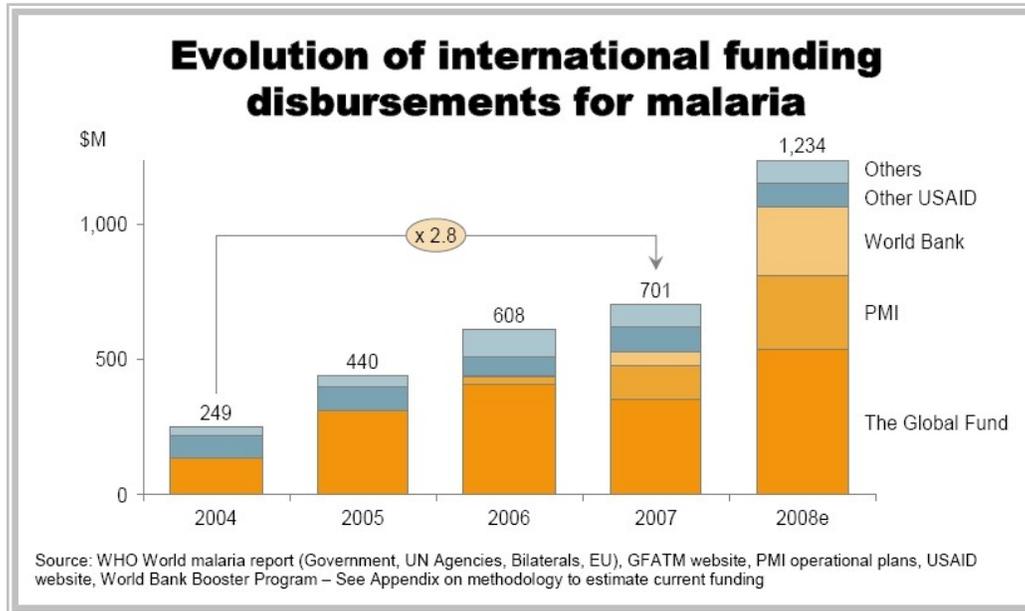
In the past decade there has been the dawning of a new era for malaria control. High profile PR has helped to drive the change ... a veritable paradigm shift. Many of the big names in development economics and music have made the malaria crisis visible and the crisis of malaria in Africa became widely known by the public.

Since the year 2000, the simple media message about

the malaria crisis in Africa has been that 3,000 children in Africa die every day from malaria.

Since 2000 there has been significant media attention to the African malaria crisis, and the outcome has been very much increased international commitments of funds to fight malaria and the emergence of a new community of people and organizations engaged in various aspect of the malaria industry.

The following graphic from a WHO-RBM publication shows the expansion of the funding used for malaria over the period 2002 to 2008. The increase over this time period and the absolute size of the fund flows in 2008 are impressive.



In the last few years since around 2000, the international commitment to global health has increased substantially. A new institution, the Global Fund for AIDS, tuberculosis and malaria (GFATM) has been launched to facilitate international funding and has helped to change the funding situation. This has been supplemented by important initiatives like the US President's Emergency Fund for AIDS Relief (PEPFAR), the US President's Malaria Initiative (PMI) and the health programs of the Bill and Melinda Gates Foundation which have set the stage for progress in global health.

Part of the message in recent years is that there are now new technologies that make it possible for malaria to be controlled effectively. This is largely mis-information. As described above, the burden of malaria was reduced by an impressive amount in the period 1935 to 1970. However, subsequent progress was constrained because (1) there was a US initiated ban on the use of DDT, which while appropriate in agriculture was wrong for malaria health; and, (2) there was a lack of funding for malaria control in Africa with almost every government in Africa financially constrained.

It is great PR more than anything else that has translated into increased funding. The available international funds for malaria were less than \$100 million in 2002, and the amount disbursed in 2008 is reported to have been in excess of \$1.5 billion. The reports of progress in reducing the prevalence of malaria and reducing the malaria burden are, however, inconclusive. The methodology for measuring performance and providing actionable management information is seriously flawed.

However ... WHO Predicts Huge Future Costs

There are warning signals emerging. The following table from the WHO Global Malaria Action Plan. (WHO-GMAP) suggests that as much as three times more money is required ... and that very high costs are to be anticipated into the distant future. The projection for 2009 is around \$6.1 billion and more than \$6.9 billion for 2010. The spending level stays at more than \$5.5 billion a year for another decade and only reduces to \$3.8 billion a year in the decade after that. This has all the characteristics of the famous Almata Declarations of 1978 about “Health for all by 2000” which were wonderful words, but essentially ignored for more than 20 years! Again, these financing projections are not what is going to happen ... but what is?

Table 1: Summary of annual global costs

Cost (US\$ millions)	2009	2010	2015	2020	2025
Prevention cost	3,728	3,982	3,724	3,864	2,576
Case management cost	968	1,359	550	226	87
Program cost	638	839	764	787	714
<i>Global control and elimination costs</i>	<i>5,335</i>	<i>6,180</i>	<i>5,037</i>	<i>4,877</i>	<i>3,378</i>
Research & Development cost	759	759	800	681	460
Total cost	6,094	6,939	5,837	5,559	3,838

Note: Detailed cost estimates are included in Part II - Chapter 5: Costs and Benefits of Investing in Malaria Control, Elimination and Research, Appendix 4 and Appendix 5
Source: GMAP costing model

The cost estimates that underlie the above WHO-GMAP projections are based on costs that reflect the prevailing high costs and inefficiencies in health care delivery that has been accepted as the norm ... which makes good healthcare not only inaccessible to the poor of the developing world but also to many in rich countries like the United States.

The good news of increased funding referred to before should also be matched by increased effectiveness in the use of the funding. The IMM approach uses data so that it is possible to use available resources in the most cost effective way. The WHO experts who made these spending projections have ignored the cost implications of using resources more efficiently and effectively in the future. The IMM approach has the effect of shortening the time it takes to lower the burden of malaria in the community and in turn to reduce the cost of malaria control interventions and sustaining progress.

Malaria ... Long History

Malaria is a very old disease ... certainly prevalent in Roman times ... and a scourge almost everywhere humans and mosquitoes were able to survive.

But, if you have the good fortune to live in most richer countries in the latter part of the 20th century or later ... the problem of malaria is no more. This has not been true for most of human history and malaria remains a killer disease in much of the world where poverty and malaria are endemic.

Malaria was a problem along the Hudson River in New York State until quite modern times. Malaria was a serious problem in California during the Gold Rush and for a long time after that.

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The first vector control district in the United States was established in California about 100 years ago.

Malaria ought not to be a problem in any part of the world ... but it is. More than anything else the reason for endemic malaria in Africa at this time is availability and use of resources. The problem of malaria has been ignored for far too long by leadership and decision makers, and resource allocation has been insufficient. The idea that the science of malaria in Africa is fundamentally different from the science of malaria in other parts of the world has been used as an excuse ... but it is not the core issue. As IMM recognizes, while there are local variations in the way the mosquito behaves and the way the parasite has evolved ...this is not the core reason why progress to abate malaria has been so slow.

The Panama Canal (1905-1910)

The construction of the Panama Canal was made possible only after yellow fever and malaria were controlled in the area. These two diseases were a major cause of death and disease among workers in the area. In 1906, there were over 26,000 employees working on the Canal. Of these, over 21,000 were hospitalized for malaria at some time during their work. By 1912, there were over 50,000 employees, and the number of hospitalized workers had decreased to approximately 5,600. Through the leadership and efforts of William Crawford Gorgas, Joseph Augustin LePrince, and Samuel Taylor Darling, yellow fever was eliminated and malaria incidence markedly reduced through an integrated program of insect and malaria control.

The U.S. Public Health Service (USPHS) and Malaria (1914-1942)

During the U.S. military occupation of Cuba and the construction of the Panama Canal at the turn of the 20th century, U.S. officials made great strides in the control of malaria and yellow fever. In 1914 Henry Rose Carter and Rudolph H. von Ezdorf of the USPHS requested and received funds from the U.S. Congress to control malaria in the United States. Various activities to investigate and combat malaria in the United States followed from this initial request and reduced the number of malaria cases in the United States. The USPHS established malaria control activities around military bases in the malarious regions of the southern United States to allow soldiers to train year round.

The U.S. Tennessee Valley Authority (TVA) – The Integration of Malaria Control with Economic Development (1933)

U.S. President Franklin D. Roosevelt signed a bill that created the TVA on May 18, 1933. The law gave the federal government a centralized body to control the Tennessee river's potential for hydroelectric power and improve the land and waterways for development of the region. An organized and effective malaria control program stemmed from this new authority in the Tennessee River valley. Malaria affected 30 percent of the population in the region when the TVA was incorporated in 1933. The Public Health Service played a vital role in the research and control operations and by 1947, the disease was essentially eliminated. Mosquito breeding sites were reduced by controlling water levels and insecticide applications.

Chloroquine (Resochin) (1934, 1946)

Chloroquine was discovered by a German, Hans Andersag, in 1934 at Bayer I.G. Farbenindustrie A.G. laboratories in Eberfeld, Germany. He named his compound resochin. Through a series of lapses and confusion brought about during the war, chloroquine was finally recognized and established as an effective and safe antimalarial in 1946 by British and U.S. scientists.

Dichloro-diphenyl-trichloroethane (DDT) (1939)

A German chemistry student, Othmer Zeidler, synthesized DDT in 1874, for his thesis. The insecticidal property of DDT was not discovered until 1939 by Paul Müller in Switzerland. Various militaries in WWII utilized the new insecticide initially for louse-borne typhus. DDT was used for malaria control at the end of WWII after it had proven effective against malaria-carrying

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mosquitoes by British, Italian, and American scientists. Müller won the Nobel Prize for Medicine in 1948.

Malaria Control in War Areas (MCWA) (1942-1945)

MCWA was established to control malaria around military training bases in the southern United States and its territories, where malaria was still problematic. Many of the bases were established in areas where mosquitoes were abundant. MCWA aimed to prevent reintroduction of malaria into the civilian population by mosquitoes that would have fed on malaria-infected soldiers, in training or returning from endemic areas. During these activities, MCWA also trained state and local health department officials in malaria control techniques and strategies.

CDC and Malaria (1946-present)

CDC's mission to combat malaria began at its inception on July 1, 1946. The Communicable Disease Center, as CDC was first known, stemmed from MCWA. Thus, much of the early work done by CDC was concentrated on the control and eradication of malaria in the United States. With the successful reduction of malaria in the United States, the CDC switched its malaria focus from eradication efforts to prevention, surveillance, and technical support both domestically and internationally. This is still the focus of CDC's Malaria Branch today.

Eradication of Malaria in the United States (1947-1951)

The National Malaria Eradication Program, a cooperative undertaking by state and local health agencies of 13 Southeastern states and the CDC, originally proposed by Louis Laval Williams, commenced operations on July 1, 1947. By the end of 1949, over 4,650,000 housespray applications had been made. In 1947, 15,000 malaria cases were reported. By 1950, only 2,000 cases were reported. By 1951, malaria was considered eradicated from the United States.

Eradication Efforts Worldwide: Success and Failure (1955-1978)

With the success of DDT, the advent of less toxic, more effective synthetic antimalarials, and the enthusiastic and urgent belief that time and money were of the essence, the World Health Organization (WHO) submitted at the World Health Assembly in 1955 an ambitious proposal for the eradication of malaria worldwide. Eradication efforts began and focused on house spraying with residual insecticides, antimalarial drug treatment, and surveillance, and would be carried out in 4 successive steps: preparation, attack, consolidation, and maintenance. Successes included eradication in nations with temperate climates and seasonal malaria transmission. Some countries such as India and Sri Lanka had sharp reductions in the number of cases, followed by increases to substantial levels after efforts ceased. Other nations had negligible progress (such as Indonesia, Afghanistan, Haiti, and Nicaragua). Some nations were excluded completely from the eradication campaign (most of sub-Saharan Africa). The emergence of drug resistance, widespread resistance to available insecticides, wars and massive population movements, difficulties in obtaining sustained funding from donor countries, and lack of community participation made the long-term maintenance of the effort untenable. Completion of the eradication campaign was eventually abandoned to one of control.

A Multitude of Problems

Economics of Health

For most rich countries ... expectation of life has increased substantially over the past hundred years ... which is good. For those who are not in the rich countries ... and without big fortunes ... the healthcare system is problematic. Expectation of life in poor communities around the world is something like half what it is in rich countries ... with rates of infant mortality ... complications of pregnancy ... and prevalence of all sorts of preventable disease that are simply awful.

The bad news is that real world market economics does not result in good outcomes in healthcare ... market economics and healthcare are incompatible systems and produce dysfunctional outcomes. The tools for analysis used by economists are insufficient ... inadequate ... to manage resources in healthcare. Techniques that work for scientific research do not work well for managing resources. Good management accounting, however, has techniques that can get clarity about matters and what does not.

Each of the interventions needed for sustainable success in malaria control builds on a different foundation of science, and must be planned for and implemented in different ways. All interventions have two things in common: (1) they have costs; and, (2) they contribute more or less to impact. They are planned differently and have different cost and impact behavior. The best ... most cost effective ... outcome is not always apparent because the science is complex as is society.

A Lot of Malaria

There is a lot of malaria. Because there is a lot of malaria there is mortality and there is morbidity resulting from the prevalence of malaria. While many parts of the world have reduced the burden of malaria, much of Africa has endemic malaria. Many countries has a lot of malaria ... but not every place in these countries have malaria. Malaria prevalence has a spatial as well as a time characteristic.

Limited Resources

The availability of resources has improved substantially from around the year 2000 to the present time (2009) ... but the availability of resources is, according to the WHO-GMAP work, about a third of what is needed. The problem of resource shortfall will likely get worse rather than better as new issues around malaria emerge and donor fatigue sets in. Very little of the financial support for malaria abatement programs comes from local sources.

Limited impact from available resources?

The most basic question that must be answered is how to get the most value from scarce resources? This is the key policy question for the leadership of the health sector and society at large.

There are two themes that have been broadly accepted for a very long time: (1) prevention is better than cure; and, (2) there is value in early intervention.

But there is already the problem of malaria being endemic in much of Africa ... the pandemic is in place ... the problem is widespread and well established. In this situation there must be (1) cure; and (2) the prevention of new infection.

Cure needs a medical solution ... and this means effective medicine, and diagnosis of malaria so that malaria is treated when it is present, and other diseases are treated when they are present. While malaria is widespread, it is not the only disease that produces fever.

Prevention of new infection means stopping the transmission of the disease ... and this means control of the mosquito vector. There are many ways to control the mosquito vector and the most effective depends on the specific situation in any particular location.

Sustainability

Because very little of the financial support for malaria abatement programs comes from local sources, the sustainability of programs depends totally on donor support. This is an untenable position ... but it is the reality in almost every developing country.

Health care is sustainable when

1. The population ... or an individual person ... earns enough, or produces sufficient surplus, so that they are able to afford the needed healthcare over their lifetime.
2. When the system of healthcare is able to deliver the needed healthcare at prices that are affordable by the society and generate reasonable remuneration for the healthcare staff.
3. When the system is able to reward investors for the use of their resources on a reasonable basis.

Addressing the issue of sustainability cannot be done just before donor support is withdrawn ... it must be a part of strategic planning and implementation of programs right from the start.

Resistance

Resistance has been recognized as a problem for years ... but as a practical matter very little is done until the resistance is widespread. The build-up of resistance is a part of biological make-up and helps a specie survive ... or a parasite ... and this is ubiquitous.

Much of the problem of resistance is a result of poor use practices ... both use of medicines and use of pesticides. Best practice in both fields takes the issue of resistance into consideration ... but best practice is not the norm.

The focus on single intervention strategies is one of the reasons why resistance does not get controlled. A focus on treating malaria ... over and over again ... is an almost perfect setting for rapid development of resistance. Using the same drug over and over again ... especially when its performance has diminished is a formula for disaster, yet it is the most common practice. Drug therapy, ignoring the issue of rapid malaria transmission and reinfection is a strategy that builds resistance.

As in so many situations, early recognition of a problem makes it easier to address the problem. Ignoring the problem for a long time is about the worst thing one can do.

Environmental Considerations

Protecting the environment is a laudable goal ... and the agricultural use of pesticides in excessive amounts should be discouraged. On the other hand, use of pesticides as a part of a public health program ... specifically interior residual spraying (IRS) of pesticides to repel or kill mosquitoes inside dwellings ... is advantageous and advances public health at little or no environmental cost.

No Vaccine

There have been efforts for many years to develop a workable vaccine against malaria ... but progress has been slow. Scientists are nearer now than at any time in the past ... but it is not confirmed yet through clinical trials that the work has resulted in an effective vaccine. Clinical trials are in progress ... and the results are promising.

However, it is also a reality that malaria can be controlled without the use of vaccines. Available interventions may be used to achieve near elimination ... eradication ... of malaria in a location. When comprehensive malaria control programs are implemented in Africa, there is every reason to predict that the control of malaria will be successful.

Weak Metrics

The metrics associated with malaria control are inadequate. There are many reasons for this, and the outcome is a portfolio of programs where resources are consumed and results are not obviously excellent. The typical report to stakeholders shows little or nothing and the costs of the program and the impact of the program ... rather there are broad statements about the financial scale of the program and the amount of work that has been done ... but rarely any clear data about

the specific impact of the work done. The key IMM concepts of cost efficiency and cost effectiveness are rarely ... more accurately, never ... reported.

Poor performance optimization

Because the metrics are weak ... decision making is weak and resources are not well used. The widely used methodologies for program analysis only work in very simple settings ... and successful malaria abatement programs are unlikely to be simple. Even though they are not simple ... they should be managed ... but most are not.

The IMM Approach

Key Idea

Doing What Works Best, Where and When Needed

Strategic Context

The most basic question that IMM aims to answer is how to get the most value from scarce resources? This is the key policy question for the leadership of the health sector and society at large.

There are several themes that have been broadly accepted for a very long time: (1) prevention is better than cure; and (2) there is value in early intervention.

Because malaria is endemic in much of Africa ... this must be modified so that there is (1) cure; and (2) the prevention of new infection.

Cure needs a medical solution ... and this means effective medicine, and diagnosis of malaria so that malaria is treated when it is present, and other diseases are treated when they are present. While malaria is widespread, it is not the only disease that produces fever.

Prevention of new infection means stopping the transmission of the disease ... and this means control of the mosquito vector. There are many ways to control the mosquito vector and the most effective depends on the specific situation in any particular location.

Surveillance and Data Acquisition

The core of the IMM approach is to drive decisions with surveillance, data acquisition and analysis.

The role of surveillance is to know what is happening and where. With timely spatial information it is possible to target interventions where they will do the most good. Without this information, resources are wasting supporting interventions where they are not needed and not doing enough where they are needed.

Surveillance also has a key role in keeping malaria levels low. Good surveillance identifies when an area is at risk, and it then becomes possible to target interventions in these areas at risk.

The Value of Good Decisions

The cost of malaria control is high ... but its cost can be reduced by good decisions. Good decisions are possible when the data are timely and detailed.

It is possible to justify any malaria control interventions based on the humanitarian justification of lives saved ... but well planned interventions based on timely and detailed data can improve the outcomes and reduce the costs substantially.

Malaria is spread by the mosquito ... and detailed knowledge of mosquito behavior and the prevalence of the malaria parasite in the area makes it possible to intervene in the most cost

effective way. There is no need to have intensive malaria control interventions in places where there is little or no malaria ... but where the malaria exists it must be controlled aggressively.

Spatial and temporal decisions may double the cost effectiveness of a malaria control program ... in some situations it may be possible to improve the cost effectiveness by a factor of ten.

Cost Effectiveness in Malaria Control

Because the various possible malaria control interventions work in different ways, the problem of resistance is minimized ... but it is also true that these interventions also provide a multiplier effect. In simplistic terms it makes sense to combine environmental controls, source control, dwelling repellancy (IRS), personal protection (bednets) and medical therapy to reduce not only the medical impact, but also the transmission. There are very complex linkages between the different elements with no reliable information on how these various interventions can be optimized ... but it is nevertheless apparent that a combination of interventions is significantly better than a single intervention.

Integrated Portfolio of Interventions

For each community ... or geographic area ... there are many different interventions ... and many possible permutations and combinations of these interventions ... that might result in malaria burden abatement.

These interventions should be planned to be the most cost effective ... that is minimum resource use for maximum impact ... based on data about the local habitat, the local mosquito population, the local human population, the history of prior interventions, the accessible health services infrastructure, etc.

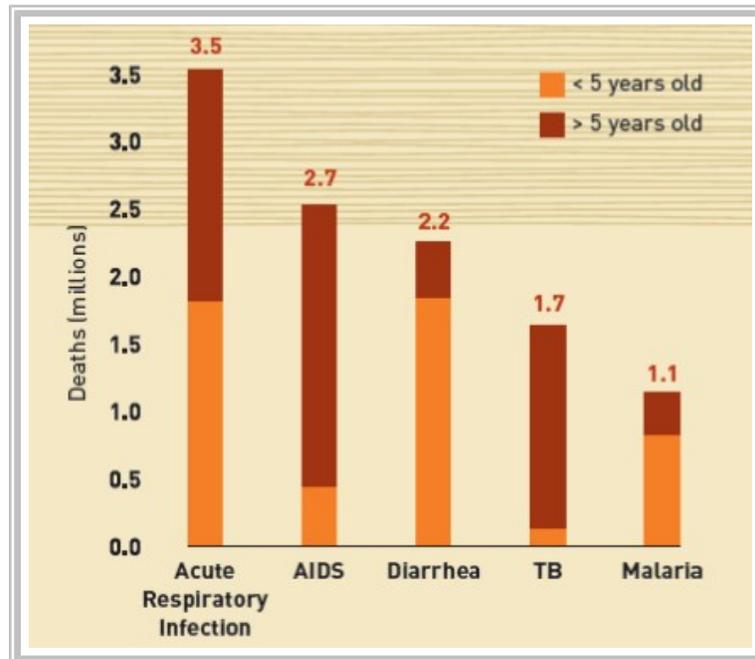
Data are central to the IMM approach. Surveillance ... data acquisition ... makes it possible for analysis to be used to plan the best use of available resources and implement interventions that are likely to be the most effective. The portfolio of possible malaria control interventions include:

- ◆ Surveillance ... data acquisition
 - Data about all aspects of community, malaria and mosquitoes
- ◆ Community centric activities
 - The place where people live and work
 - What is the place like
 - Awareness about malaria
 - What is being done to combat malaria
 - Data acquisition cooperation
 - Where is malaria
 - Where are mosquitoes
 - Where are breeding sites
 - Source control and community clean up
 - Community health infrastructure and staff
 - Community organization
- ◆ Medical interventions
 - Community focus ... health capacity
 - People ... health personnel
 - Timely diagnosis
 - Drug treatment
 - Parasite pool reduction
 - Support elements
- ◆ Vector control ... entomology
 - Community focus surveillance
 - Community level interventions
 - The people dimension
 - Community awareness, clean up

- Source control ... larvaciding
- ULV adulticiding
- Interior residual spraying (IRS)
- Insecticide treated bednets (ITNs)
- ◆ Research
 - Operations research
 - Medical
 - Entomology
 - Operations research

Cost Effectiveness for Community Health

The case for integration of health programs is strong. The following data from WHO in 2000 shows the relative importance of diarrhea, acute respiratory disease and malaria for under 5 child mortality. While malaria mortality is high, so also is mortality from diarrhea and acute respiratory disease. From a purely medical perspective none of these diseases should be life threatening for young children. If there is no accessible health infrastructure there is going to be mortality that would otherwise be preventable. The data show that HIV-AIDS and TB are the diseases associated with high mortality for older children and adults.



These data suggest that the most cost effective successful health performance at the community level will be one where there is a broader clinical capacity rather than one that has only a single disease focus. Infrastructure is most cost effective when the system has the capacity to address all the main diseases, and not just a single one.

Sustainability

Sustainability that is achieved simply by having perennial external financing is not reliable sustainability ... it is fake sustainability. It is however, embraced by much global health planning and projections, while little or nothing is done to develop health programming that will result in sustainability.

The IMM strategy incorporates sustainability as a core issue. Experience shows that malaria can be substantially reduced in an area ... as in Zanzibar several times ... but malaria rebuilds in the community very rapidly as soon as control measures are terminated.

Low cost helps with sustainability, as does high benefit. A strategy that embraces local organization, local staff and local implementation has the basis for sustainability. Medical treatment that helps to eradicate the disease is very much more cost effective than medical treatment that only addresses a presently active bout of malaria, that will reactivate in a matter of weeks, and perhaps many times in a single year.

The data are not clear yet, but the simple model for an optimized program suggests that a geographic focus with multiple interventions can move towards elimination of the malaria parasite in the community in months not years ... and of course, the long term cost of this approach is very much better than anything else. Where an initiative is valuable ... it would be good if there was the possibility that it could be paid for by the people that need it and the community get benefit not only when some external funding is available ... but when the community must pay the costs. This is the essence of sustainability.

Improving health outcomes makes economic activity more productive ... but is the economic activity available for most of the people in poor countries sufficiently productive so that the resources need to pay for health are available. If not ... why not?

Donors who have become a big resource for health financing need to look carefully at what they are paying for, and especially need to understand the distortions in the pay scales that get introduced when donor funded projects are implemented. There are many situations in health where cost effectiveness can be improved by a small intervention at the right time ... yet this is almost totally absent because the health infrastructure is so weak.

The health infrastructure needs to be present ... needs to be functional ... and needs to be affordable. The health infrastructure needs to be staffed by local professionals and para-professionals, and support staff that earn enough to be motivated, but not so much that the system cannot pay the salaries.

Cost Effectiveness

Cost effectiveness is a reflection of the system. It is as much about result as it is about cost. A nurse at a clinic is not cost effective whatever the pay scale when the essential medications he/she needs are not available or affordable. Good cost effectiveness requires that all the pieces of the puzzle are in place.

A system that has the capability to reduce mortality caused by diarrhea, acute respiratory infections and malaria is going to have a level of cost effectiveness way better than one that only treats malaria ... or only treats an other single disease. Some data from studies conducted in Zambia suggest that where interventions to reduce the prevalence of malaria have worked, infant mortality from other causes remained high. This indication is another element that has motivated a strong focus on community health performance and the spatial dimensions of the IMM approach

IMM ... Management

Management

Management is not the same as administration ... it is not academic ... it is intensely practical and pragmatic. The IMM approach has management central to what it is.

The IMM approach is not only integration of the various elements of operations that make up a comprehensive malaria abatement program ... it is also integration of performance metrics into the operational framework for management ... and the use of these data for rigorous scientific analysis.

“What gets measured gets done”

The IMM approach aims to facilitate decisions that result in the minimum of resources being used to get the most result.

Some key facts about malaria are well known: (1) too many children dying ... too much malaria mortality and morbidity; and (2) too little resources to do everything that is needed.

IMM is a program that addresses malaria control in an integrated optimum comprehensive manner. IMM provides for an integration that is practical at the operational level, rather than merely being an academic construct associated with a top level coordinating committee and with little or no integration and coordination on the ground in the community where it matters.

Data needed ... based on experience and common sense

Someone with long experience of vector control and public health in the USA was asked how he would implement a malaria control program in Africa. His reply had a focus on getting data to show where the problem of malaria was the most serious ... where malaria mortality and morbidity was the worst and starting there. This would be followed up by getting data that showed progress relative to the interventions that were implemented, and then applying the lessons learned area by area until the malaria was fully controlled

When there is a problem, the management approach may be simply described as follows:

- ◆ There is available knowledge ... not perfect ... not totally complete ... but substantial
- ◆ Do something based on the best available knowledge ... do the best available based on what is known now
- ◆ Measure costs and measure impact ... learn lessons. What might be done better?
- ◆ Do something better ... measure costs and measure impact ... seek to use less resources and have more impact.
- ◆ Learn lessons ... Do something better ... measure costs and measure impact ... seek to use less resources and have more impact.
- ◆ Continue ... expecting the measurements to show changes in the situation ... because success requires changes in the situation
- ◆ Continue

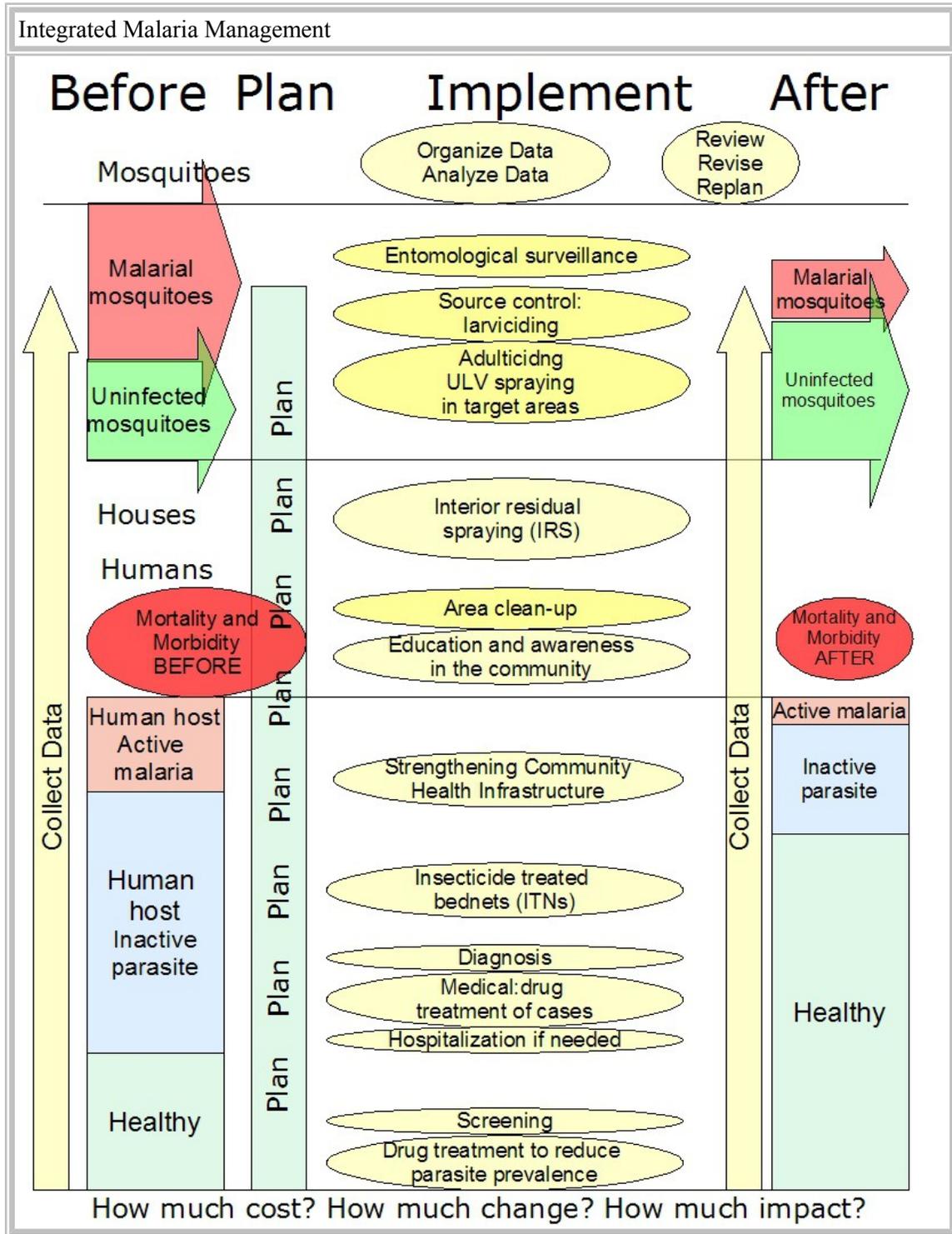
Linkages

Plan ... Implement ... Impact

There are costs and there are results! The core of most successful implementation processes includes activities to plan, activities to implement and from this there is impact. Metrics are needed for planning, during implementation and to assess impact.

- ◆ Before: There is a certain situation with malaria and mosquitoes and with the human host.
- ◆ Interventions are planned and implemented ... there are activities and there are costs.
- ◆ After ... there is a new condition with malaria and mosquitoes ... and the human host.

The core of most successful implementation processes includes activities to plan, activities to implement and from this there is impact. Metrics are needed for planning, during implementation and to assess impact.



Better Metrics for a Complex Society

A better system of metrics

There is no good reason for not having the data about cost of healthcare, what it paid for, and the impact for each and every community.

Guideline

It is understandable that there is some doubt about how things will turn out in the future ... but there is absolutely no excuse for not knowing how things have worked out in the past. This is what cost accounting is designed to do.

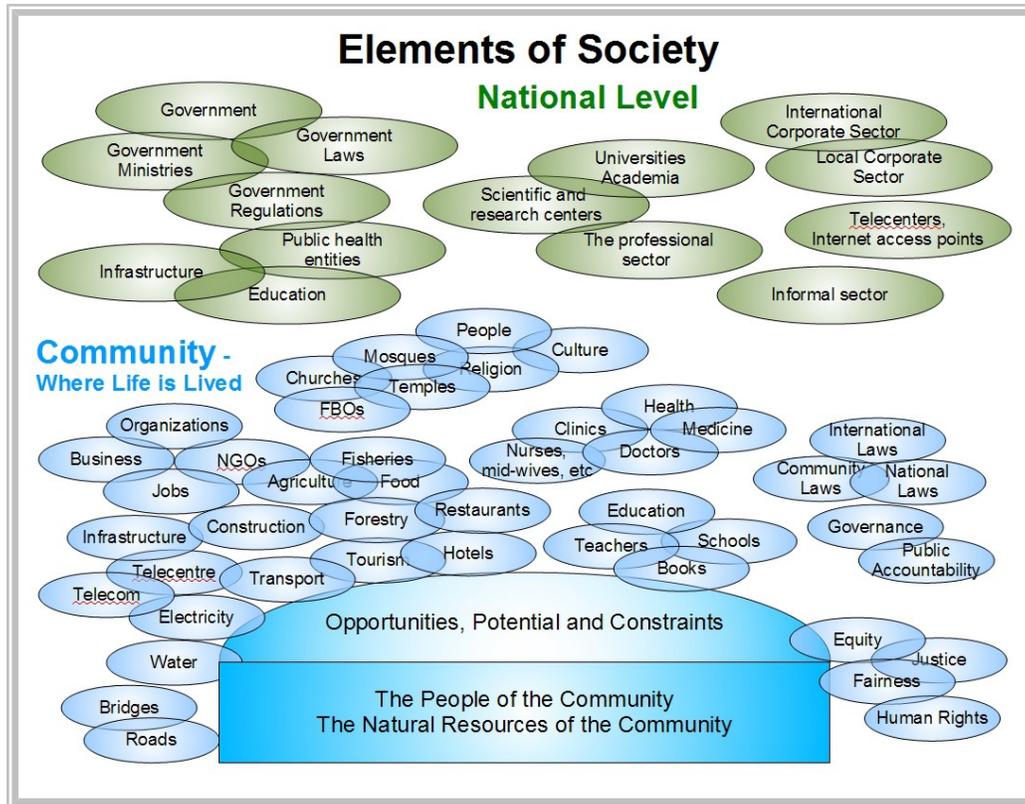
The data centric aspect of IMM addresses the need for the metrics that are essential to the management of scarce resources ... the essence is economy. The conceptual framework for IMM data derived from the TrueValueMetrics (formerly Community Analytics) methodology is more aligned with science and accountancy than with the techniques of the social sciences and statistics.

TrueValueMetrics (TVM) builds on ideas from science and engineering, economic and accountancy. The understanding of cost is simple relative to much of science and engineering ... but not well done. It is possible to calculate what costs should be using technical considerations and simple arithmetic ... and it is possible to know what actual costs are using equally simple cost accounting. The fact that such data are not compiled and available is a failure of management pure and simple ... usually because management knows that such data will highlight poor performance and create embarrassment, if nothing more serious. Cost efficiency is the idea that actual costs may be compared to a theoretical standard of what costs should be ... a common practice in corporate organizations.

It is possible to calculate cost effectiveness using similar concepts. The idea is simply to relate the resources used ... costs ... with the value realized, or the impact on the community. The quantification of value is not easy ... and very much a subjective exercise ... but it is not impossible. TVM has developed an approach where a standard value is assigned to all matters of importance in a community ... and progress may be measured using changes in this value.

Society is very complex

Society is very complex. The following graphic shows some of this complexity ... in a very simplified manner. There is complexity at the national level and the international level (not shown) and all sorts of complex detail at the community level. An aggregate or average is not very useful for decision making ... what is needed is granular data that reflects a real reality ... not a distant derivative of reality!



It is readily apparent that the complexity at the community level is a significant analytical challenge ... and when aggregated to the national level ... or the global level ... only some very broad analysis results will have any meaning at all.

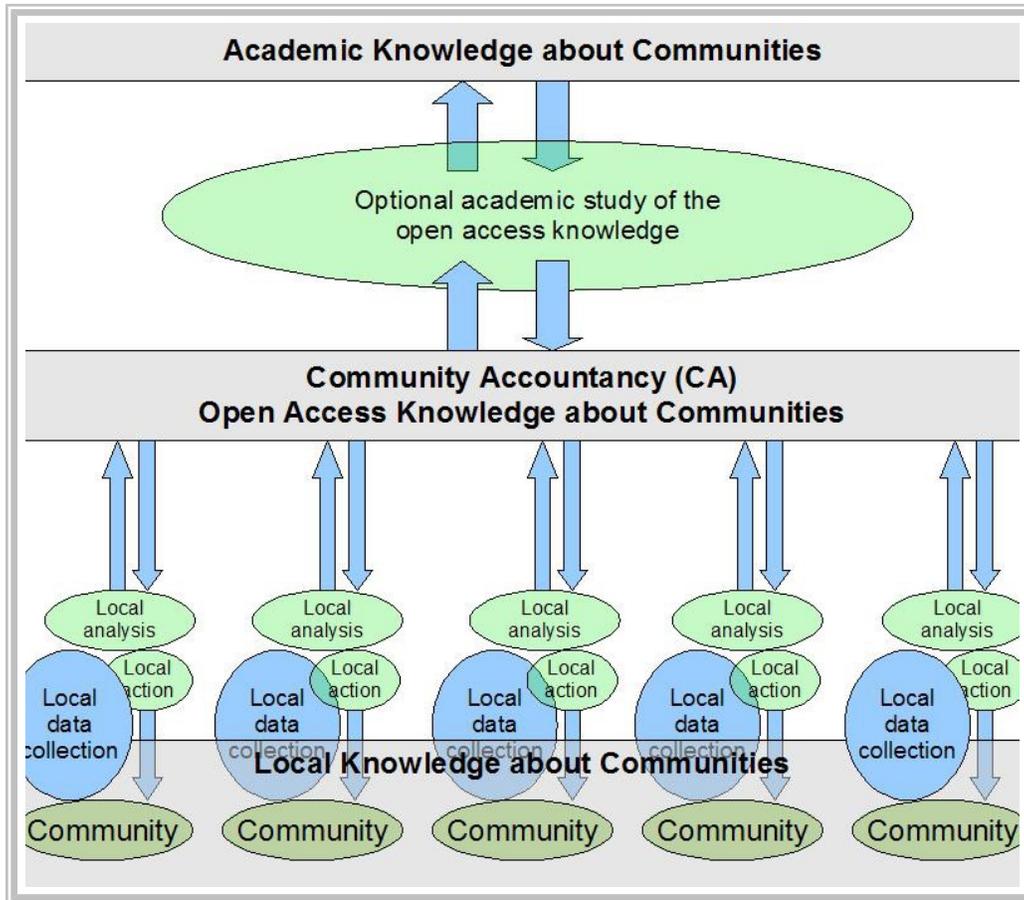
Local and global data analysis

In the TVM methodology, the key goal of data collection is to have data that help improve performance. Local data collection ... local analysis ... local action is the cycle that improves performance most directly and most quickly.

Data may be multi-tasked. “Collect once ... use many” is a data management idea that goes back to the very early days of electronic data processing (EDP). Thus, the data may also facilitate easy oversight ... ensuring that the operational decisions are getting good results ... and if not allows for rapid response so that the important questions are asked, such as: (1) is the result because of poor operations that management must address locally; or, (2) is the result because there are problems emerging, such as resistance, that need to be addressed on at all levels, local, national and global.

The most cost effective utilization of data is at the local level, at a national level and at a global level. The specific granular data available at the local level and the analysis of very large datasets at the global level facilitate good local decisions and powerful data-mining and the identification of “best practice” that are impossible to identify with local analysis alone.

The graphic below shows the idea of local use of data in the community ... with aggregation to higher levels. This shows that community centric data gets used at the community level to do local analysis and get local action ... and then these data are also used to have an oversight level ... and then again at a global academic and scientific level.



While the data may be of limited use when aggregated ... data can be of critical value in the local context, especially in the context of managing the malaria abatement interventions.

Experts in the field recognize that mosquitoes and malaria have behaviors that are determined in large part by the facts of a specific location ... and accordingly all communities are going to have different needs.

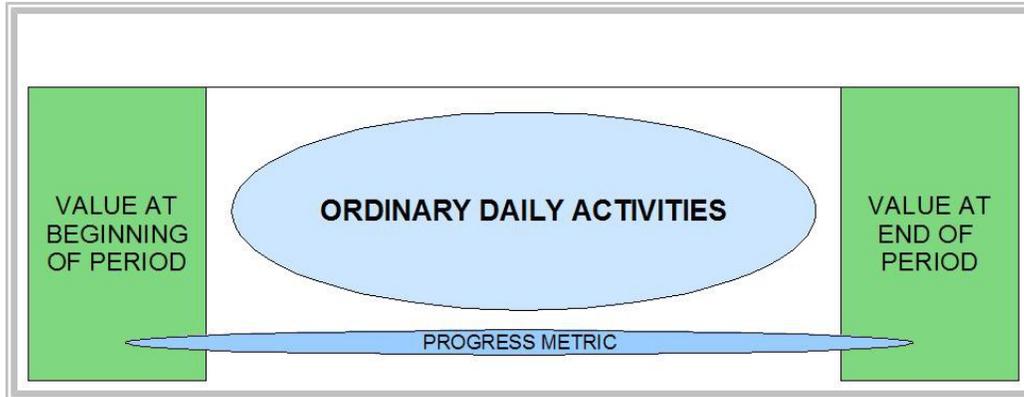
The prevailing management approach where national and regional averages are used for planning and prioritization is fundamentally flawed ... and wasting resources in an unconscionable way. Organizing for data and decision making to be community centric will make it possible for interventions to be implemented only where they are needed and in the most efficient way.

Using the local data in an aggregated manner using a very large database and modern data mining techniques will add value to the data that are also of high value and utility at the community level ... a win-win for both the community and for the global malaria community of researchers.

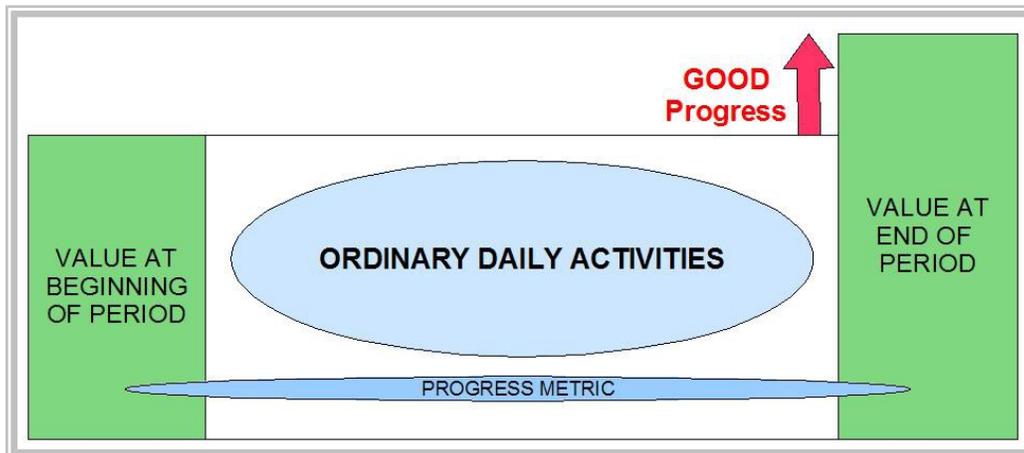
This is not a complex idea, and there is no reason why there cannot be quick, easy and useful data about this, and no reason why this cannot be applied within the framework of the IMM program. This is shown in the following series of graphics. There is a status at the start ... there are activities to control malaria ... and there is a status at the end. There are costs for the activities that result in an improvement in the status from the beginning of the period to the end.

A Really Simple Idea

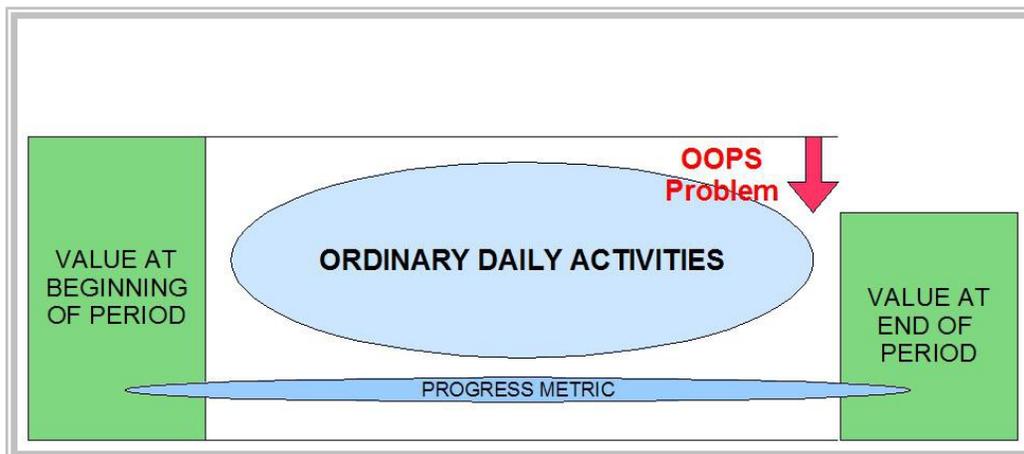
TVM's primary metric of progress is very simple. Is the community better now than it was in the past? In the image below, the value of the community is the same at the end of a period as it was at the beginning ... ordinary daily activities produce what is consumed ... it is a stable situation.



In this next case the value of the community is more at the end of a period than at the beginning of the period ... ordinary daily activities produce more than is consumed. It is progress ... it is a good situation.



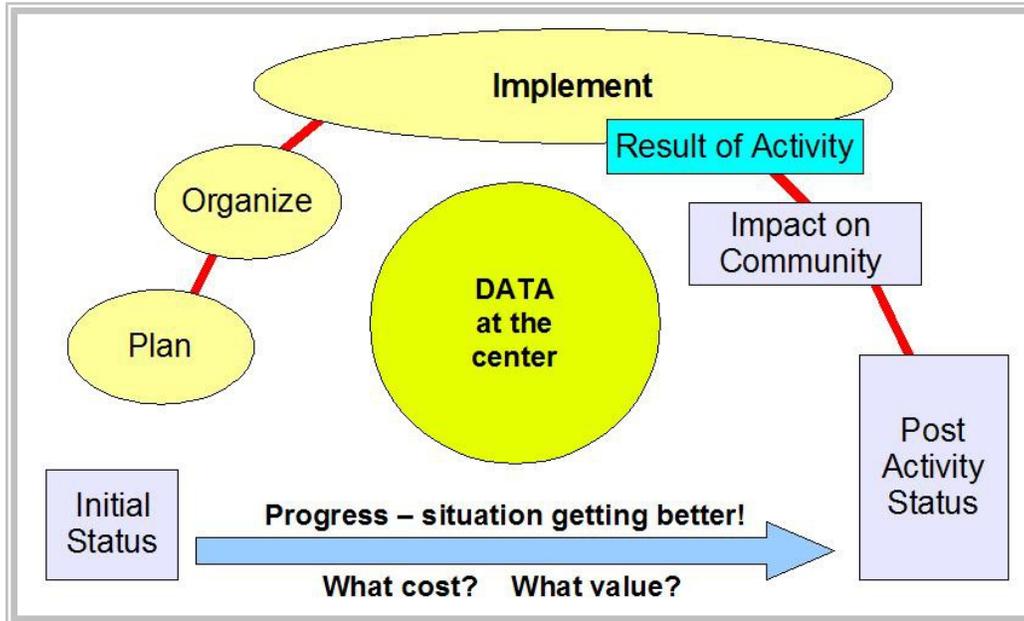
In this last case the value of the community is the less at the end of a period than at the beginning of the period ... ordinary daily activities produce less than is consumed. It is a problem situation.



The ideas that are generic in these graphics are equally applicable for the metrics of performance for malaria control interventions.

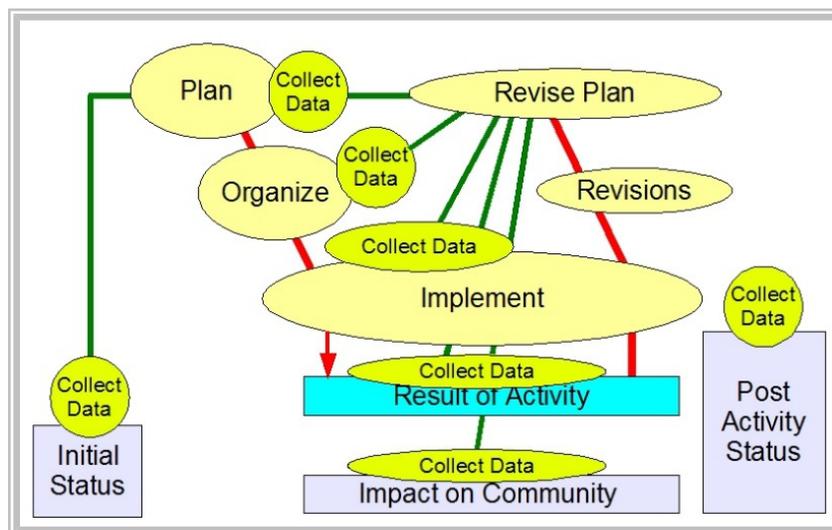
Data at the Center of the Management Cycle

This is a simple representation of the TVM perspective of the management cycle. It has data at the center ... and uses the data at every stage of the process.



Data are used to ascertain the initial status and the post activity status ... that provides a metric for progress. Data are used to plan, organize and to implement. Data are used to measure the result of the implementation activity, and the impact on the community. The data answers important questions about performance ... what cost? ... what value?

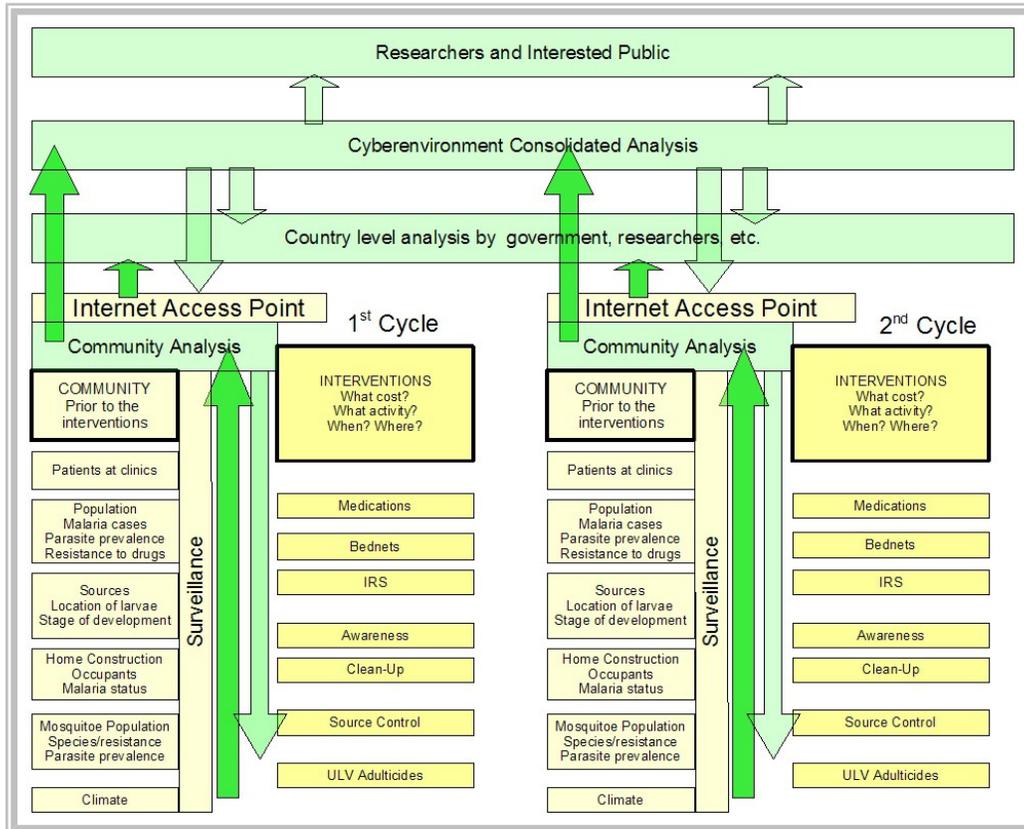
The following graphic shows that every step of the management cycle needs data.



Note that in this graphic there is a specific separation of the results of activity from the impact on the community. They are not the same ... and in most situations it is unreliable to consider result of an activity as a proxy for impact on a community.

TrueValueMetrics - Integrated Malaria Management Workbook

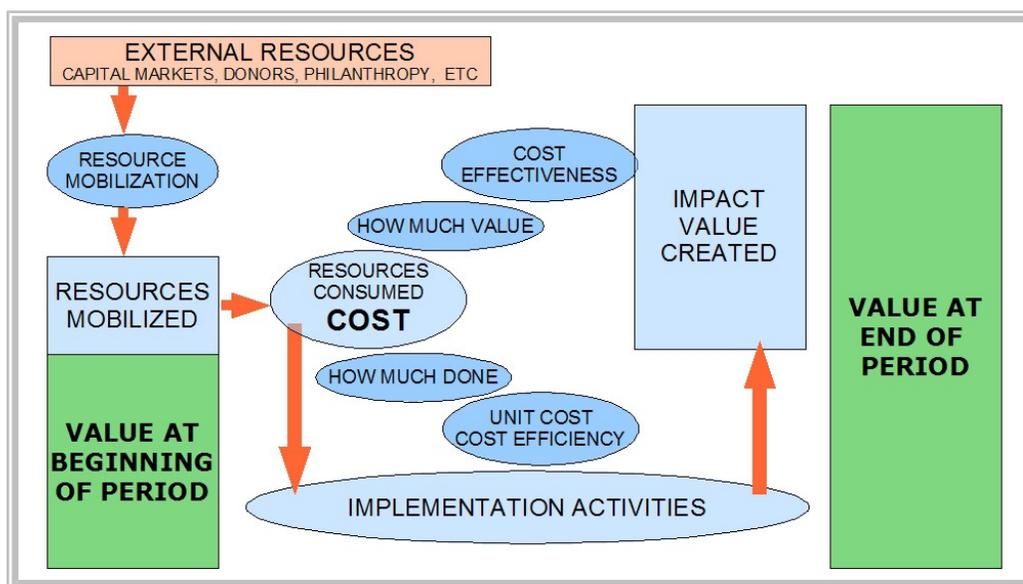
The following graphic shows how these basic concepts are applicable in the malaria management situation. Specific data are collected about the community prior to planning community malaria control interventions. The data are used to plan interventions and to implement interventions. The interventions have costs and there are levels of activity ... and after the interventions there is a new state of the community ... which then permits further planning and further implementation of control interventions. The process continues as long as there is a potential for vector borne disease like malaria. The graphic also shows the dataflow that feeds into aggregate data systems for research and access by the interested public.



How Much Cost ... What Impact ... Value?

Two key measures ... efficiency and effectiveness

TVM measures progress ... measures performance ... they are related but not the same. They are both important. There are two critical measures that should be taken into consideration (1) cost efficiency ... how much interventions cost versus how much they should have cost; and (2) cost effectiveness ... how much progress or value improvement was achieved relative to the cost or resources used.



Cost efficiency

Cost efficiency may be computed for each of many different interventions, with each intervention compared to similar interventions of the same sort under different circumstances. Cost efficiency measured what something cost relative to what it should have cost.

Cost effectiveness

Cost effectiveness may be computed quite easily where there is a single intervention. How much did the intervention cost ... and what was the impact ... what was the change in value from the beginning to the end of the period. Where there are multiple interventions it is relatively easy to come up with the total cost of the interventions ... and to get the impact ... the change in value from the beginning to the end of the period.

Because there are an almost infinite number of combinations of interventions and circumstances it is a difficult analytical exercise to come up with a statistically significant or a scientifically valid conclusion about what is best, it is easy to report how much a specific set of interventions cost, how much of the intervention activity was done and what progress has been made in the community from before to after the interventions.

The following table shows the arithmetic calculations for cost effectiveness

Item	State 0	Activities	State 1	Activities	State 2
Item AAA	A0		A1		A2
Change of state (impact ... value)		$B1=A1-A0$		$B2=A2-A1$	
Cost of activities		C1		C2	
Value increment		B1		B2	
Net value adding		$D1=B1-C1$		$D2=B2-C2$	

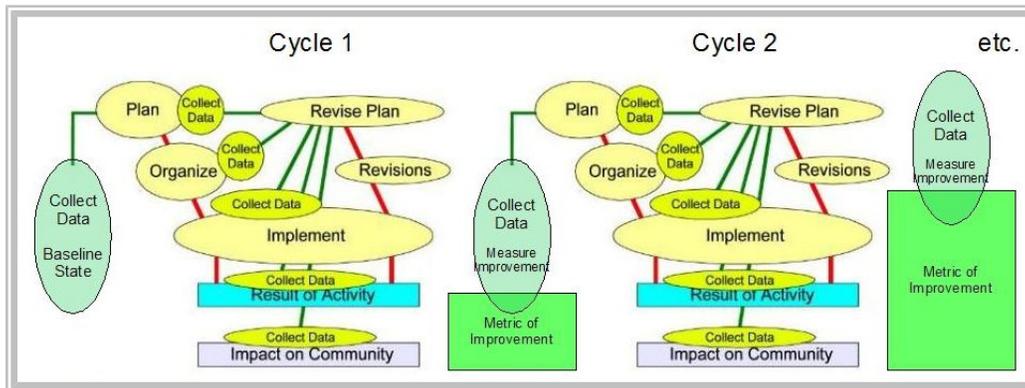
Cost effectiveness		D1/C1		D2/C2	
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Managing for Cost Effective Progress

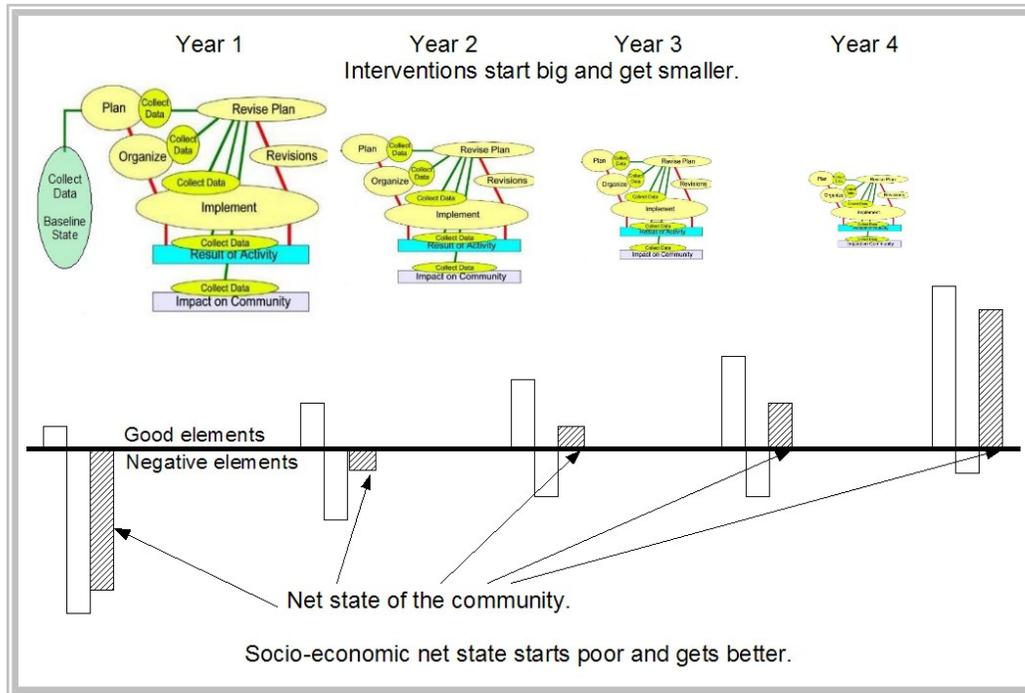
In order to be the most useful, the data must be simple, timely and clear ... and not cost a lot to collect. This basic idea replicates throughout the TVM framework. TVM has data at the center. Data are needed to develop management information which is central to the process of management ... the management cycle.

“Management information is the least amount of information that enables a good decision to be made in a timely way.”

The management cycle has the following form: (1) Collect data, do analysis; (2) plan and organize; (3) implement; and (4) measure and analyze again. High performance programs integrate data collection, analysis, planning, action, more data collection, more planning, more action in a perpetual process. These are reflected in the following schematic. Everything has a data component. The basic construct is not done once but is repeated over and over again ... data are collected and used for decision making all the time.



The ultimate measure of success is whether the change between the initial status and the post activity status has a value that (substantially) exceeds the costs. The above schematic shows this as a box “Metric of Improvement”.



In this graphic the initial condition reflects a high level of socio-economic burden which over time diminishes, yielding socio-economic improvement. Over time the amount of activity to improve the situation and sustain the improvement diminishes. This is the essence of success and sustainability.

In corporate accountancy there is both balance sheet and operating statement as an integrated whole ... similarly TVM has the state of the community and the economic activities of the community. Corporate accountancy has focus on money transactions and financial profit ... TVM takes into account the broader idea of social value creation and destruction

Over multiple cycles the aim is for the scale of the interventions to diminish and for the impact on community to get better and better, and the bad things to get smaller. The following depicts this graphically over a four year cycle. The interventions start big and get smaller while the net socio-economic state starts poor and gets better.

Cost efficiency and cost effectiveness strategy

The strategy is to do the most of what works best and give the most value for the least cost. A first step is to know what works best, what the costs are and what impact or results there are. This is a very simple idea ...essential to achieving the goal of good health at least cost ... but frequently not in the competence of the people engaged in managing in the sector. This is a deplorable state of affairs and totally unacceptable in a well managed civilized society ... there should be all the data needed so that clear and relevant information about cost efficiency and cost effectiveness are easily accessible.

Early intervention

Health professionals have embraced some important simple ideas for a very long time ... notably the idea that:

- ◆ Prevention is better than cure

Systemic approach

Health professionals think in systemic terms ... for example the following

- ◆ Triage
- ◆ Diagnosis

- ◆ Treatment
- ◆ Follow up

These should be part of a smart data environment where activity costs and related results are well understood, it becomes possible to plan and implement in an optimized manner.

Triage is needed because resources are always limited. It is not possible to do everything ... so what is most useful should be funded. Resources dedicated to malaria need to be allocated to specific places where malaria is most concentrated ... a function of population and the prevalence of malaria.

Capacity constraints

Capacity constraints are not only associated with money, but also the availability of trained staff and systemic issues with things like government procedures.

The IMM approach has a respect for community, and the full range of socio-economic activities that are important in the community. Good health is not just a matter of good healthcare ... it is also a result of a sound economy and the minimization of negative risk factors like poverty and malnutrition.

In an integrated socio-economic development environment, the following are all needed:

- ◆ Food and nutrition
- ◆ Job opportunities ... economic activity
- ◆ Basic health awareness
- ◆ Prevention instead of cure
- ◆ Access to basic health services
- ◆ Affordable treatment ... drugs
- ◆ Access to referral health services
- ◆ Affordable advanced treatment

Looked at from the IMM perspective and the community ... the most sustainable long term program will improve the health infrastructure in the community and do as much as possible with local awareness and disease prevention. The challenge of sustainability must be addressed by both cost effectiveness and an adequate level of productive economic activity in the community and not merely by long term health service subsidy from the international donor community, emergency aid and charity.

Prevention of malaria is ... as much as anything else ... breaking the chain of transmission. With control over the transmission of malaria, there is reduction in the burden of malaria. IMM does this ... and because of this, the IMM approach is least cost and the most sustainable in the long term.

IMM ... Technology

Using Technology

The basic concepts behind the analysis and use of data have changed little for a long time ... but the technology to facilitate this has been improving rapidly for a long time. Technology has been driven by science that tracks according to Moore's Law ... the idea that the power doubles and the cost halves every 18 months ... and this has now been going on for at least 30 years! My shorthand for this is that today the power available for management information analysis is one million times greater than 50 years ago ... so how come performance in all areas of socio-economic activity is not tracking along a similar trajectory?

The cost of technology

The cost of technology is huge in terms of development costs and the capital cost of infrastructure ... but the cost of use, the incremental cost of use is almost zero. The cost of technology relative to the power of technology has improved exponentially for many cycles ... following Moore's Law there the cost reduces by half over 18 months while power doubles in the same time. It should be noted, however, that "behavior of cost" means that only technologies with huge mass appeal will every have a low unit cost for the user. In practical terms it means that only technologies that have use in a mass market can ever cost effective.

Data structures ... data architecture, data flows, etc should be designed so that they are compatible with available technology being used in mass markets. Cost in this segment of the global economy is a key item to understand ... volume makes a big difference. Special purpose is expensive ... using an existing product or service in a new way requiring little or no modification is very very cost effective.

Mobile devices and infrastructure

The data acquisition process may now be optimized for use with low cost mobile devices. Specialized mobile data entry systems have been available for many years, but they have been expensive and suited only to well funded segments of the global economy ... not for healthcare in poor environments.

In conjunction with relational database logic, it is possible for a mobile device to send text messages that have critical data content using standard SMS protocols. Software such as FrontlineSMS facilitates transfer of these messages into a structured format in a database. This is a powerful application of low cost technology that can facilitate data acquisition from every community on the planet that are within range of mobile cell telephone infrastructure. At the present time (late 2009) even very remote rural communities have access to cell phone infrastructure.

Relational database

The relational database appeared on the technology scene in 1978 ... and it was said at the time, that this would change accountancy for ever. In some way this has become true ... the ideas of good accountancy were able to be integrated into a lot of management information in very powerful ways ... and that has been very good ... but in the process the accountancy profession has strayed away from some of its core responsibilities, and reported numbers are now rarely what one would expect them to be!

In the context of IMM, the relational database makes it possible for a lot of meaning to be transmitted ... communicated ... in ways that are low cost and very clear. This is incredibly valuable, and should be exploited as much as possible.

The use of technological power to organize unorganized data is not a good way to go ... it is possible to do ... but it is suited more to an academic exercise than to practical management.

Internet and Web 2.0

The Internet has changed the world ... not just the world of information. It is, however, a challenge to use this so that there is speed and progress and not just more volume. The web is still evolving ... and its impact huge. What has already happened may well be modest compared to what is possible in the future.

History repeats itself

In about 1962, I attended one of the first public demonstrations of the laser. It was at the Royal Institution in London .. in the same room that Faraday had used to demonstrate electricity in the 19th century. A few years later ... 1967 I guess ... I was working in the USA and laser light decorations were fashionable ... but that was about it. A decade later laser beams started to be used for industrial and commercial purposes ... and eventually every check out system in the world practically uses lasers and bar code scanning ... and industrial processes use laser for both measurement and for machining ... and the medical profession uses lasers for their precision work. The practical application of great technology takes time.

My take on the Internet and Web 2.0 is that a lot of what the public is doing with the technology is about where the laser was in 1967 ... imagine what can be done in the future.

Web accessible satellite imagery

Satellite imagery is a very powerful and cost effective way of getting rapid knowledge about an area and an overall understanding of the topography. While satellite imagery makes it possible to accelerate learning about any location, limited, of course, to those locations where satellite imagery is available ... there is a continuing big role for on the ground mapping.

The following images have been obtained from freely accessible web sources. They are good and getting better ... but have important limitations.

Image 1



Image 1 shows the area around Monrovia, Liberia. The map covers around 50,000 acres of which some 15,000 acres is marsh, and very close to human habitation.

Ground surveillance will confirm whether the whole of the marsh is habitat for mosquito breeding, or just limited areas.

Image 2

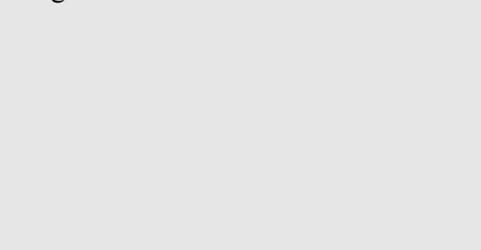


Image 2 shows individual houses in a section of Monrovia. Images of this sort enable plans to be made for surveillance and for interventions. The interventions may be interior residual spraying, source control or verification that bednets are available.

The level of malaria control activity should be



based on knowledge of the community and the impact of malaria in the community.

High resolution satellite imagery

Very high resolution satellite imagery is available that can provide extremely powerful planning information ... but at some cost. There are some situations where this cost is justified.

Image 3

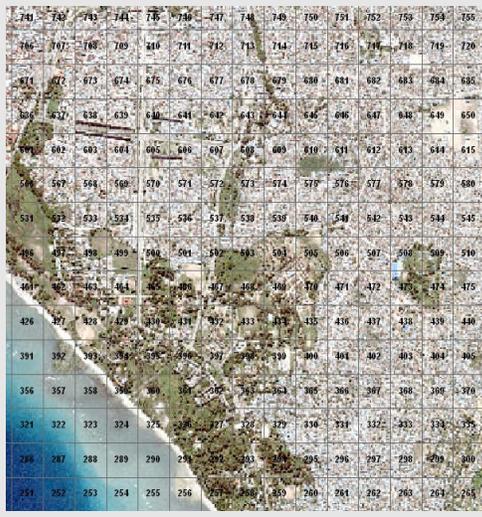


Image 3 is of Stone Town and its outskirts in Zanzibar. It is supplied by QuickBird and incorporates data from both the visible and the near-infra-red (NIR) spectrum. A grid based matrix has been overlaid.

With this technology it is possible to get images with a resolution of under 1 meter, a level of resolution that makes it possible to plan in detail without the expense of land mapping.

Supercomputing and data mining

The wall map and colored pins is a powerful way of planning ... it is low tech. and works very well for day to day decision making. Keeping track of how things change over time is, however, a data intensive exercise that rapidly gets out of control. This is where technology comes in.

Using the same data that are used to update the daily wall map ... it is possible to update a database with every data element necessary for subsequent analysis and data mining.

A team of local staff in cooperation with international IMM experts makes it is possible for very cost effective data acquisition and analysis.

It is expected that these data will confirm that good knowledge about the spatial distribution of mosquitoes and the spatial distribution of malaria in the community makes it possible to plan effective interventions that can be very much lower in cost than blanket coverage and much more valuable in terms of results being achieved.

IMM ... Data

About Data

A fundamental concept of the IMM approach is that data are essential to effective decision making.

In accounting the system requires that there is transaction data about every economic activity of the organization ... these data points are collected, organized and added up. There is not statistical manipulation in good accountancy ... no estimating ... just a simple recording of a simple fact.

The foundation for TVM is similar. Simple data about an economic event is collected, organized and eventually added up.

Easy data

Easy data are the key to TVM ... the data that are acquired should always be simple and easy to collect.

Lots of data about a simple thing will be of more decision making value than the same amount of data about a complex thing. Where things are complex, it becomes unclear about what is important and what is not. In a simple thing, it is usually quite clear what is going on.

Low cost high value

The cost of data acquisition is an issue ... it needs to be low cost. However, reducing the cost of data acquisition must not be achieved in ways that destroy the value of the data.

The practice of small surveys and powerful statistics is dangerous for decision making.

Data neutrality

Data should be a proxy for some reality ... data should be neutral, and reflect a fact. Data should facilitate an analysis that S

Granularity

Data are useful for decision making when they are able to show "cause and effect". The data should help in the understanding of the question "If this is done ... this will be the result". The starting point for this is to have data to show that when "this was done ... this was the result"

A simple system is always easier to understand than a complex system ... the community is a much simpler system than a nation ... a small geographic part of a community is yet again simpler.

Drill down only works when the base data are available ... and the IMM approach has data being collected that are extremely detailed with both temporal and spatial characteristics.

Aggregation

Aggregation is a good way to summarize data ... but it does not help a lot with the understanding of how complex systems at the community level are working.

Average

Averages normally don't tell very much. Data are needed to show differences ... and then explain differences. An average does not show this ... but a dataset might provide the explanation.

Time and place

Knowing about time and place makes it possible to put data into context ... to give the data perspective.

Neutral

Data must be neutral in order to be valuable

Timely

Data have the most value when they are available when they are needed. Many biological systems change rapidly over time ... slow data are often useless data.

IMM ... Metrics

Metrics for Paradigm Change

Integrated Malaria Management (IMM) is long overdue. The good news is that a lot of money has been made available for malaria control purposes ... the bad news is that a system to assure society that the resources have been well used does not exist. The transparency and accountability needed so that the costs and the impact of malaria control interventions are recorded and accessible to the interested public is inadequate ... it takes far too much effort for anyone to find out any of the basic facts about resource use, the costs and the impact in any location.

The data dimension of malaria control should be the easiest ... but it is not. The reason is not that data acquisition, organization and analysis are particularly difficult, it is more likely that data are powerful, and the story that the data will tell is not the story that many want to see told. This is not a new problem ... it is a problem since Biblical times, and will not change in the foreseeable future ... except that new tools are available so that “we the people” is not a mere platitude. Data by the people for the people is now possible.

The IMM framework incorporates data ... and while there is no guarantee that the major actors in the malaria control industry will adopt the IMM data framework, it is to be hoped that they will. However, if they do not, in due course much of the data will be acquired anyway and there will be an accounting.

The IMM opportunity may be simply stated to be that very much more health benefit will be achieved when an IMM approach is widely adopted than with the other approaches. The IMM approach that mainstreams relevant data so that decision making can be optimized has the potential to improve cost effectiveness by a substantial amount ... maybe even as much as an order of magnitude. The IMM approach also has the potential to make health state improvement sustainable, even in money poor environments.

Though there are much bigger fund flows for malaria control now (in 2009) than there were a decade ago, the progress towards a sustainable state of better health is tentative at best. The emerging progress seems to be in places, such as Rwanda, where the program has many of the elements of the IMM approach.

About Metrics

For the purpose of describing IMM, data is about a single fact or transaction, and metrics are about something more ... about the way the system is behaving.

Iterative learning

The IMM system is one of iterative learning ... simple knowledge is way better than no knowledge.

Take a community ... the starting point may be knowing nothing about a community. The steps might be as follows:

- ◆ Knowing the name of the community
- ◆ Knowing where it is
- ◆ Knowing how big it is
- ◆ Knowing what it does for employment
- ◆ Knowing what it does for entertainment
- ◆ Knowing about its infrastructure
- ◆ Knowing about its health
- ◆ Knowing about its education
- ◆ Knowing about its malaria

- ◆ Knowing about it mosquitoes
- ◆ And so on

Changes over time

Knowing how it compares today with what it was like at another time.

Depending on what bit of the community facts ... the time series should be hourly, daily, weekly, monthly or annually.

Time series is very powerful

And while two time series do not prove cause and effect ... they might well be a good indicator of cause and effect, and a basis for initial decisions about what needs to be done.

The TVM data are of two types: (1) data that describes a state; and (2) data that describes an activity. This is the same concept that is used in corporate accounting where there is a balance sheet (that describes a state) and the operating statement or profit and loss account (that describes activities). The changes in state are a result of an activity. Progress is most accurately measured by observation of the state. It is possible to have activity with no change in state and no progress.

TVM analysis aims to be useful ... to improve decision making and socio-economic performance. This means that the data and analysis has a focus on what is material. There is no point in having a lot of data about unimportant things.

TVM builds on accounting principles, applying them to a reporting unit that is the community and incorporating the double entry of both money and value. There are many tools available for analysis and reporting included techniques like (1) aggregation analysis; (2) time series analysis; (3) value chain analysis; (4) various forms of cost analysis; and, (5) various way of looking at impact and cost effectiveness.

Socio-economic activity data

Activity data are much more rapid moving ... resources are used and results are achieved. Where, what and when are important, and the data will change rapidly as the activities progress. The purpose of activities is to accomplish something of value.

Activities have costs. A quantity of activity for the costs incurred yields a unit cost. This unit cost relative to a standard cost yields a measure of cost efficiency.

The activities result in some impact or value. This may be measured by change in state. The value increment or change in state relative to the cost incurred is a measure of cost effectiveness.

Performance analysis includes cost analysis to: (1) compute the total cost of an activity; (2) compute the unit cost; and, (3) see whether the costs are in line with what was expected and adequately efficient. Performance analysis also looks at the value generated ... this is more than the activity, it is impact and benefit that results from the activities and the consumption of resources.

The following graphic shows these relationships:

Smart Data

Characteristics of the data needed

The data that are needed are data that go to the heart of all the issues that have importance. The data flows are organized so that all concerned are making good decisions and are seen to be making good decisions. Data are best when they are quick, clear and simple ... and low cost. When the situation is under control, the data will confirm what is expected. A situation is out of control when what actually is happening is very different from what was expected.

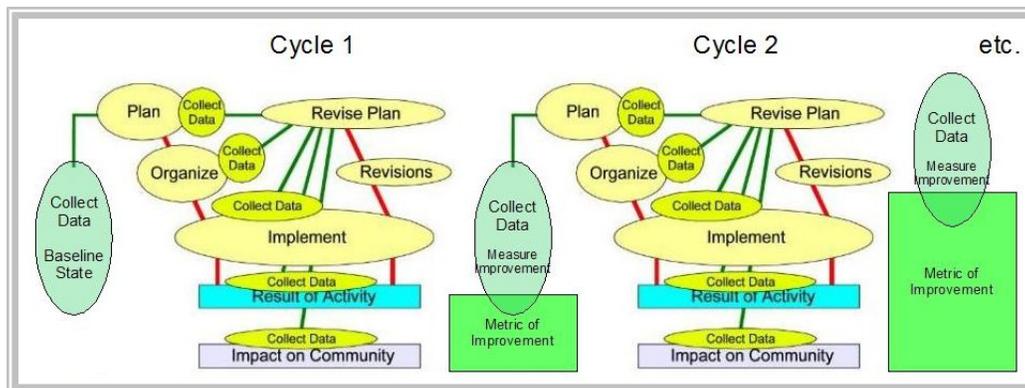
It is important to note that cost and management data have a different purpose than the statistical data used in, for example, clinical trials. Generally speaking, statistics used in cost accounting give results that are frequently just plain silly ... while a drill down to critical data in the IMM framework will provide useful and very relevant information.

Purpose of these data

The purpose of data is to facilitate progress ... to manage scarce resources so that there is a better future. These data are important because of the following:

“What gets measured gets done”

The data are the foundation for performance measurement. The IMM data are based on the Community Analytics (TVM) framework that has a focus on community and the social benefit that inures to the community from economic activity. In this system there is a continuum of metrics that inform decisions all the time. Data are at the center of everything and progress is achieved over time ... a continuum of progress:



State data and activity data

The IMM data are of two types: (1) state of the society data; and, (2) socio-economic activity data. This is similar to the reporting concepts of corporate accounting where there is a balance sheet (that describes a state) and the operating statement or profit and loss account (that describes activities).

State of society data

State data are the data that show the situation ... like a corporate balance sheet. They are mainly data that changes rather slowly. The change in state data from year to year is a reliable measure of socio-economic progress. Community and health infrastructure data are state data ... but important because these data show the limitations of the available infrastructure and serve to explain other aspects of community performance.

When the data show there is no hospital, no clinic, no doctor, no medicine, no nurse and there is a population of 100,000 people ... the projection of health outcomes is not going to be very favorable. The anticipated health outcomes deteriorate further when data about food shortage, no safe potable water, inadequate sanitation, etc. also become part of the state of the society data.

Useful data

Data are important ... but not more and more data, but rather data that are more and more useful. IMM embraces the following idea:

“Management information is the least amount of information that enables a good decision to be made in a timely way.”

IMM ubiquitous neutral useful data

In the IMM approach, data are ubiquitous and used to inform about everything: (1) the community; (2) spatial information about malariology; (3) entomology ... surveillance; (4) medical ... screening; (5) weather and the role of water; (6) performance ... cost and value; and, (7) research; and so forth

Some data has a high value especially if it is available at the right time. With timely data, there can be the correct response and a problem resolved. Examples include:

- ◆ Data about the life cycle stages in mosquito breeding sites;
- ◆ Data about disease in a sick person.

Data have high value when the data can be used in decision making. There are two issues that play into this:

- ◆ Is there a feedback process for decision making;
- ◆ Is there the capacity to implement what is needed.

Operational performance data are needed to ensure that there is progress ... that the strategy for progress is working ... that the operational activities are effective and efficient. These data address the questions of cost effectiveness and cost efficiency.

How much did it cost?

Are the data capable of providing this analysis? Are the following cost data elements available?

- ◆ Total cost?
 - The aggregate of the resources used ... many different ways to calculate this but very much an essential for responsible managers to know
- ◆ How many?
 - A measure of the scale of the activity ... how many or how much was done
- ◆ Unit cost?
 - The total cost divided by how many ... which then becomes a metric that can be used all sorts of comparisons
- ◆ Standard unit cost?
 - What something should have cost ... a standard based on what should be expected.
- ◆ Cost efficiency?
 - What it did cost relative to the standard or what it should have cost.

Are the cost data capable of providing analysis by activity ... somewhat similar to analysis by cost center or profit center in corporate accounting?

Are the data also able to provide analysis by the various elements of cost:

- ◆ People costs;
 - Remuneration ... salaries and wages;
 - Benefits ... healthcare, vacation plans, etc;

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- Training allowances;
- Incentives, per diems, etc;
- Consulting services;
- ◆ Materials and supplies;
 - Medical: Drugs, diagnostics kits, etc;
 - Vector control: Pesticides, bednets, etc;
- ◆ Facilities and equipment;
 - Medical: Clinics, hospitals, vehicles, etc;
 - Vector control: Labs, spray equipment, vehicles, etc;
- ◆ Operating expenses
 - Rent, utilities, communications, office supplies, travel, etc.
- ◆ Overhead expenses
 - Financing costs

Are the data that show costs by activity and the data that show costs by cost element easily reconciled ... do they show the same performance but from different perspectives? If not, why not?

What was the value?

The IMM approach also asks about the impact and value of the activities. Impact is different from the scale of the activity ... it is what value the benefit had to the end beneficiary. This approach gets answers to the questions:

- ◆ How much benefit/impact?
 - If the benefit is less mortality ... this is good
- ◆ Standard unit value?
 - This is a subjective value that has been compiled to reflect what people think things are worth ... what value they have.
- ◆ Impact value?
 - And the value of less mortality is very high ... and in the TVM methodology is computed using a table of standard values.
- ◆ Cost effectiveness?
 - Somewhat similar to cost benefit ... shows the relationship between the value added and the costs incurred.

Disability Adjusted Life Year (DALY)

The Disability Adjusted Life Year (DALY) is a measure used in the health sector to measure ... but rather than giving clarity it seems more to add confusion and further complexity. The idea that there should be some metric that facilitates comparison across disease and location has merit, but not when too many assumptions that vary have to be made as well. Community Analytics (TVM) aims for simplicity, clarity and ease of understanding.

Healthcare is more than just malaria ... the DALY as a measure of performance assumes that when a treatment is successful ... the value of the treatment is determined by how many years there is post treatment survival ... which is OK if there is a reasonable expectation of living an average lifespan ... but not OK when there are multiple killer diseases in the community. With childhood disease killing perhaps 30,000 children a day, and malaria responsible for killing 3,000 a day ... it appears that the situation is one of multiple killer diseases.

Because of this the best outcome is going to be one where there is integration of malaria interventions with a broader all disease medical strategy ... and for this to be optimized, there will be easy all health access at the community level.

About the weather

The population density of mosquitoes is directly related to weather conditions, especially precipitation (irrigation), temperature and relative humidity. Monitoring these key climatological conditions can provide the necessary information to predict which sites will be producing mosquito larvae and when. These parameters coupled with a knowledge of sub-surface water (water table) can provide additional information on where and when to begin mosquito larval control applications.

Rainfall (mm per month)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Site 1													
Site 2													
Site 3													
Site 4													
Etc.													
Average													

Temperature

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Site 1													
Site 2													
Site 3													
Site 4													
Etc.													
Average													

Humidity

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Site 1													
Site 2													
Site 3													
Site 4													
Etc.													
Average													

Prevailing winds

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Site 1													
Site 2													
Site 3													
Site 4													
Etc.													
Average													

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There are many different ways to present data so that the time series tells as story. The following example uses rainfall to show some of the alternative presentations.

In the following table the data are presented month by month for each of a number of sites in the community.

Rainfall (mm per month)

AREA: ABC													
Year NNNN	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Site 1													
Site 2													
Site 3													
Site 4													
Etc.													
Average													

In this table the data for a single site are tabulated year by year for a number of years. From this table it is possible to see changes from year to year. The month by month layout shows seasonality and timing which frequently has importance for such things as farm performance and the prevalence of mosquitoes.

Rainfall (mm per month)

Site N	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Year 1995													
Year 1996													
Year 1997													
Year 1998													
Year 1999													

When the data are presented in a cumulative way, it is possible to assess progress through a year and compare this cumulative progress with similar cumulative data such as from year to year or from place to place.

Rainfall (Cumulative mm)

AREA: ABC													
Site N	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Year 1995													
Year 1996													
Year 1997													
Year 1998													
Year 1999													

For some data a similar series of datasets are needed by day, and there are cases where the data needs to be at even shorter intervals. All data should be compiled reflecting the natural rhythm of the data so that the data has meaning and is not “just a number”.

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The data may also be summarized for a year, and data presented as a year series ... or year data from one location may be compared the similar data from another location.

Health data at the household level

Simply put, the data at the lowest level will start to inform decision makes in a useful way.

At the family or household level, the critical information is: (1) What was done, and when; and (2) what have been the results.

This is a sample of the data table that could be used.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Number of people in the household													
Number of adults (F)													
Number of adults (M)													
Number of children													
Bednets acquired this month (quantity)													
Number that used a bednet every night this month													
House was treated with interior residual spraying this month													
Adult cases of malaria this month													
Adults that got treatment for malaria this month													
Children cases of malaria this month													
Children that got treatment for malaria this month													
Number of clinic visits this month													
Deaths in the household this month													

The specific questions might vary for clarification. The aim is to have a simple time series that serves to show what is happening in the household in respect of malaria interventions (bednets and IRS)

Education and awareness

Cost factors for education and awareness

Education and awareness cost – actual by month for year N

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Training													
Salaries													
Workshops													
Transport													
Equipment													
Supplies													
Etc.													
Total													

Training programs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Person.days of trainers													
Cost													
Person.days of students													
Unit cost per student													

Activities – Standard versus actual

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
People involved													
Std. cost													
Standard													
Actual													
Variance													

Health and malaria coordination

Coordination cost – actual by month for year N

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Training													
Salaries													
Workshops													
Transport													
Equipment													
Supplies													
Etc.													
Total													

Training programs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Person.days of trainers													
Cost													
Person.days of students													
Unit cost per student													

Activities – Standard versus actual

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
People involved													
Std. cost													
Standard													
Actual													
Variance													

Diagnosis

Diagnostic activity - # of tests performed by site

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Site 1													
Site 2													
Site 3													
Site 4													
Etc.													
Total													

Diagnostic activity – results of diagnostic testing – per site

Site # NNN	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
# of tests													
# positive for malaria													
Percent having malaria													

Diagnostic activity – results of diagnostic testing – summary for area

Area # NNN	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
# of tests													
# positive for malaria													
Percent having malaria													

Actual cost of diagnostic activity - by site

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Site 1													
Site 2													
Site 3													
Site 4													
Etc.													
Total													

Standard cost of diagnostic activity - by site

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Site 1													
Site 2													
Site 3													
Site 4													
Etc.													
Total													

Time series for health

Time series of malaria cases

By population segment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Population (total)													
Population (male)													
Population (female)													
Population (5 and under)													
Population (6 to 15)													
Population (16 to 45)													
Population (46 up)													
Population (female pregnant)													

The number of cases is a result and can be considered either as a state or as an activity ... the number of cases can be used as a metric for “state” or as a metric of “activity”.

Time series about the malaria parasite in the population

By population segment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Population (total)													
Population (male)													
Population (female)													
Population (5 and under)													
Population (6 to 15)													
Population (16 to 45)													
Population (46 up)													
Population (female pregnant)													

The malaria in the population can be measured in various ways. This may be done using statistical sampling with a sufficient sample size and an approach that includes all the population.

It is not normally satisfactory to use those visiting a health center as a sample that reflects the whole population.

It is possible, however, to use almost any time series of data that are compiled on a consistent bases to serve as an indicator of change.

Time series about mortality in the population

By population segment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Population (total)													
Population (male)													
Population (female)													
Population (5 and under)													
Population (6 to 15)													

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Population (16 to 45)													
Population (46 up)													
Population (female pregnant)													

The data about mortality with the same analytical breakdown as the data about population. There are two groups that normally have high mortality: (1) children under 5 and (2) pregnant women.

Time series about morbidity in the population

By population segment	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Population (total)													
Population (male)													
Population (female)													
Population (5 and under)													
Population (6 to 15)													
Population (16 to 45)													
Population (46 up)													
Population (female pregnant)													

The data about morbidity with the same analytical breakdown as the data about population. Morbidity affects all of the population. Morbidity in the group aged 16 to 45 has the most impact on economic performance.

Health data from a clinic

About malaria

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Total number of people presenting at the clinic													
Of which malaria cases													
Of which adult (M)													
Of which adult (F)													
Of which pregnant													
Of which age 5-16													
Of which age < 5													
Malaria - no treatment													
Malaria treatment A													
Malaria treatment B													
Malaria treatment C													
Malaria hospitalization													
Malaria death at clinic													
Malaria death elsewhere													

The data detail may be different ... the aim is to get an indicator of the scale of the problem, and how the disease profile is changing over time.

Table of comparative costs

Element of cost	Type of facility	Health clinic	Rural hospital	Referral hospital	Community health worker	Transport
Capital cost of land and buildings						
Capital cost of medical equipment						
Capital cost of vehicles						
Capital cost of office equipment						
Total capital cost						
Annual cost of land and buildings						
Annual cost of medical equipment						
Annual cost of vehicles						
Annual cost of office equipment						
Total annual cost of capital items						
MD salary and benefits						
Nurses salary and benefits						
Other staff salary and benefits						
CHW salary and benefits						
Consultants, etc						
Total staff costs						
Drug costs						
Other medical supplies						
General expenses						
Travel						
Housing						
Training						
Other						
Awareness training						
Bednet marketing and promotion						

Medical cost

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Training													
Salaries													
Drugs													
Transport													
Equipment													
Supplies													
Etc.													
Total													

Training

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Cost													
Person.days													
Unit cost													

Medical intervention

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Number of cases													
Unit std. cost													
Standard													
Actual													
Variance													

IMM ... Resources

Resources are More than Money.

Money may be important ... but other things are important as well. Resources include the following:

- ◆ Money
- ◆ People ... Human Resources
- ◆ Natural Resources
- ◆ Organizations
- ◆ Working Capital

Sustainability

Sustainability is helped when there is money. Money makes it possible to pay bills on time, and to plan for the future ... indeed to spend or invest for the future.

Sources of Funds

Most times the source of funds is thought to be either a donor, an investor, or retained earnings ... or something similar. But in fact the source of funds is prior surplus production ... and at some point in the past they convert into something else and are to be found in the forms just listed.

For the immediate purpose of spending bills and making current investments ... money has to come from somewhere where it already exists.

In the future ... source of funds and sustainability are linked together. It is surplus production that makes it possible to accumulate ... and prior accumulation is what becomes available for current use.

Intellectual Property

Profit and Value

IMM ... Funding

Public Health has Value

Public health has public value ... and benefits everyone. But most poor communities ... most poor countries ... cannot afford good public health programs.

The health budget at the governmental level in most developing countries is grotesquely small relative to what is needed ... public health expenditures are heavily reliant on external funding.

International Funding for Global Health

Most international development assistance funding is not optimized for public health in general, but is disease specific.

A major issue addressed by the TVM initiative and IMM is that international funding for global health at current levels is most likely not sustainable. If the funding declines from present levels ... how best to use scarce resources.

The conclusion of planning teams such as the WHO-GMAP team that funding for global malaria control initiatives needs to increase to more than \$6 billion a year is of academic interest but not a serious basis for planning.

There are many serious issues that arise in connection with international funding for global health ... most of which are difficult to address because the essential data are hidden from view. It is, however, abundantly clear that the relationship between money disbursed and results achieved is poor ... just as high cost healthcare in the United States does not deliver the best healthcare outcomes ... though the specific reasons are different.

Some major shifts in the way international funding for global health is managed is possible. Many of the key organizations understand that there is a need for substantially improved performance metrics along the lines of the TVM/IMM methodology. This is not an easy change for many reasons, including (1) the fact that this level of accountability has been absent for a very long time; (2) in depth knowledge about how to do it is missing; (3) a robust organizational framework for such accountability does not exist.

As cost performance is integrated into the process of international funding for global health, there will be many changes in the way health interventions are planned. This is already taking place to some extent but it is driven by relatively few organizations that understand the cost performance imperative and not yet by the large organizations that are in control of most of the available global health funding.

At the present time, poor countries deliver very little healthcare that is locally funded ... relying largely ... in many cases almost exclusively ... on the funding of donors to address critical needs and emergencies. This approach has helped ... but the cost of this help has been substantial and while the benefit from these resources are substantial ... whether they are as good as they should be is unproven. Very little data about project performance has been compiled in a useful manner for analysis, and to the extent it has been collected, it is not easily accessible to the interested public.

The provision of healthcare using public finance is always constrained by costs and the limited availability of resources. With these constraints, health services are rationed. But there is also

rationing in the typical free market privately funded system as well. In both cases there are people who have healthcare needs, but who are impoverished or disenfranchised will not be able to access good healthcare ... only those with the financial means can access the system.

Thought there has been increased spending ... both on field implementation and research, there are very little data that enable prediction of the optimum mix of interventions. Most data that are easily accessible are about coverage ... and some about progress, but little that links cost and impact. Simple models to predict the behavior of mosquito and malaria suggest that integrated programs work better, but data have never been organized to generate reliable results about this.

The health sector has is complex with both infrastructure and activities ... with healthcare providers and patients. The goal is good health.

Funding

Funding is critical, but external funding that facilitates high cost health services without any ability for these services to be sustainable into the future is a disservice to society ... and that is, in the main, the funding model that is being used for global health ... and for malaria.

There are many issues to be addressed ... there is some cause for encouragement ... and as much cause for concern. While the increase in funding for malaria related initiatives from 2000 to 2009 is impressive ... there is absolutely no assurance that these levels of funding will continue, and there are questions about whether or not these funds have been used in the most appropriate way. s but this funding may not be sustainable at either the recent 2008 levels nor the higher levels needed for malaria control in the future according to WHO.

Country government budgets for health are very small almost everywhere in developing countries, and especially in malaria endemic countries in Africa. Health budgets in African are miniscule, with not unsurprising consequences: (1) public facilities have not been built; (2) If they are built, they are not staffed; (3) if they are staffed they do not have adequate medical supplies; and, (4) they are not maintained ... with things like the cold chain not functioning.

Affordability is a challenge. The value of good health is very high ... but even the least cost services cannot be afforded by the poor that need the services. Personal funding has a role. In most places, people are on their own ... they can pay for health services that are available if they have the money. Only affordable services can be supported this way ... and most donor plans for health service are not affordable within the norms of the local economy. The only possible outcome of this arrangement is a poor health outcome.

Patient fees are the natural way for health services to be paid for ... but this natural arrangement does not work well when there is a high level of disease and a low capacity to pay for even the most affordable of health service.

The intersection of microfinance and health is emerging as a potential way forward where government finance is insufficient to fund good health, and individuals do not have immediate access the funds to pay for health services ... the cost of micro-finance loans is small relative to the value of the service.

Local taxes and community level funding is rarely on the agenda ... yet it is the most likely way for sustainable community progress to be made. The benefits accrue to people in the community ... and it is reasonable that these benefits are funded from local resources.

There is often a lot more local wealth and private resources than might be apparent from the prevalence of poverty and the general appearance of squalor ... but this is rarely tapped as a source of funding for important local programs. The idea of public private partnership has proved very effective for local improvement of public space for the benefit of neighborhoods ... as for example in recent times in New York City.

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Private philanthropy is a potential source of funding ... and it usually flows to causes that are popular or for which the philanthropy has some connection. Philanthropy is an important source of funding, but dangerous to rely on as a source of long term sustainability.

Official development assistance (ODA) or official relief and development assistance (ORDA) are important sources of funding. There are several different flows: (1) from bilateral development agencies like USAID (USA), DFID (UK), SIDA (Sweden) etc.; from multilateral institutions like the World Bank, Global Fund for Aids, Tuberculosis and Malaria (GFATM), UN, etc.; and (3) emergency appeals arising from humanitarian crisis.

Specific humanitarian aid has received much of the funding that has flowed from the global north to the global south, and has been helpful in mitigating some of the suffering ... however, in almost every case these funds are consumed in an emergency mode and usually in very expensive ways ... such as, for example, flying food to affected areas, premium pricing (in effect profiteering) on most emergency goods purchases, etc.

IMM ... People

People ... the Critical Resource

The biggest resource is human capital ... but human capital needs development. With perhaps as much as 70% of the population under 20 years old, the demographics of Africa are a huge challenge ... and an opportunity. The challenge is to help this population get jobs that are productive, and to have enough education and training so that they can do the available jobs well. The need for work to be done is everywhere ... but the training and skills and the organization is missing. Work to help improve health in Africa should be a great work opportunity and a priority.

Health workers are the key to success in the health sector. But there is a global crisis in health ... and there is a critical shortage of health workers. This is a complex issue with many different elements. There are no simple and quick solutions, but there are some ways forward that should be considered. The demographics of the population make it possible to determine what clinic capacity is needed. There should be at least one MD for a population of (say) 10,000, one nurse for a population of (say) 3,000 and a CHW per population of (say) 400. These numbers vary depending on a variety of factors, notably the age of the population. From this the requirement for medical staff can be estimated.

Using this calculation, the shortage of health staff is staggering. The recruitment, training and retention of health professionals is a crisis and needs addressing.

People ... the Population that Benefits

The population needs to be the focus of everything ... are the required health services available and are the available services producing the results needed?

A community is where people live ... it is where people need to have healthcare. It is where people need to understand how their health can be as good as possible ... what they can do for themselves, and what the broader world needs to do to be helpful. Most communities that are poor have little of the essential infrastructure for health that is needed for optimum health outcomes ... and there are not enough resources ever to do this using the high cost health models that have emerged in rich societies.

People need information ... knowledge. People get most of their knowledge from practical interaction with others ... as children first, and then as adults. Good knowledge about health needs to be a part of the community infrastructure. This can start at schools ... or with adults and community groups ... or with religious groups. It does not matter how or where it starts ... how or where it is ongoing ... but it is needed, and most poor communities are terrible in knowledge deficit when it comes to health knowledge.

If a person is becoming ill ... or a family member, a child perhaps, is becoming ill ... there is a need to be able to get health guidance, and get it easily and affordably. A community accessible health clinic may do this ... or it could be a community health worker (CHW) with the requisite training. A person that is ill needs to be able to get a diagnosis ... there needs to be identification of what is wrong ... and then steps available so that the appropriate treatment can be delivered.

Prevention is an important part of successful low cost health ... and prevention encompasses a whole range of matters, including items like good potable water, adequate food and the associated essential nutrients that are needed.

Vulnerable and high risk groups

Malaria is a deadly disease for children and pregnant women. The global malaria funding industry has deemed this to be a priority but the logic of this may not be quite as simple as it seems at first sight. A focus on providing malaria mitigation interventions to young children and pregnant women seems to have had an impact in terms of reduced mortality from malaria for these groups ... but at considerable expense, and with little sustainable progress in terms of the larger problem.

An approach that is spatial in nature and addresses the totality of the malaria problem in the area has more likelihood of being cost effective and sustainable. There are some types of malaria that are deadly for everyone ... and malaria in all its variations is a debilitating disease for everyone.

People ... how much is the cost?

Cost is a metric that should be easy to obtain and to study ... but it is not. One important reason is that good cost data about people is likely to raise uncomfortable questions. Valuable local people are paid too little and international staff are paid much more ... in some cases way more than is economically reasonable and justified. Detailed cost might well show that the level of cost inefficiency that prevails in the global health sector is depressingly low ... in some cases because high cost approaches have been chosen rather than ones where the costs are lower.

The value is difficult to quantify ... but it is widely agreed that good health has a huge value. One of the biggest numbers associated with the African economy is the economic cost of Africa's terrible health status ... an annual cost, some estimate, of more than US\$10 billion a year! A complete analysis of this is beyond the scope of this paper, but the cost of failed health in Africa is likely to be an order of magnitude bigger than this when all the associated impacts are taken into account.

The issue of remuneration and working conditions is important. There are many aspects to the matter of remuneration, including:

- ◆ Base remuneration
 - Base pay of health workers is low in almost all developing countries
- ◆ Incentive pay
 - Incentives are rare ... and when they exist they are usually not providing the right incentives.
- ◆ Career path
 - Career path is also important for people working in the sector. If the best career path is economic migrations, then the sector cannot be sustainable
- ◆ Living conditions
 - Living conditions are abysmal for health workers who are required to work in remote rural areas, especially for the critical junior entry level staff who are key to everything.

Remuneration is one of the issues that needs to be addressed seriously. It is one of the root causes of dysfunction in the health sector with some people being paid far too much, and some people not being paid enough. The system for deciding on how much people are paid is inadequate and results in totally perverse consequences. Remuneration is a critical matter that requires a lot of attention.

Some critical human resource issues

Brain drain ... economic migration

Many developing countries are losing trained health workers to economic migration. Trained health professionals are able to earn a lot more money and have better working conditions in the rich developed countries, and this economic incentive has created a crisis of health worker shortage in developing countries.

Within developing countries there is a further problem of differential remuneration. Health workers paid by the Ministry of Health are often ... almost always ... paid substantially less than the staff who work for “health projects” funded by international donors, financing agencies and international NGOs. This distortion is very damaging ... frequently career wrecking!

Staff remuneration is a serious matter. There must be the right balance between incentive to work well and having an affordable cost that can be sustainable. The use of volunteers for essential work that needs to be done should not be done.

The problem of living conditions must be addressed. Housing in rural communities ... and poor communities ... is of a low standard, and a problem for staff that must move into the area. When staff are recruited locally, this is less of a problem.

Recruitment

The health sector needs people ... a lot of people. However, recruitment is constrained by the high cost of entry ... the education and training that is required for certification, for example ... and a very rigid way that the people in the sector are organized. Some of this is justified ... the idea that health professionals should be unqualified is not very comforting ... but the broader dysfunction of the health sector because of its high costs, its lack of sufficient staff, etc. are also not very comforting.

Recruiting is important ... the sector needs people ... and the people need to be able to do the work that is required. Work needs to be done to ensure that good people get the opportunity to join the health sector, and to be paid reasonably for what they do. This is not going to be easy without some changes and a way better appreciation of how people can be more efficiently recruited, trained and deployed.

Recruitment is only successful if there the staff stay in their jobs, or progress from their entry jobs to further work in the sector. Career path development is a part of retention ... the the issue of remuneration and the working conditions are also important.

The problem of professional certification

A lot of people would like to work in the health sector, but are barred from the work because of laws, rules and regulations. Some of these are valid ... some are not. There is a substantial amount of “protectionism” in the rule making that serves the interest of specific groups of people, but does nothing for the health sector as a whole.

Professional reforms

Some professional reforms are needed. The medical profession has changed out of all recognition over the past fifty years, but some of the professional constraints that were appropriate then are still in place. The glacial pace of reform is a function of the rewards available under the status quo, and the lack of urgency about healthcare costs and the appalling global state of health.

Developing Human Resources for Sustainability

Training

Training is a very expensive part of the health sector ... but it is essential. It costs a lot of money to get the education, training and basic experience to become a board certified medical doctor. It costs money to get educated and train as a nurse ... and so on for all the professional and support staff in the health sector.

The IMM strategy for training is to train well and to train local people ... and to train trainers ... and to make training an integral part of the healthcare program. Training is key to sustainability ... not narrow training, but broad training so that the broad issues about society and health are understood as well as the purely academic and technical aspects of the training. Education should be about giving people the knowledge and motivation to take advantage of opportunity ... and service in the global health sector represents a huge need which should translate into great opportunities for a worthwhile careers

There has to be training so that staff know what is needed to identify malaria. Training must be done well, and staff must be appropriately remunerated.

Training has a key role ... especially training that facilitates local people being able to do the work that is most needed. There are enormous shortages of trained staff ... which argues for more training. But there are also serious shortages of opportunities for trained staff to be employed to do what needs to be done. This is separate from training and is more to do with the structure of the health sector, the organizations and the funding.

Evaluating training programs

I was asked to evaluate a national training program that was funded by international donors. There was voluminous data about who had been trained and with whose money ... but absolutely no data about what this training had done for all the people who had received the training benefit. The question about how the training had opened opportunities and how careers had been changed was totally missing in the data about results ... though it was central to the justification used to run training programs and get the funding from the donors!

Some innovations in training are being implemented by emerging nations. These initiatives need to be evaluated to see how they might contribute to the way forward for the health sector everywhere. Staff that have potential beyond their certification and being trained to do a range of things that need doing but would not normally be done by them. Staff shortages make it impossible to get them done in the conventional way of training and certification ... and in the meantime people will die.

In best practice is for a person to be engaged in a continuing process of learning ... with nothing a dead end. Everyone should always have the possibility of learning more and doing more that is valuable to the community.

Training CHWs

The training of ordinary people to become community health workers (CHWs) ... and to have CHWs do as much as possible that are important in the community has a lot of potential. There needs to be training ... and there needs to be trained oversight.

Training nurses

Training nurses has to be a high priority. There is a shortage at present and this shortage is likely to continue into the foreseeable future. The shortage of nurses in some countries is aggravated by outward migration to countries where salaries are higher and there is also a shortage.

Training MDs

Universities are training MDs, though far fewer than are needed to satisfy the need for trained health personnel. The training is very expensive and probably could be done at far less cost and still serve the needs of society. There is very little analysis of such a possibility because of the favorable economics of shortage to the people in the existing system ... though it is increasingly clear that the value to society of the prevailing system is being severely compromised.

Training IRS spray staff

IRS spray staff need to be trained well so that they operate in a safe mode both for themselves and for the public at large. Heavy exposure to some of the pesticides that are used is dangerous if appropriate precautions are ignored. Good training ensures that dangerous chemicals are always used in a safe manner. There also needs to be training of oversight supervisors and quality control and safety personnel so that all the system operates in the appropriate manner.

Training surveillance staff

Surveillance staff need to be trained so that they can identify as much as possible without error. Good local staff can be very valuable quickly ... but this value only increases as they learn more about both the community and its socio-economic dynamics and the various important scientific disciplines that are impacting the area. Training should be ongoing, and there should be as much opportunity as possible for staff to move to positions of higher responsibility and remuneration.

Medical Personnel

The MD centrality of healthcare

The HR dimension of the health sector has been MD centric for all the last century. This is changing ... and accelerating. There are two new elements that are impacting the structure of the global health system (1) the role of technology everywhere from advanced diagnostics to patient records; and (2) a panoply of other people with some level of education and training that are part of the health system. The MD is an important piece of all of this, but the role is different ... or ought to be ... now from what it has been in the past.

A big part of the success of the health sector in the years to come will be derived from the expertise of HR professionals who understand the linkages between education, experience, continuing learning and the value being delivered to the society. This is not a simple equation ... but it is important and a key to sustainable success.

The following is an outline of the various staff that are involved in the health sector ... maybe not complete and not accurate in any specific situation ... but a useful overview of the context.

Board Certified Doctors ... MDs

Very few doctors are available and therefore are normally found only at hospitals, expensive private clinics and externally funded projects. The Medical Doctor (MD) is the main professional qualification in the health field. The training is long, rigorous and costly ... and the Board Certified MD has a first class professional qualification.

The MD is a key piece of the modern medical structure ... but the cost of the MD needs to be turned into maximum value. The MD is not not needed for many basic health interventions and this work should be done much more by health professionals below the MD level. The MD is needed in some situations ... but not in all situations ... and a good health system should understand the difference.

It would be great if every community had enough MDs to satisfy the needs of the population ... but there is a global shortage of doctors! Or is it perhaps that the system is moving trained medical professionals away from areas where they are most needed for critical high value medical interventions to rather less critical by high profit interventions.

It is a challenge to get qualified to work in rural settings ... but the need for medical attention does not disappear with the remoteness. What to do?

Surgery is an important part of modern medicine. Well trained and experienced staff are needed ... but this is a costly part of the health structure.

Registered Nurses ... RNs

More nurses than doctors ... but not enough. Trained nurses in international demand. Nurses are a key to success of the health sector ... but the shortage is getting in the way and also nurses are constrained from doing a lot more than they are permitted to do under professional regulations of the health industry.

The nursing profession is a core element in the medical system ... but there are not enough RNs to satisfy the needs of the population ... there is a global shortage of nurses. There is the same question for nurses as for doctors ... are the people that are getting the training moving into the work that has the most value to society, or is the system merely encouraging migration to the most profitable high salary positions.

Because of the shortage of doctors ... nurses need to do work that MDs would normally have done, if they were available. This is an interesting development, because as this happens it becomes apparent that a lot of the work that is normally done by MDs can quite reasonably be done by nurses with good outcomes.

Community Health Workers (CHW)

The community health worker (CHW) is the first link in the chain of professional health staff. They are on the front line, and their work makes the most immediate impact. They are a critical element in monitoring health status and getting someone who is ill to get treatment. A CHW cannot work in isolation and be successful. A CHW needs to have an accessible health facility so that getting someone to get treatment is relatively easy rather than being near impossible. A CHW needs to have access to drugs for the patients, and for these drugs to be affordable.

Given the shortages of MDs and RNs it is imperative that the potential of people is used in the most propitious way. People with non-formal education and training need to be included because they are needed and because they have a lot to offer. A community health worker (CHW) may not have the academic credentials and training of an MD or an RN, but the contribution that they are able to make is huge, and it is quite possible to give a CHW a very useful training quite quickly.

A community where there are sufficient CHWs is likely to have way better health outcomes than a community that does not have them. (Note 1: Please contact me if you know of any studies which show this! Note 2: Please contact me if you want to see a Community Analytics (TVM) study about this!)

Rwanda

Since 2006, there has been substantial progress in reducing the burden of malaria in Rwanda. This success is attributable in part to some 40,000 community health workers (CHWs) who have been trained to diagnose malaria and provide treatment. Some CHWs are trained to do IRS spraying or help with bednet use.

The effectiveness of health workers depends on several factors:

- ◆ The capability, training and experience of the CHW
- ◆ The availability of treatments to the patients ... especially drugs
- ◆ The affordability of treatment
- ◆ The support available to the CHW
 - MD, nurses and local clinic
 - Referral hospital
 - Transport
- ◆ The remuneration and incentives for the CHW

Traditional Birth Attendants (TBA)

The traditional birth attendant (TBA) is a key part of the prevailing health system in much of the developing world. They rarely have formal education ... but do have “on the job” experience and often have the confidence of the community. They are a potential important human resource in the rural health sector and should not be ignored.

Midwives

The midwife has been an important part of the medical community for a long time. They are the TBA of more modern medicine ... with formal training. Midwives and home delivery have been displaced in rich countries by hospital delivery which is somewhat safer but a lot more costly.

Technicians

Medical technicians are able to carry out many procedures that are part of healthcare. The training usually has a focus on a limited part of the whole range of medical procedures now being used.

Medical researchers

Medical research is important for tomorrow ... but also because some problems may well move from tomorrow to today, and the health community needs to be prepared. The development of resistance is one area where ongoing research is important.

Administration, etc.

Underestimated in importance ... critical to keeping the health infrastructure functioning. The role of administration is both in terms of merely the paperwork, but also helping to build knowledge about the economic dimension of the health sector.

Support staff

Making any medical institution run well requires all sorts of support staff. They are critical and too little recognized for their role in making things work.

Public Health Professionals

Increasingly there are people who have trained in the administration of the health sector without being medical professionals.

Social workers

There are also people trained in social work who are able to provide a lot of help to people without actually providing healthcare services. In a complex society ... coping can be a challenge.

Therapists

Others are trained to provide therapy in various disciplines.

From the above it is clear that people are a big component of the healthcare industry ... not all these people are required in any given situation ... but in any given situation it will be people that make or break what is done. The IMM approach is to make people central to the work that needs to be done ... and essentially local people before anyone else.

Vector Control Personnel

Entomologists

The science of mosquitoes is complex. Enough has already been done to know where to start a long term malaria control program ... but the mosquito and malaria change over time in response to their environment ... including the development of resistance. Managing a malaria control program for long term success requires progress in science so that there can be effective response to emerging resistance.

Field entomology

Staff with training in entomology are needed in the field. The transmission of malaria will be controlled most effectively when there are an adequate number of well trained people who understand the basics of vector control

IRS staff

IRS spray staff need to be trained well so that they operate in a safe mode both for themselves and for the public at large. Heavy exposure to some of the pesticides that are used is dangerous if appropriate precautions are ignored. Good training ensures that dangerous chemicals are always used in a safe manner. There also needs to be training of oversight supervisors and quality control and safety personnel so that all the system operates in the appropriate manner.

Data acquisition staff ... surveillance staff

Surveillance staff need to be trained so that they can identify as much as possible without error. Good local staff can be very valuable quickly ... but this value only increases as they learn more about both the community and its socio-economic dynamics and the various important scientific disciplines that are impacting the area. Training should be ongoing, and there should be as much opportunity as possible for staff to move to positions of higher responsibility and remuneration.

Researchers ... analysts

There are various levels of research ... and analysis.

Training the trainers

Trainers

Trainers are an essential part of an organizational team that does important productive work.

Drivers

Drivers are needed to get the work done. Good drivers make a big difference to the performance of the work.

Helpers

Helpers are not unimportant ... they are needed to get work done, and that has immediate value. But helpers are also important because by helping they are also learning. These jobs are the beginning of a ladder of progress ... with much potential.

IMM – Organization

Importance of Organization

A society is not a society without some framework of organization. The framework may have many forms ... but certain functions must be possible within the framework.

An organization normally has a life in perpetuity ... not something that is possible for people. This enables an organization to do things that people cannot do.

An organization can organize ... and by organizing is able to do things that individual people cannot do. An organization can build teams of people that have more power and capacity than the people have as individuals.

An organization can be held accountable ... more so than individuals. But it is also possible for organizations to be less transparent, and to hide things that ought not to be hidden!

An organization can be big ... or small. More important, an organization can be the right size for the work it wants to do. The size of an organization may be too big ... too big to fail! Or an organization can be conflicted with most profitable being one size and most valuable to society another size.

An organization may be in many places at once.

There are some bad dimensions of organization ... an organization may be structured so that it creates profit from nothing and removes value from society.

But without organization ... very little is accomplished

Organizations To Do the Work

People are unproductive unless they are in an organized setting. What organizations are there to get the work done?

This is a key issue and addressed in the next section.

People Can Change Organizations

Strengths and Weaknesses

Organization has both strength and weaknesses ... both!

Organization is needed to do things that are beyond the capacity of one person ... organization can get many people to work together ... the organization is stronger than the sum of the parts.

But organization does not have the same view of society ... it may, but it might not. Individuals may have very different ideas than seem to be the consensus of the organization.

Organization to Manage Data

A society that does not have good data will never be managed well ... and there can never be an efficient market in a society where the data are compromised.

One of the key characteristics of society in the latter part of the 20th century has been the amazing increase in the capacity to communicate ... but it is easy to argue that the use of this capacity has been very poor.

Data are valuable if they are reliable and neutral

Scorekeeping is not done by the players

Scorekeeping in sports is not done by the players, but by an independent part of the sport system. Scores are reliable and neutral. How the game is played is handles by the rules and the referees. How the players are trained and instructed to play is in the realm of the coaches. The fans know the score ... and in addition to the score there are also a huge amount of independent “stats” that record all the performance data for the team and the individual players.

The value of data are not realized by having the data ... but by using the data in a way that produces value adding.

Data always have a cost ... more data usually has more cost than less data.

More data may have more value than less data ... but not always. In fact more data when the data and analysis are delayed may well reduce the value of the data.

More data ... and more confusion ... may be counterproductive. Sometimes more data will help clarify and issue and be valuable ... but usually not.

Repeating Studies

The UN system and the academic community are famous for the number of studies that are being done. These studies have a cost ... and not insubstantial.

Some experience I have had suggests that some popular subjects have been studied upwards of 30 times, with almost no incremental value after the first study. In one case, I estimated the cost of the studies that the UN had paid for to be around \$3 million ... while the incremental value after the third study was almost zero, and the cost of the first three studies was around \$60,000. Waste ... terrible waste!

Getting Organized to Control Malaria

Malaria was successfully controlled in the past when there was a lot less scientific knowledge and sophisticated medicine ... and there was malaria eradication in many parts of the world as science emerged to help. But more than science, it was organization that made progress to control malaria possible. People were mobilized and organized to control mosquitoes and reduce the transmission of malaria.

There is a need once again to mobilize people and organize so that there can be a large scale sustainable programs that is not outrageously costly.

Most of the work that needs to be done can and should be done by local people, drawing on expertise from international organizations as needed.

are needed to work to control malaria ... at the community level within community organizations and structures, in larger organizations both private and public ... at the local, national and international levels.

In the IMM approach, there are people with a focus on the mosquito and vector control as well as those that specialize in medical interventions. There are people that work with community awareness and cleanup ... and people that focus on the issues of data acquisition, transmission, analysis and reporting.

IMM ... Organizations

National Government Organizations

Government has a critical role to play. It is government, more than any other part of the organizational framework that establishes the enabling environment for success.

Importance of Government

I attended a conference some years ago where one of the panelists observed that in the modern era of globalization, everything can move ... people, capital, know how, goods and services ... but not the core functions of government. Accordingly, it is critical that government does all it can to attract these in order to have success.

The form of government is less important than the function of government. It is apparent from history that the need for government and the structuring of government goes back to very ancient times.

The idea of rule of law is also ancient. In some ways, modern statutory law is more problematic than the natural law of earlier times. The rules and regulations ... and practices ... established by government are an important part of an enabling environment for success.

Checks and balances in government

The importance of checks and balances in government is not new. The idea of separation of power is enshrined in the US Constitution with three separate branches of government: the executive, the legislative and the judiciary. The idea of elections and appointments for people in different parts of the governmental structure is complex and interesting. The idea of elected representatives representing the people of the country is interesting ... as is the idea that different groups should have some say even though a minority without the numerical power to elect representatives.

There are also the checks and balances associated with money ... the income of the government , the expenditures of the government and the commitments of government. This is also an old problem ... and it is perhaps some 400 years since the power to spend was removed from the ruler or the executive branch of government and given to the legislative branch. The mechanism for this was the Single Treasury Account ... where all moneys coming into government were deposited ... and disbursement was authorized by the budget legislation.

Government Financial Regulation

It is a serious matter that there has been a weakening of government financial regulation around the world in the last five or six decades. The control of public moneys by the Ministry of Finance or Treasury has been unintentionally weakened by bilateral and multilateral donors (USAID, World Bank, UN, etc) as they sought to facilitate the easy disbursement of funds for their projects. As project disbursement became easier ... so also did other behavior that could flourish without strong financial accountability and control.

Ministry of Finance, Treasury and Central Bank

The Ministry of Finance, Treasury and Central Bank are the core organizations that are responsible for managing the day to day financial affairs of the country. They operate under rules and procedures established by law. Much of the procedures have a long history and are governed by detailed Government Financial Regulations.

Reform of Government Financial Management

The reform of Government Financial Management that has taken place in many countries over the past three decades may have helped to computerize accounting ...

but in the process may well have weakened accountability with very serious consequences for society. The simple idea of the Single Treasury Account is powerful, but probably less used for accountability and control now than in previous eras ... with all the likely undesirable consequences!

Developing country governments are constrained both by the cash flow of government and the availability of foreign exchange in the country. These are respectively the responsibilities of the Treasury and the Central Bank ... but the control of much of these fund flows is also in the hands of external organizations, the bilateral and multilateral aid agencies and foreign investors and financial institutions.

“Dead Aid” by Dambisa Moyo

Dambisa Moyo is a well educated Zambian. She talks of aid to Africa: “60 years and US\$ 1 trillion ... a little to show for it! There must be a better way!” But what is the better way ... and why has such a failed fund flow been continued for so long? One answer might be that while ordinary people have seen no benefit ... the leadership of the development community and the developing country governments have been quite happy with the way the process worked!

Success requires honest accounting and accountability. Fund flows that go to government should go specifically to the Ministry of Finance and the system of accountability function from this foundation.

Ministry of Health

The health of the nation is the responsibility of the Ministry of Health. It is usual for the health of the nation to be a priority ... and not to be funded adequately, especially from the national government budget. External funding for healthcare becomes essential ... and in this situation it is difficult for the country priorities to be followed, rather it is the donor funding agency priorities that are implemented.

Whose Priorities for Health?

I served as the acting aid coordinator for a developing country at some point in my career. Donors were committed to supporting the health sector as a priority ... which was good. It was also a national priority. But what was bad is that donors all wanted to give support to “study” the health sector but not to fund actual work that would deliver health services to sick people. Even though the country had three excellent studies of what was needed in the health sector ... sixteen separate donor countries required their own studies as a prerequisite for providing funds for anything. My reaction to this was that it would be good if the donor experts would learn to read ... then read what is already available ... then move to funding real work.

Regional Government Organizations

A regional government organization is the organization of government within a country and “below” the national government. Depending on the country there are different names for this ... State in the United States, Provinces in Canada, Counties in the United Kingdom, Districts in Zambia ... and so on.

Sometimes there are multiple levels of subsidiary regional government.

International Governmental Organizations

International governmental organizations ... multilateral government organizations also have a role to play. There should be care in expecting these organizations to do more than is their mandate ... and their technical capacity ... and their financial capacity.

WHO

UNICEF

UNAIDS

GFATM

UN Foundation

The UN Foundation is not a UN organization ... it is a privately organized foundation funded by an endowment from Ted Turner who wanted to highlight the potential of private philanthropy in financing international development.

G-8

G-20

Regional Inter-Governmental Organizations

Religious Organizations

Government has a critical role to play. It is government, more than any other part of the organizational framework that establishes the enabling environment for success.

Non-Governmental Organizations (NGOs)

The concept of a non-governmental organization does not have the purity that the name might suggest. A name that tells you what it is not, leaves a lot of scope for what it is ... and this is even more confusing when the funding of NGOs is analyzed and government is a major source of funding. In the most accepted use ... an NGO is a not-for-profit organization rather than an organization that operates for profit. Commercial businesses that are privately owned are not government organizations but are not NGOs!

Community based organizations

An unreported problem in the NGO arena is the lack of reach by most organizations into the community where the bulk of the population actually lives. In too many cases a brief visit to a community in a 4WD vehicle ... time for tea ... and return back to an urban office constitutes the totality of interaction with community. This is clearly a modus operandi that cannot work ... but it is widely practiced.

Local NGOs

A local NGO is one that has its main activities in the country. Some local NGOs are very good and have strong connections with communities ... some do not.

International NGOs

Some of the international NGOs are very large with strong brand identity and track record of performance. There are others with more questionable records.

Many ... if not most ... of the large international NGOs get a substantial part of their funding from “government sources. This helps the NGO to sustain itself and its staff, and it lanhley”

Faith based organizations

Microfinance Institutions

When the microfinance sector was in its early days, microfinance institutions were almost always NGOs. This enabled them to address the goal of progress out of poverty without paying attention to financial profit ... merely the sustainability of what they were doing. The not for profit MFI is a very valuable organization for any community ... especially communities that have resources and people, but merely lack money.

Funding ... and accountability to whom

It is never clear to whom an NGO is accountable. Most will suggest that they are accountable to their mission ... which usually is expressed as doing something of benefit to some disadvantaged segment of society. Being accountable for doing this is usually laudable ... but is this actually how accountability works.

It is more likely that the reporting of an NGO has a core focus on the goal of the donors rather than the mission of the NGO. Simply put ... without the funding from the donors, the NGO ceases to exist and it closes. In time this causes the NGO community to reflect the mission of the donors ... with all the conditionality and methodological constraints that are associated with donor funding.

Community Organizations

The community is important ... and the performance of a community depends heavily on whether or not there are the required organizational structures in the community.

Local community organizations

Organizations that have a presence in the community are very important. These may either be a totally local organizations or be the branch of a larger organization. The key is that the community organization should know the community and be known by the community.

Organization for vector control

An organization for vector control is needed in or near every community. A single vector control organization may serve many communities in a single vector control district. Such a district would normally be contiguous area where the malaria and mosquito behaviors interplay to put the population at risk.

The vector control district organization may serve as the local focal point for IMM data and its analysis for local use. They may also coordinate all the other IMM related activities in the area.

Religious organizations

Religion is often a very important part of the life of the community. The religious organization may be a very valuable link in many of the activities associated with IMM.

Microfinance Institutions (MFIs)

Microfinance Institutions (MFIs) are an area of apparent success in development, and with access to international support for MFIs, the MFI or its branches are being located in more and more communities

Business Organizations

Business is potentially both a resource to help implement sustainable malaria abatement programs and a beneficiary. It is widely understood that business performance is adversely affected by the sickness of its employees ... and indeed the sickness of related family members. With endemic malaria companies are faced with serious absenteeism and the associated impact on productivity.

Business represents a resource in not only the potential for financial support for malaria abatement initiatives, but also in helping with organization. Business does many things well ... and organization is one of them.

What Marathon Oil Has Done ... Equatorial Guinea

What BHP Billiton Oil Has Done ... Mozambique

What Ashanti Gold Has Done ... Ghana

Health clinics

Health clinics run by business organizations are some of the best anywhere in the world. This is not only the money funding, but also the ability to recruit and retain good staff and facilitate the procurement of therapeutic drugs.

Vector control

Some companies have had good results with interior residual spraying (IRS) for vector control. Companies have used their own employees to do this work ... or have arranged for the work to be contracted out.

Philanthropic Organizations

Sector Focus Organizations

IMM – Community

IMM Has Critical Focus on Community

Understanding the dynamic of socio-economic development at the community level leads to the idea that access to health care at the community level is a very critical matter. When resources are allocated to multi-tasked community level clinics, staff and necessary medicines and appropriate community environmental clean-up initiatives there can be more progress than when there is just one intervention in isolation.

A community is, more than anything else, people! Furthermore, people are the beneficiaries of a good public health environment, and ... not insignificantly ... it is people that make a health infrastructure work.

Good health that results from public health ... including malaria control ... are benefits for the people.

Community also includes resources, organizations, infrastructure, activities, events, constraints, issues, etc. There is entertainment and culture and spirituality. There is education and sport and music. There is governance and security. All of these things add up to community and to quality of life.

Two vectors ... people and mosquitoes

There are two vectors for the transmission of malaria ... people and mosquitoes. A person with malaria is not going to infect someone else unless there are mosquitoes to complete the transmission cycle ... and a mosquito is not going to transmit malaria unless there is a pool of malaria parasite somewhere to infect the mosquito and set the stage for onward transmission.

If there is work on reducing the malarial mosquito population it can be very successful ... but useless because the mosquito population will come back again very quickly ... and then will become infected very quickly again if there is a pool of parasite located in the human population.

If there is work on reducing the malarial mosquito population and there is work on reducing the prevalence of malaria in the human host at the same time ... then it is possible that the problem of malaria can subside quickly. Malaria control medication is fairly rapid acting ... and vector control interventions may also be rapid acting ... so that results may be significant in weeks or months.

There is an important caveat ... the speed of success will be replicated in the speed of re-emergence of the malaria disease.

Early Diagnosis and Treatment

It is widely accepted that early diagnosis and treatment is the best way to mitigate the bad consequences of illness and disease. For this to be possible there has to be an appropriate locally accessible health service ... and the starting point for having this is to have data that shows what elements of health infrastructure exist and what capacity and capability there is. An adequate health infrastructure must not only be easily accessible to the local population, but this access must also be affordable.

The strengthening of health care infrastructure should start with what the community needs based on the profile of disease in the area. A strategy for addressing a single disease is unlikely to produce a long term sustainable health infrastructure unless there are the data that help determine best use of resources.

Early intervention is one of the ways to get the most value from scarce resources. Community centric health interventions may be the best way to do this. The best way to get early diagnosis and treatment is to have the required healthcare capability within the community. Every person should be able to get to a community clinic relatively easily and quickly, and every community clinic should have the capacity to be able to diagnose malaria correctly and to treat it with a drug that is effective.

Medical science has made amazing progress ... but the economics and performance of the health sector does not reflect the same progress. This is because of a systemic disconnect between what is known and how this is deployed. Some of this reflects resources constraints and some is because of structural and institutional factors that serve as terrible constraints to optimized performance. Many communities in developing countries in Africa and other parts of the world have little of no access to health services.

Human Health and the Community Economy

The economic performance of the community is a major factor in the health status of the community. The health status of the community is a major factor in the economic performance of the community.

How is it possible to progress out of this vicious cycle? Is it possible?

Poverty results in hunger and associated malnutrition, and then poor health outcomes. Poverty means that treatment is unaffordable ... and even reasonably accessible health services cannot be used. Poverty constrains any locally sustainable program of healthcare.

But ill health reduces the productivity of people ... especially the productivity of people who have to labor and use their human energy. Most of the work in a poor community has a large component of heavy work that is made difficult with ill-health.

The extended family and self-help makes poverty less disastrous than it might otherwise be, but a community where the local economy cannot support even modest surplus production is unsustainable. In these situations, the health status spirals downward.

Improvement in health outcomes can be funded externally ... by the government and by the international community. This external funding is unsustainable, if not in the short run, certainly in the long run. However, good health outcomes must be a priority, and to get this to be sustainable there must also be parallel efforts to improve the local economy so that it is productive and surplus producing.

The key to long term sustainability is to have the cost of good health low so that it is affordable in the context of the local economy. This applies in both a poor resource constrained places and in rich countries like the USA.

The IMM strategy has cost and affordability in balance with values of a successful program that delivers good health to society.

A strategy that has the least amount of treatment and medical care being required ... the most success is the least amount of health care being needed because people are healthy. But this is not easy because the history of healthcare has tended to reward intensive treatment of unhealthy people rather than rewarding those that ensure that people merely remain healthy!

Health Care Costs in the Community

Health care cost in the community must be low in order to be sustainable. There is a problem in that hardly anyone seems to know much about the costs of health care.

Frequently cost is reported by the equating price paid for something to be its cost. This is rarely the case ... the price is either an aggregation of cost and profit or the derivative of cost and subsidy.

Getting an understanding of cost behavior requires

With data about the unit cost of all the elements that go to make up health care interventions it is possible to understand how costs behave. Good cost accounting data would be an advantage, but to the extent that good cost data are not available, good cost models that reasonably predict costs may be developed and standard costs ... what the costs should reasonably be ... may be developed.

Health Care Value to the Community

The understanding of value may be difficult ... but it is important. Value cannot be measured simply by equating value to how much the healthcare service costs. Value must be measured by how much health is improved ... how much health improvement is achieved.

Quantifying the value of good health is a challenge ... but it is important. Good health provides all sorts of positive possibilities ... and ill health takes them away. Clearly there is a difference between good health and ill health ... but what is the value.

TVM / IMM has developed a matrix of standard values for good health, various stages of deteriorated health and mortality. The standard value changes with age and a variety of other factors associated with the community and its socio-economic characteristics.

and these data are not organized in any meaningful way. The most valuable outcome is perfect health and no need for any medical interventions at all ... but this is also the least profitable for the medical industry.

Making Complexity Manageable

Anything to do with human health ... or behavior ... and science ... anything to do with human organization ... rapidly becomes complex and unmanageable.

If the modus operandi is to look at a community from the perspective of Washington, or Paris or London, things get very complex. There are many thousands of activities, organizations, fund flows, etc that start in Washington, Paris or London and it is a big job to find out which reach any specific community.

But the reality is that rather few activities, organizations, fund flows, etc that start in Washington, Paris or London ever reach any community ... so looking at what is going on from the community perspective becomes quite simple. Identifying the fact that nothing is going on in the community is really easy ... and in fact very worthwhile information.

This is not a new problem, and there are many approaches that have emerged to help make good decisions in these situations and achieve good performance. The most reliable approach is one where data are acquired and used as the basis for decision making.

Community Centric Data

The community must know what it is doing ... and to the extent that this is not practical, other responsible parties need to have data about the community and be able to do analysis of the data to provide guidance to the community

Rapid data and decision cycle

A rapid data and decision making cycle forces simplicity ... but works well when the simplification has been done thoughtfully with respect for the underlying science and complexities. Where mosquitoes are a public health hazard ... mosquitoes infected with the malaria parasite or the West Nile Virus ... rapid elimination of the infected mosquito population stops the transmission of disease quickly and reliably.

Data collected TODAY gets used to determine whether or not ... where and how much ... vector control intervention will be done TONIGHT with the expectation that the infected vector will be eliminated by TOMORROW and this will be confirmed by the data collected tomorrow. This is standard practice in most of Europe and the United States ... but it is good practice ... or best practice for anywhere.

People in the Community

People

People are the key to success ... but also a potential constraint on success. People need to have access to opportunity, and people need to have access to what is needed so that they might benefit from opportunity. This is a Catch 22 in socio-economic development that has to be addressed ... and can be addressed at the community level.

Success will be achieved ... and there can be sustainability ... when the people of the community take responsibility for the work that has to be done to have a healthy society. In matters of importance like health and malaria control, the government may do some of the work ... but local people and organizations are going to have to do an important part of the work as well. This benefits the people of the community more than it costs the people of the community.

Organization / Organizations in the Community

Community and coordination

Coordination is frequently identified as an issue that constrains performance ... and the usual solution is to have a top level coordinating group that meets as a committee to “coordinate”. This rarely works ... and, in fact, usually adds to the problem by adding another element of complexity. On the other hand, a focus on coordination at the community level is very effective. The community is where coordination really matters and where results can be achieved. Coordination at the community level results in the elimination of useless overlap and collaboration to fill gaps that would otherwise get ignored.

Community governance

The political governance of the community must be respected. This is not merely a matter of courtesy ... it is vital. It is very practical since it is common for the elders to be custodians of much of the important wisdom of the community.

Health activities are best coordinated at the community level. A person who is sick wants to attend a clinic that is going to address whatever illness there is ... not merely a single specialty of the clinic. This is doubly important where the capacity for diagnosis is low.

Coordination of malaria specific interventions needs to be area specific. Malaria is an unusual disease. Because of the mosquito vector and the life cycle of the parasite, people are exposed to reinfection. This has many consequences including the need to have multiple interventions that both treat malaria and control mosquitoes.

There must also be capacity to carry out malaria control interventions. Having the capacity to carry out malaria control activities must be a priority. For staff, this means recruitment, training and the funding for staff remuneration. For treatment, this means capacity for accurate diagnosis and the availability of the required drugs and medical supplies.

Community responsibility

There are costs to create the infrastructure and there are costs to keep it working. How should these costs be funded? Is it a government responsibility, or the responsibility of international donors or charities? Maybe ... if the costs are moderate ... the payment for these services should come from local people and local business in the general interest of the community.

The value chain of community health interventions is very healthy ... low cost intervention quickly reduces illness and makes it possible for the people to be more productive. More productive people should be able to pay for the healthcare intervention.

In some communities the health care intervention may be paid for by the intervention of a microfinance institution that can pay for the healthcare and recuperate the cost from the clients directly or as part of an insurance program.

Creating jobs is always a benefit. Local health care should be provided in some part by locally hired staff. These staff may need extra training, but the value to the community justifies the additional expense.

Awareness Training in the Community

Awareness is important! Ordinary people need to know as much as possible ... a lot more than they normally do in remote rural areas and poor urban communities.

Prerequisite for Success

Malaria eradication is unlikely to be achieved until there is an understanding of how malaria is transmitted, and some simple knowledge about the life cycle of the mosquito.

Public awareness and community involvement. Good health is facilitated when the community has some understanding of the need for early intervention, and knows the critical issues about malaria and mosquitoes. Changing long held beliefs is not easy and quick ... but is essential and yields great results when given enough time.

The lack of awareness about health issues in general, and malaria health in particular is a serious constraint that needs to be addressed. The problem is not only the lack of information, there is also a problem of serious misinformation.

In many communities modern medicine has never been easily accessible or affordable. In this situation it is not surprising that alternatives to modern medicine have taken hold. Traditional medicine is available and is widely used ... in some cases the traditional medicine is based on herbal remedies that work well, in some cases not. Knowledge about malaria, and specifically how it is transmitted, is often wrong.

The development of community level understanding of basic good health practices and a broad awareness of how health outcomes can be improved is needed.

But, of course, awareness without an ability to follow good practices is insufficient. The IMM approach addresses this with community level health infrastructure and interventions

Increased individual and community awareness of mosquitoes and their role in the transmission of malaria, and the importance of treatment is very important. The community needs to know:

1. About how malaria is transmitted
2. about ways to control the mosquito population,
3. about how to use bednets to reduce incidence of malaria,
4. about the ways to keep mosquitoes away from the house,
5. about the advantages of interior residual spraying,
6. about how to recognize the symptoms of malaria, and
7. about how malaria can be treated.

With better knowledge of these matters, the community becomes empowered to take control of many of the factors that have an impact of the malaria status of their community.

The community can do a lot for itself ... but only when there is knowledge and awareness about malaria and mosquitoes.

Learning is a long term process. While some learning can take place very quickly, there is other learning that takes a generation to take hold. Education is critical ... but not done in a vacuum. People need to learn about malaria and mosquitoes ... and have an awareness of how malaria and mosquitoes and the environment all play together to create the crisis of malaria ... and how there can be progress to reduce the prevalence of malarial disease.

Awareness ... personal health care

The role of personal knowledge about good health practices is the starting point for a healthy society. The cost of using personal knowledge is essentially zero ... and the cost of acquiring this

knowledge should be modest. It cannot be assumed, however, that this essential knowledge is ubiquitous because it is not.

Clean water doesn't taste good

A brand new bore hole started delivering clean water in a remote part of Ethiopia. The local women did not like the taste ... it was so very different from the awful water they had always had. It was not until they were shown with a microscope what was in their old water supply that they understood that it was the dirty water that was giving their children stomach pains and diarrhea. They quickly learned ... but it took a training intervention to make the change happen.
Ethiopian consultancy 1997

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Community awareness and clean up of the environment is a first stage in reducing the mosquito population. Eliminating standing water of all types will reduce the breeding places and help keep the mosquito population near the human population under control. It is important to have awareness of the causes of malaria and the importance of keeping potential breeding sites under constant surveillance, and taking timely action to stop mosquitoes emerging as flying adults.

In order for a malaria management program to be successful and sustainable there is a critical need to get the community involved and running as much of the program as possible. In a situation where the malaria level has been reduced almost to zero, it is possible that everything can be done in the community with little external inputs.

It costs a lot of money to do training programs with expatriate trainers ... but it should be possible for awareness of malaria and the value of environmental clean up to be communicated by local people at relatively low cost. This information should be everywhere.

Community View of Access to Healthcare

Knowing what is going on in a community is a good starting point for effective initiatives for progress and healthcare improvement:

- ◆ Health activities ... what there is!
- ◆ What focus ... What organization is doing it?

It is also interesting and useful to identify what is not happening ... what additional health activities are needed in the community:

- ◆ What is missing ... what is needed?
- ◆ What focus ... What organization might be able to do it?

The health infrastructure is a critical element of success ... no infrastructure ... no success. The health infrastructure has many components including:

- ◆ Community
- ◆ Organizations
- ◆ Environment
- ◆ Physical facilities ... clinics, hospitals
- ◆ People ... CHWs, nurses, MDs, etc.
- ◆ People ... taking care of their health
- ◆ Medical supplies, drugs
- ◆ Access to knowledge
- ◆ Adding to knowledge ... research
- ◆ Support structures, etc.

Multi-disease health care capacity

The strategy for health in a community ... and from a community perspective ... should be to do all that is needed to have good health using available resources in the best possible way. Good health is not merely being free of malaria, but being free of all diseases. Few health focused organizations work in this way ... nor do donors and funding organizations. People and families who live in underserved locations around the world need access to health care that treats all the ailments of the area.

Many health programs have a single disease focus. In some ways this is a good way to organize expertise, but it is rarely good public policy for health service delivery unless it is carefully integrated with the full range of other health needs for the community. From the community perspective it is better to be more than malaria ... while malaria is the focus of the IMM initiative ... the clinics and community health centers should have staff, equipment and supplies for all ailments in the area.

Health Infrastructure

The community health infrastructure may well be the most important determinant of the health of the people in the community. If timeliness is important ... then a community health care presence is very valuable. But community health is improved with local infrastructure because the process is lower cost as well as the outcomes being better.

The data about the health cost and health situation in communities that have a working health infrastructure and those that do not are not easily accessible ... and may not exist in a form suitable for easy analysis. But simple observation suggests that there is a great difference in the two situations.

Clinic

Community transport

Community transport is a part of the infrastructure needed for good health outcomes. Are there ways for sick people to get to the clinic or hospital as and when needed. Can patients get to the clinic ... or to a referral hospital. Are there any vehicles that are equipped as ambulances?

Ambulance in New York City

I had a heart attack and was incapacitated on the streets of New York. Fortunately it was a few blocks from New York Presbyterian Hospital and an emergency call and a few minutes and an ambulance and emergency medical staff were on hand. Almost instantly they had all my vital signs on the record and my case was being progressed. My thought as this was going on was that there was more medical equipment in this single ambulance than in most hospitals in poor countries ... and that while this was good for me ... it was a pretty obscene global state of affairs! In less than an hour I was in the hospital and in the operating room for surgery!

Brilliant! But I am reminded of very sick people in very poor communities being carried for miles by their relatives ... or being wheeled in wheelbarrows. Not so brilliant!

Access to a Hospital

How much hospital access is there?

Probably most of the world's population is too far away from a hospital for it to be able to do much good ... for those who are wealthy a hospital may be a good place to get excellent healthcare ... but it is going to cost a lot, the price is going to be high ... and the outcome may well not be worth the price. In other words, the hospital might well be a value destroying institution.

Are hospitals valuable?

My heart attack

I had a heart attack in New York at about 8.50 on a weekday morning while walking to the subway. I felt chest pains and thought it would be smart to get a taxi to take me to the emergency room at the local hospital about 5 blocks away. Rush hour ... no taxi! I tried to get a traffic cop with his car to help ... but it was against regulations ... but he did make a 911 call and within a few minutes an ambulance arrived. The EMS staff had my case under control in just a few minutes and the emergency room was alerted to my situation ... I arrived at the hospital in just a few more minutes (then had to have paperwork handled!) ... and was in an operating room and being stented in just a few more minutes again! From first chest pains to a completed stint operation ... an elapsed time of about 40 minutes. This is fantastic. I am alive and well ... but what does it take to have this for everyone!

Most illness does not need to be handled in a hospital setting. The goal of medicine should be to make the hospital unneeded. Clearly, this is a long way off ... but the idea that more and more of healthcare should be hospital based and very high tech is a formula for disaster. It should rarely be necessary to treat routine ailments in a hospital setting. Timely intervention at home and at a clinic should result in control of the illness ... and the hospital should be an intervention of last resort.

An optimum health strategy must ensure that the hospital is needed as little as possible. Health interventions need to be as soon as possible and as convenient as possible. That translates into home visits by a community health worker, clinics located in communities and only referral to a central or regional hospital when the illness is very serious.

Hospitals as a training and research resource!

Besides patient care, a hospital also has a role in the training of health professionals. This is a very important role ... especially in the current circumstances where there is a global shortage of health professionals.

There is also a role for the hospital in the development of health science. In the future more relevant world class research for tropical disease needs to be located in hospitals in developing countries. This does, however, require an appropriate system of financing that has not yet fully emerged.

Who should operate hospitals?

There are a variety of entities that build and operate hospitals. These include the following:

- ◆ Public hospitals
- ◆ Private for profit hospitals
- ◆ Private not for profit hospitals
- ◆ Mission hospitals
- ◆ Emergency humanitarian aid hospitals

What role should a hospital play in the health infrastructure?

There are several roles that a hospital should play in the health infrastructure:

- ◆ A referral facility for complex cases needing specialized medical expertise;
- ◆ A center for training health professionals; and
- ◆ A locus for local medical research.

Drug Supply from the Community View

Each community is different ... the following information will describe the situation:

- ◆ What is the medical drug supply situation?
- ◆ For each drug:
 - Name of drug
 - Availability
 - Price to the patient
 - Cost to the supplier
 - Experience with quality ... any fake or counterfeit drugs?
- ◆ For each drug sale outlet:
 - Name of the drug sale outlet?
 - Where is the outlet?
 - What are its capabilities?
 - Who runs it (organization)?
 - Who is in charge of it?
 - How big a staff?
 - Any fake or counterfeit drugs?
- ◆ How are drugs verified as good?
 - Is there access to testing facilities?
- ◆ Generic versus brand name drugs?

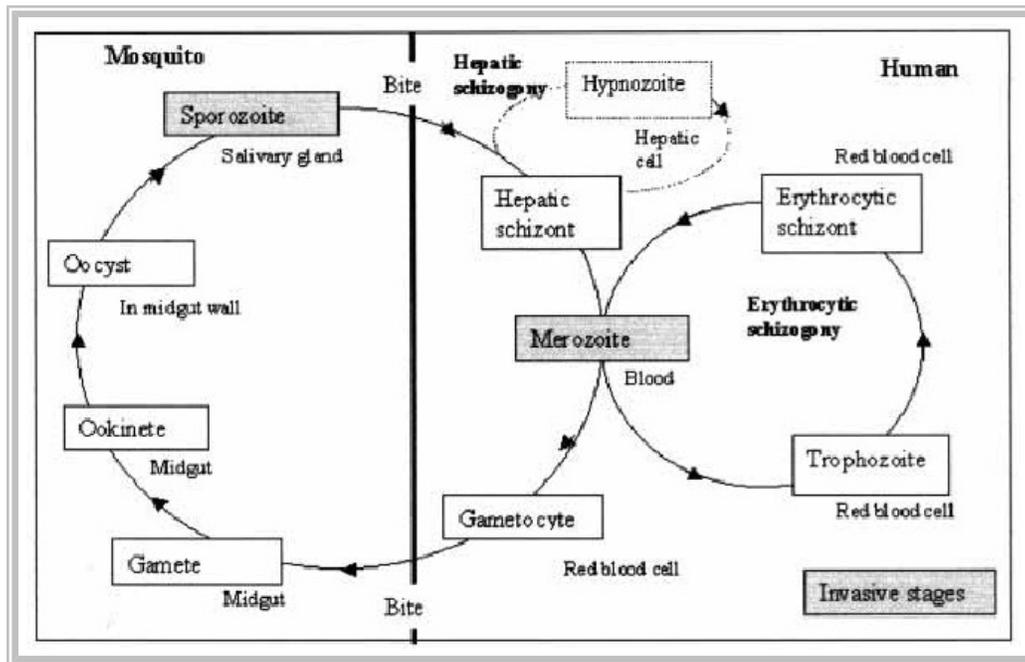
IMM – Medical Science

Medical Science ... Amazing Progress

The progress of medical science over the last century has been amazing. The rate of progress at the frontiers of medical science continues to be impressive. Knowledge from health science and technology is substantial ... some of it new, but a lot that has been known for a very long time. Success comes by doing what we know in an effective way.

Malaria is caused by a parasite transmitted from one human to another via the bite of an infected Anopheles mosquito. The parasites migrate to the liver, mature and enter the bloodstream, where they rupture red blood cells. An infected pregnant woman can transmit malaria to her unborn child. Scientific knowledge has been sufficient to eliminate malaria from many areas that were once dangerously malarial.

The best possible progress will be made when plans and interventions are based on deep knowledge about the science involved. It is science and technology that is the underlying basis for costs and effectiveness of malaria burden reduction interventions. Many sciences are involved ... and none will be effective on their own. This is a simple schematic showing the passage of the parasite through its life-cycle through the mosquito and the human host.



The parasite moves from human to mosquito during a blood meal, and then back to another human some time later during a further blood meal. When a mosquito bites, takes a blood meal, there are several possible consequences:

1. the mosquito is non-malarial and the human host is non-malarial in which case the mosquito remains non malarial,
2. the mosquito is malarial and the human host is malarial in which case the bite does not change the situation,
3. the mosquito is non-malarial and the human host is malarial in which case the mosquito becomes malarial

- the mosquito is malarial and the human host is non-malarial in which case the host becomes malaria.

Smart Healthcare Strategy

But while the issue of resources for malaria is important ... the way all resources in the health sector are used may well be even more important. Resources that are of use to improve malaria performance may, at the same time, improve the situation for other diseases ... and together the burden of disease in the community then becomes very much reduced. In smart health ... the most amount of good health is achieved at the least cost. With smart health data, decisions are measured based on the impact there is on health outcomes and cost effectiveness.

With community health infrastructure	No community health infrastructure	No community health infrastructure
The better way	Good luck outcome	Bad luck outcome
A person feels ill	A person feels ill	A person feels ill
Easy visit to the clinic	Waits in hope illness will go away	Waits in hope illness will go away
Quick accurate diagnosis	Illness gets worse	Illness gets worse
Treatment specified	Have to find transport	Have to find transport
Pays for clinic	Pay for transport	Pay for transport
Drugs purchased ... pay for drugs	Get to clinic	Get to clinic
Treatment started	Wait in line	Wait in line
Person goes home	Maybe have to wait to next day ... stay overnight or redo the journey.	Maybe have to wait to next day ... stay overnight or redo the journey.
Person gets better	See health worker ... get diagnosis	See health worker ... get diagnosis
	Treatment specified	Needs hospitalization
	Clinic paid for	Clinic paid for
	Buy drugs ... pay for drugs	Pay for hospital
	Treatment starts	Treatment starts
	Patient goes home	Buy drugs ... pay for drugs
		Treatment too late
		Patient dies

It really does not matter what disease a patient has ... they need access to medical care. Medical care is more effective when the diagnosis is timely, the diagnosis is correct and treatment is given soon after the onset of the symptoms.

This requires a functioning health infrastructure that is easily accessible to the local population. The community health infrastructure may well be the most important determinant of the health of the people in the community. If timeliness is important ... then a community health care presence is very valuable. But community health is improved with local infrastructure because the process is lower cost as well as the outcomes being better. The table shows how this works:

One of the most valuable metrics for health sector planning in developing countries would be to know the cost and the impact of the community clinic ... or even just the community health

worker ... having cost and impact well documented. Some understanding of how disease progresses and treatment progresses suggests that early intervention at the community level is a very good way to go ... but not much data about this seems to exist.

How this applies to malaria!

Malaria is transmitted by mosquitoes ... specifically female anopheles mosquitoes that become infected when they take a blood meal from an infected human and later pass the parasite on to another person in a subsequent blood meal. Break this chain and the malaria parasite will not be transmitted from person to person around a community. Prevention requires that this chain is broken.

If a person is infected, the best medical intervention is early diagnosis and correct treatment. The primary symptom of malaria is fever and headache ... but fever and headache may not be malaria but something else. Quick and correct diagnosis is a first step in improving the malaria situation ... and more broadly the general health situation.

Correct diagnosis needs to be followed by effective treatment. Many of the anti-malaria drugs that have been in common use, like chloroquine, for the past fifty years or so are no longer effective because the parasite has become resistant to the drug. Other drugs introduced more recently have also dropped in effectiveness because of emerging resistance ... and the problem of resistance get worse rather than better as time goes on.

With early diagnosis and early treatment, it should be rare for malaria cases to require hospitalization, and death should be rare. On the other hand when there is delay in diagnosis and treatment malaria becomes serious and there is mortality. The mortality among young children under five and pregnant women is particularly high.

Malaria science ... malariology ... comprises many different branches of science. To achieve effective malaria control, all the relevant sciences need to be incorporated into the programs that are deployed. Science should not get in the way of management, and management should not ignore the science. Worse, scientific research should not be used as a replacement for management ... they are different functions.

Diagnosis

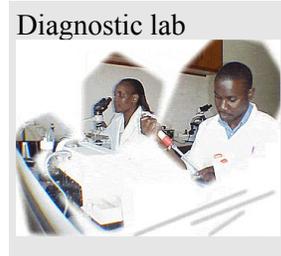
There are two parts to medical treatment: (1) what is the ailment to be treated; and, (2) what is the appropriate treatment. Because the capacity to make a scientific diagnosis has been lacking in many places ... especially remote rural settings ... there has been large scale presumptive diagnosis of malaria.

This is not a good situation. Better diagnosis needs to be a priority. Without this there will be a continuation of ineffective treatments and a fertile ground for the development of resistance to available medications.

Diagnosis helps to determine what ailment is to be treated. Studies have suggested that diagnosis is often not very accurate ... in many cases a fever is considered to be malaria and there has been presumptive treatment for malaria. The result of this is: (1) that those patients who have something other than malaria do not get the right treatment and remain ill; and, (2) the excessive use of malaria drugs accelerates the build up of resistance.

Importance of diagnosis

In the context of malaria: Do people have malaria ... or is it a fever caused by something else? What is the capacity to do “blood work” for the analysis of a patient's health? What is the use of RDTs. The diagnosis of malaria is important. All fever is not malaria ... and data about malaria is often based on an assumption that fever is malaria. The correct diagnosis of malaria will help to treat malaria better ... not to mention reducing the problem of resistance.



Lab work should be locally possible. There should be capacity to do blood smears and microscopy. The lack of required health infrastructure is a problem ... and trained staff.

Diagnosis ... blood work ... microscopy

Diagnosis is important. All fever is not malaria, and mis-diagnosis has consequences, notably the excessive use of anti-malarial drugs results in accelerated resistance build up.

Rapid diagnostic tests (RDTs)

Rapid diagnostic tests (RDTs) are one way to test for malaria. All RDTs are not the same, and the accuracy of the diagnosis varies quite significantly. Some RDTs do not identify malaria in young children. Some data about malaria prevalence based on use of best performance RDTs suggests that malaria has come down in some places (like for example Zambia) even though prevalence of fever may still be high. This needs clarification. FORWARD

Tracking parasite prevalence

Is the parasite prevalence going down? If there is a reduction in parasite prevalence, is it because of the seasonality of malaria in the community or because there have been effective interventions. Data about the prevalence of the malaria parasite is needed. Sustainable progress requires that the malaria parasite prevalence is reduced to near zero.

Part of an integrated program includes medical screening so that people carrying the parasite can be treated and the parasite eliminated. Some data about malaria can be obtained from clinical records in health centers and hospitals, but this does not capture information related to people who never come to these facilities. Medical screening is broader in scope, and provides data on the prevalence of malaria in the population as a whole, and also the prevalence of the parasite in the human host.

Diagnostic screening



Screening is needed to identify where the malaria parasite is the most prevalent.

Screening ... diagnosis of malaria and the identification of the parasite in the subject may be done using rapid diagnosis tests or by using blood smears and microscopy.

Absolutely critical to get data about what is happening on the ground. With data there can be analysis, and with analysis understanding and good decisions to ensure the most cost effective results. But the need for surveys of this type should be minimized by having a strong local health infrastructure that knows the health issues of the local population

Treatment

There are a range of drug therapies that have been developed and deployed over the past several decades. For a variety of reasons there is now significant resistance to many of the drugs that have been used in the past.

Quinine, Chloroquine

Chloroquine and other quinine based medicines have been used for many years. Initially it was quinine that served to minimise the fever due to malaria. For a very long time the drug Chloroquine was used both as a prophylactic and as a treatment, but over the years, malaria has become resistant to chloroquine and it is no longer effective. Despite the fact of chloroquine resistance, chloroquine tablets are still retailed in the informal sector all over Africa.

Fansidar

Fansidar became the preferred treatment in the 1980s as chloroquine resistance became widespread, but it is more expensive and not easily affordable by the majority of the affected population. In many places there is now also Fansidar resistance.

Artemesin Therapy

Artemesin therapy has been developed over the past few years and it has proved effective ... but the effectiveness is likely to be short-lived because of the likely emergence of resistance. Resistance is already being seen in some localities and Artemesin based therapy may lose effectiveness sooner rather than later.

To counter the rapid development of resistance, Artemesin Combination Therapy (ACT) has been developed and is now the preferred treatment. It is more expensive than other treatments but is currently effective, and the approach makes rapid development of resistance less likely.

Malaria case treatment is a confusing metric. Zero malaria cases treated either reflects an excellent outcome or something that is totally unacceptable.

If there is no malaria in the area to be treated ... that is good. A decline in the number of cases because there is less malaria is good ... but is this the reality, or is it something else?

If there are cases of malaria and they are not being treated for any of many reasons, this is a bad situation. For example

1. Ill patients cannot get to the clinic to receive diagnosis and treatment
2. Patients are diagnosed with malaria, but there are no drugs available to treat the patients
3. Patients are ill with malaria but cannot afford the fees for treatment

Resistance to Drugs

Cases treated and illness cured

With increasing resistance to drug therapy, the treatment of cases may or may not result in cure. This is a very bad outcome ... and one that is feared by medical scientists.

Reducing parasite prevalence

The prevalence of parasite in the human host is a factor in the reinfection cycle. By reducing the prevalence of the parasite in the human host, there is a lower risk of the blood meal adding to the population of infected mosquitoes. This helps. The strategy to reduce parasite prevalence includes screening and treatment. Malaria transmission is linked to the prevalence of malaria in the human host population ... so steps need to be taken to identify high levels of parasite in the human host and treat effectively to reduce transmission. A bite from a non-malarial mosquito is not the start of transmission when the source of a blood meal is not host to the malaria parasite. The bite is a nuisance, but the bite is not dangerous.

Drug therapy

Drug therapy is used to reduce parasite prevalence. Medical treatment that addresses the active malaria bout should be supplemented by medical treatment that addresses the parasite that is simply hosted in the human subject. Medical treatment to reduce the prevalence of the malaria parasite in the human host is a key part of an integrated malaria management regime.

Cost effectiveness

How much has malaria parasite prevalence in the human host gone down, and what have been the cost of the malaria control interventions to get this result. The impact of case treatment on the human host in a malarial setting is to reduce the burden of malaria by reducing morbidity and mortality. It also serves to reduce the prevalence of the malaria parasite in the human host. In combination with other interventions, the use of malaria case management to reduce the prevalence of malaria in the human host has benefit that is both immediate and sustainable.

While the treatment of every case of malaria has a beneficial impact on the immediate morbidity and mortality, it does not address the reinfection problem directly. There is no impact on reinfection by malarial mosquitoes. This means that nothing is going to change unless either there is a vaccine or there is widespread use of an effective prophylaxis.

Health Infrastructure ... Hospitals

For much of the last 20 years, maybe longer, there has been talk of a digital divide ... with rich communities having access to the new world of digital technology, and poor communities having little or none of it.

The issue is worse in terms of the capacity of the health sector in poor developing countries to access state of the art technology health technology ... or even electricity to run the equipment.

This issue needs to be on the agenda, but it should be integrated into a strategy that optimizes the use of resources for optimum health outcome, rather than a sub-optimization around merely having the advanced equipments.

Data seem to suggest that having health facilities accessible to local residents is important ... but the facility must have adequate staff and supplies in order to function.

A community focus strategy for health sector facilities and equipment can be very cost effective when it is done as part of a comprehensive program for health. Most health care interventions are best done quickly. The travel to a health facility should not be long and difficult. There should not be a long wait before a health professional does a diagnosis and the facility should have the capacity to take care of most cases at this stage.

The value of a functioning local community health facility is substantial not only for malaria, but for all diseases affecting the community.

How much does it cost to run a hospital?

Hospitals are expensive. They have a high capital cost and they also have high operating costs. Making hospitals the central element of a health strategy makes health costs high ... and usually unaffordable for the public as a whole. There are not enough hospitals ... but where there are hospitals there are big costs to keep them running. Building the physical facilities has a cost, but the cost of staff, medicines and supplies, maintenance, and so forth are substantial and ongoing. Because of financial constraints, there are staff shortages, equipment shortages and drug and medical supply shortages that make a hospital way less effective than it should be.

JFK Hospital in Monrovia, Liberia

When it was built it was state of the art and reflected the norms of modern medicine circa 1965. By the time I visited the hospital in the late 1970s the name JFK had come to mean Just For Killing reflecting the lack of maintenance and absence of many of the essentials for even basic treatment. Good health requires substantial operating budget as well as just the physical facilities.

Teaching

The role of hospitals in teaching health professionals is important. While hospitals are expensive relative to alternative steps in the treatment of disease, this is offset to some extent by the value associated with teaching health professionals

Health Infrastructure ... Clinics

Community clinic

The health clinic is one of the most important parts of a community infrastructure ... yet it is all too often either missing or unable to function properly.



Almost universally the population of a community welcome better clinics.

The clinic is however, a lot more than just a physical facility, it is only as good as the staff and the treatment they are able to deliver.

There are many challenges. The need for health services is great, but they have a cost, and most poor people cannot afford even low cost health care.

At the government level, there is usually insufficient budget for free service to all.

This is the dangerous dynamic that results in an exponential deterioration of health in poor communities.

Data about the existing infrastructure and the demographics of the population are needed to show what improvements are needed to improve the health situation in the community.

The clinic should be the most important part of the health infrastructure ... together with the outreach of the clinic staff as they reach into the community with their associated CHWs.

Every person should have a clinic to which they have access close to where they live and work. Close is a relative concept ... but a working reference point is that a person should be able to get to a clinic within (say) two hours.

Support Services for Healthcare

Transport

The problem of transport for sick people is serious almost everywhere in developing countries. The problem is both the lack of suitable vehicles ... sometimes the lack of roads and bridges ... sometimes the lack of funds to pay for transport that is available. The problem is widespread, but it presents in different forms in each and every community.

Ambulances

Many of the professionals associated with the health sector are good with people ... but less good with machines. As modern technology is more and more in the center of medicine, it is important that the machines are well maintained.

Ambulances in New York

For years the public ambulances in New York were operated by the Health and Hospitals Unit of the City. The unreliability of the ambulances was taken for granted ... and was the butt of unfriendly jokes. Then the ambulance service was made a part of the New York City Fire Department who have always taken a pride in their equipment ... and now the ambulances are as reliable as the fire engines. Good to have people doing what they have a passion for!

Blood

Where are blood supplies available? What steps are taken to ensure that the blood is safe? It is not known to what extent the blood supply in poor countries has been compromised and been the cause of the spread of disease. At one point, it was reported that a large proportion of the blood supply in developing countries was tainted with the HIV-AIDS virus.

Drugs and Medical Supplies

Cold chain

How are drugs, vaccines, etc transported and stored? How much medicine is stored at the proper temperature?

Testing labs for drugs

A testing lab should be available so that drugs may be tested for their quality. There needs to be the capability test drugs to ensure that the drugs are of the correct standard and quality. It is critical to be able to identify fake or counterfeit drugs and alert the public about it.

Supply chain for pharmaceuticals and medical supplies

There are many problems with drugs supplies including availability and affordability. But in addition there are also a range of other problems including (1) resistance to available low cost drugs like chloroquine; (2) fake drugs that have no pharmacological value; (3) counterfeit drugs manufactured without the patent holder's authority; (4) poor storage conditions; etc.

What is the point of having competent staff if there are no medicines and supplies to treat the patients? And what is the point of dispensing drugs when their quality is unsatisfactory? There are all sorts of questions that need to be addressed so that the system works and serves the public well.

Market mechanisms

Market mechanisms may work better than government mandated production targets and prices ... the communist system ... but they do not work very well. If the market was efficient and not subject to any form of rigging, and a lot of other social and economic conditions were to apply, then it might be a suitable mechanism to get life critical products delivered where they are needed. But, of course, this is not the case!

Absent anything else ... the economics of the market do emerge. This is better than nothing but the outcome may not be particularly desirable.

Markets in a shortage economy

In a market, prices are determined by supply and demand ... and in a shortage economy the lack of supply makes the prices rise. But many shortage economies are also poor economies ... and high prices are unaffordable. Then people go without ... and maybe starve to death. Prices may adjust down ... but only a few will benefit! The simple market model does not give a desirable outcome ... but what is better.

There has been rather little dialog about what might be more important than market in making an economy function well. Rich countries have embraced the market economy ideas and especially the capital market as a source of wealth ... and poor countries have engaged in the process of perennial international subsidy for their essential government services. The market as it stands is not a very good system for a high performance society.

Private supply chains

Because drugs ... pharmaceuticals ... have a high value to the user, private supply chains are well developed all over the world. There is very little oversight, and even where there is regulation of drug distribution, there is little or no capacity for enforcement.

In a free market economy, the demand determines the price and the profit is maximized when the product acquisition price is minimum. Who knows ... who cares ... the minimum acquisition price is either a fake or counterfeit drug, or one that is otherwise compromised, for example, contaminated or out of date.

Feedback suggests that maybe as much as 50% of the drugs flowing through private supply channels are compromised as to quality or efficacy ... a disastrous situation that must be solved in

order for the health outcomes to be acceptable. Because the profits are substantial, it will not be easy to make changes. The IMM strategy is to make use of the power of the market and the informed consumer to improve the situation. Part of this is the idea of smart data about what is going on in the community, including the impact of fake and counterfeit drugs.

Affordable supplies

The value of quality drugs and health supplies is well established ... but the issue of affordability remains a constraint on what gets used to improve health outcomes. The affordability of supplies depends on two factors (1) the buying power of the patient and (2) the cost and profit of the suppliers. These root causes have to be addressed in order to have sustainable effective health services.

Subsidy

Subsidy is being used as a quick fix for the affordability problem and has widespread support. The reason for this is clear. Subsidy makes it possible for the pharmaceutical product suppliers to sell product without having to do much to address the underlying cost and profit conditions. This is an easy and desirable outcome for pharmaceutical company management and stockholders. Subsidy essentially changes the buyer from being the poor patient that cannot afford medication to a subsidy organization with a lot of funds.

Affordable Medicines Facility for malaria (AMFm)

Initiatives like that of the Global Fund for AIDS, Tuberculosis and Malaria (GFATM), the Clinton Global Initiative (CGI) and the Bill and Melinda Gates Foundation in establishing an Affordable Medicines Facility for malaria (AMFm) are emerging, but they are not getting to the root cause of why medications cost what they do ... rather these initiatives are large scale subsidy programs for a very high cost high profit patent based pharmaceutical industry.

In the short run this is a useful solution, but it begs the question of both buying power of the patient needing treatment and the high cost and profit of the suppliers. This question is avoided in poor developing countries for one set of reasons, and is avoided in rich countries as well for somewhat similar reasons.

How should subsidy be integrated into the sector? High cost, high profit and high subsidy is expensive and unsustainable. How much should subsidy be used to maintain a high profit or should the social business model be embraced within the broader health sector.

Generics

Data that support arguments that are made for the high the price of non-generic drugs are difficult to obtain ... very little transparency on this. But what is known is that name brand pharmaceutical companies have had a long history of increasing profitability that sits on top of the accountable costs of research and development, regulatory approvals, production, marketing and distribution. For anyone buying a pharmaceutical product, the profit of the pharmaceutical company is part of the cost. In addition, in the modern rich country economy there are big costs associated with the capital markets, financial services and regulatory overhead. Some of this is justified ... most is probably not.

Generic product manufacturers have a lower cost business model ... and while it would be undesirable for all drug manufacturing to migrate into the generic mode, the value construct makes this much more desirable than the total intellectual property (IP) monopolization favored by the big pharmaceutical companies.

Drug quality ... testing facilities

The problem with fake drugs, counterfeits and drug quality is difficult but must be addressed. There is big profit in bad practice and little incentive to do anything else. This must be changed by setting up ways for the consumer to be engaged.

There must be a practical mechanism so that bad practice can be identified. Maybe there is a way for a CHW to purchase drugs from suppliers, and for some proportion of the drugs to be delivered to a testing lab for quality reporting. The IMM smart data system will then flag the supplier as undesirable and alert the CHW so that everyone knows.

Medical Supplies

Medical waste

Medical waste needs to be handled properly ... good practices about medical waste should be made the norm so that this does not become the source of the next round of illness and disease.

Warehouses

Trucking

Inventory control

Supply chain

Environment that Impacts Health

Potable Water

Water? How do you run a medical facility of any sort without good water? Water supply is a prerequisite to good health ... but not thought of as a component of the health sector and medicine. But getting water right is a great step in the direction of better health.

Sanitation ... sewage disposal and treatment

The hygiene of a health facility is going to be compromised when basics like toilets and sanitation are inferior. Cleanliness ... good hygiene ... a basic of good health, and they should be taken care of.

Electricity

Electricity? Reliable electricity is a central assumption in a modern health facility, but is reliable electricity a reality in most health facilities in developing countries. Why not? It needs to be! Some things can be done without electricity ... but health will never be as good as it should be when there are problems with the supply of electricity.

Drug resistance

Resistance is widespread for the low cost anti-malarial drugs (e.g. chloroquine, pyrimethamine). This must be taken into consideration and data collected to identify emerging new resistance.

There are two issues with drug resistance that should be a priority:

- ◆ Minimizing the need for drug therapy by comprehensive malaria control measures;
- ◆ Minimizing the development of resistance by good practices in the use of drugs; and
- ◆ Research so that there are effective alternatives

Drug therapy is increasingly compromised by resistance to the low cost drugs like Chloroquine and more recently Fansidar. As long as there is endemic malaria and massive reinfection, medical treatment as a standalone curative treatment cannot be expected to produce sustainable progress. Rapid development of resistance is facilitated by rapid reinfection and the need for repeated treatments. Another factor is the poor diagnostic performance, with widespread use of malaria drugs being used for other ailments.

Government regulation

The Government's regulatory environment is often weak partly because of lack of legal regulation and partly because of low capacity to provide oversight and enforcement. There are many issues that are subject of regulation including:

- ◆ Generic drugs
- ◆ Prices
- ◆ Subsidies
- ◆ Mark-ups
- ◆ Taxes and duties
- ◆ Regulation
- ◆ Professionalism

Organizational Structures

Organization ... and organizations

Health organizations are important ... an organization is able to do what an individual cannot. An organizations makes possible efficiencies that would not otherwise be possible.

But there is also a dark side to organizations. They may well have a life of their own, and an agenda that is not consistent with the optimization of socio-economic benefit and progress. Few organizations want to embrace the practice of transparency and accountability ... though they may not oppose the concepts at the theoretical level.

The form of organization is important ... it must suit the prevailing conditions. What is sometimes referred to as a public private partnership might work, or it might be a public unit of the Ministry of Health, or it might be a private social business. It is unlikely to be successful as a pure profit maximizing business. It might be a community cooperative of some sort. What is important is that it has an ability to earn revenue and have income to sustain its operations and provide the services needed to the community.

Government

National Ministry of Health

The government ... the National Ministry of Health (MoH) ... has a tremendous responsibility for public health ... but resources for this important responsibility are usually inadequate. This is not a matter of the available resources being, say, 10% or 20% below what is needed, but something more like 90% below what is needed. Donor support ... often in the form of emergency humanitarian assistance ... is sometimes available, and is very valuable. This assistance, however, is never programmed so that there can be efficient development of a sustainable high performance health sector.

Health .. a priority sector

Donors frequently make health a priority sector ... but that does not automatically translate into support for what is most needed. In Namibia, during an assignment to coordinate development assistance, fourteen separate donors insisted on doing studies of the health sector as a precondition to providing any other health sector development assistance ... this after three major health sector studies had already been done by the UN, Germany and the Namibian health leadership. Terrible obscene waste!

Burgess, Namibia 1991

The Ministry of Health (MoH) is the apex organization within the health sector. The available budget is the limiting factor for its activities At the community level, this usually means that there is no effective MoH presence in the community. In the event that there are MoH activities it is useful to know what they are:

- ◆ What MoH presence?
- ◆ Name of the MoH unit?
- ◆ Where is the unit?
- ◆ What are its capabilities?
- ◆ Who runs the unit (organization)?
- ◆ Who is in charge of the unit?
- ◆ How big a staff?
- ◆ How big a budget?

Local Government

Local government organizations may be an important part of the health system. This may be a function of the operation of facilities like hospitals and clinics, or various aspects of the supply

chain and making medications available and affordable to being responsible for certification and accreditation.

International and multilateral actors

The international community has become a big part of the financing of global health. This means that there is a lot more funding available than would be the case if poor countries were limited by their own resources . But what it has also meant is that priorities are being set by international experts more than by local experts ... with the guidance of major economic actors in the health sector ... and funding has followed these priorities.

Donor Focus Metrics

One of the outcomes arising from the importance of international experts in designing and planning global health interventions is that the systems of metrics being used have a perspective that reflects a donor definition of program performance. This is very different from what optimized performance would look like from the community perspective where beneficiaries in need of assistance are located.

Private sector ... non-government actors

Outside government there are many different organizations active in the health sector. Some of these actors may work in collaboration with the government or through the government, or they may operate in a free-standing manner. These include:

- ◆ Donor funded projects
- ◆ NGO projects
- ◆ Faith Based projects
- ◆ Humanitarian aid projects

While these various projects and actors bring value ... they pose a challenge in terms of coordination and are rarely engaged in programs that are designed to be a part of a long term sustainable healthcare system.

Public private partnership (PPP)

What is sometimes referred to as a public private partnership might work, or it might be a public unit of the Ministry of Health, or it might be a private social business. It is unlikely to be successful as a pure profit maximizing business. It might be a community cooperative of some sort. What is important is that it has an ability to earn revenue and have income to sustain its operations and provide the services needed to the community.

Community organizations

Community organizations are a key part of community success. An individual and the family can do quite a lot ... but there are many things that need to be done on a larger scale and with the cooperation of many more people. This is where a community organization comes in. Very large national and international organizations cannot do this very well ... typically they do not have the essential detailed local knowledge. There are other problems with large organizations. Small community organizations have problems as well, often these are lack of funding and limited capabilities.

Donor funded projects

Donor funded projects have the advantage of funds ... but they may be limited in many other ways. The project form of organization and limited duration of a typical project mean that long term sustainability is almost always compromised. Frequently their way of operating conflicts with established local practices, and serves to confuse in all sorts of ways ... and may well continue long after the funding has ended. One of the issues of donor funded projects are the rates of remuneration that are often on a different scale than local operations.

Humanitarian Aid Projects

Humanitarian aid is helpful in the short run ... sometimes. The process of planning and mobilizing aid even for the most urgent humanitarian crisis is cumbersome and time consuming ... and oftentimes arrives well after it is needed ... and then adds to the economic disruption, rather than being timely and helpful. To add to the problems ... local resources get diverted to humanitarian aid initiatives that would be better allocated to programs that have a future and will help to build sustainable progress.

NGOs

The performance of NGOs is very variable. The NGO designation covers organizations that are very small to those that are almost \$1 billion revenue organizations. Very few NGOs report their performance to the public in a manner that is analytically useful ... the reporting focus is more on maintaining a good relationship with their funding partners. This is very problematic and there is a serious need for changing the performance reporting paradigm to something that has a focus on costs and on service delivery to beneficiaries

Faith based organizations (FBOs)

Faith based organizations (FBOs) are sometimes very good ... but not always. Like the NGOs, they have to report to satisfy their funders, and have to operate in ways that suits their mission. Some of their work and commitment is wonderful.

Specialized health initiatives

In times past there have been specialized health initiatives in developing countries ... and a modern version of these is emerging again. There is a critical need to have healthcare that is sustainable, professional and affordable. Much of the organizational structure that exists presently cannot serve the needs in an affordable, effective, sustainable way ... but more and more it is being shown that very low cost very effective therapies do exist and can be deployed successfully. IMM recognizes these initiatives as being of great importance for the future.

Multi-organization coordination

Multi-organization coordination is a challenge. In most situations the data available for effective coordination does not exist, and when there are data, the data are not very useful for easy coordination. The IMM approach to coordination is to encourage multiple organizations, especially those with operational expertise and capacity ... but to ask ... in fact demand ... that certain data at the community level operations are made available. These data relate to organizational capacity and the actual level of activity and outcomes in their work. These data serve to allow optimization of scarce resources in the community, and allow for practical coordination and sharing of resources and capabilities where it can do the most good.

For each project some data are important including the following

- ◆ Name of the unit?
- ◆ Where is the unit?
- ◆ What are its capabilities?
- ◆ Who runs the unit (organization)?
- ◆ Who is in charge of the unit?
- ◆ How big a staff?
- ◆ How big a budget?

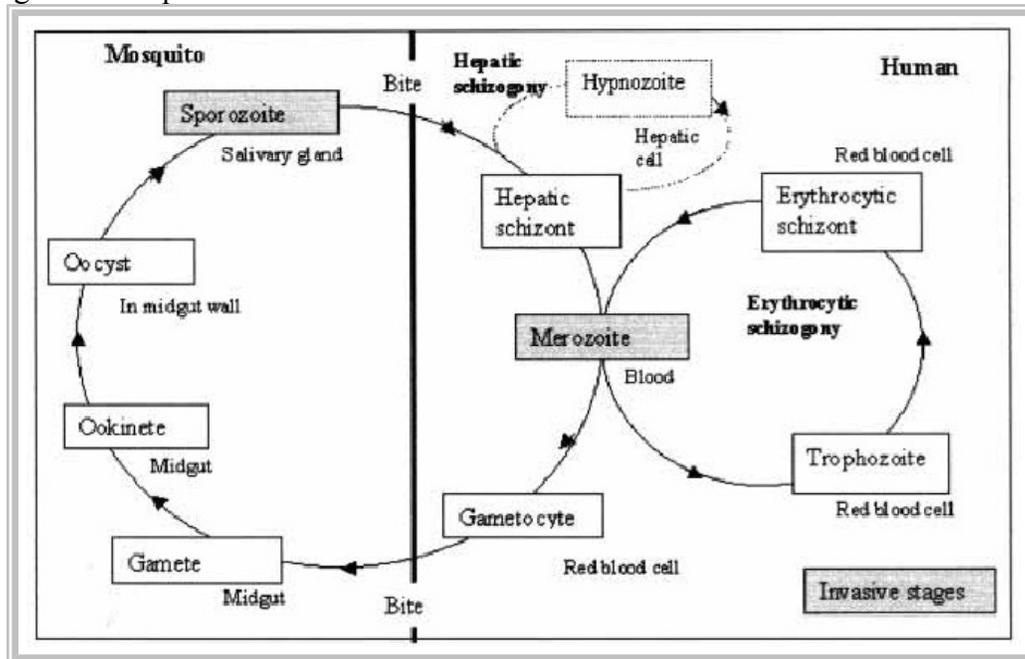
Strengthening builds on what exists and takes steps to make things better. In some cases there is nothing at all in the local community ... in other places there are some things, but not others. The starting point is what is present ... the goal is a system that produces good health outcomes.

IMM ... Entomology

Mosquitoes

Malaria science and mosquito science are BOTH important in the process of malaria eradication.

This is a simple schematic showing the passage of the parasite through its life-cycle through the mosquito and the human host.



The parasite moves from human to mosquito during a blood meal, and then back to another human some time later during a further blood meal. When a mosquito bites, takes a blood meal, there are several possible consequences:

5. the mosquito is non-malarial and the human host is non-malarial in which case the mosquito remains non malarial,
6. the mosquito is malarial and the human host is malarial in which case the bite does not change the situation,
7. the mosquito is non-malarial and the human host is malarial in which case the mosquito becomes malarial
8. the mosquito is malarial and the human host is non-malarial in which case the host becomes malaria.

Entomology is critical for malaria eradication

Malaria is a complex disease. The mosquito is an essential part of the malaria parasite's life cycle and the transmission of the malaria parasite to humans.

Effective control of transmission is a part ... maybe a big part ... of getting control of malaria and maintaining control.

Vector Control In the Community

IMM interventions in the community are not abstract ... but very tangible. The community should easily be aware of what is going on with malaria control interventions.

Vector control in the United States is organized at the community level using Vector Control Districts. The first of these was established almost 100 years ago, and they have been active ever since.

The typical vector control district has a thorough knowledge of the area and is in a position to make use of whatever vector control interventions are likely to be the most effective. This can be source control using larvicides or it can be ULV fogging with adulticides.

While much of the work in the USA is related to nuisance pests, there has been a new urgency for effective vector control to arrest the spread of West Nile Virus (WNV). At the first indications that birds are infected with WNV there is immediate vector control response to ensure that all possible infected mosquitoes are killed.

An integrated malaria management program has several components all of which impact on each other ... but there is also a broader impact on how the whole of the health sector performs. Interventions that only improve malaria health without there being any progress on other killer diseases in the community is poor outcome.

There needs to be some organization or committee that coordinates the community level interventions and ensures that good results are being achieved. Such a malaria control area or mosquito vector abatement area must be large enough to encompass the sources of mosquito vectors and pests to be managed.

Larval habitat surveys should be done within this area to locate any larval breeding sites that would be a source of mosquitoes. The flight range of an An. Gambiae mosquito is considered to be 500 meters, though some will travel longer distances, especially with a favorable wind.

Local information is the best information ... if the local information is the primary information that is used for operational management and control, these data will be operationally accurate. Data that are used tend to be good data.

These data then can become a good foundation for additional scientific analysis in a multi-variate setting.

The local coordination can be done in any way that suits the local community, including cooperating with existing civil organization, or a school, religious organization, or a telecentre. The goal is to have the community be the key agent for success, and to have a reliable link with the global IMMC program so that there can be easy exchange of ideas and help with programs and resources.

Vector control management is a community based activity ... if not community an area close to several communities. The key question is what is to be done where, when and how much? There needs to be mapping of intervention activities ... what mosquito and malaria control interventions need to be done: when, where and how much.

There is evidence that shows that multiple interventions are more effective than single focus interventions ... but they are more difficult to manage and ascertain costs. Because of the use by IMM of TVM's standard costs and values it is easy to get an approximation of cost effectiveness by knowing how much of each intervention is done and what result or impact is observed (see results, impact below).

TrueValueMetrics - Integrated Malaria Management Workbook

IMM surveillance quickly learns where there are the concentrations of malaria infected mosquitoes. IMM maps these concentrations ... and then plan for immediate adulticiding if this capability exists in the community and it would be effective ... as for example, where there are high concentrations of mosquitoes near people and their housing.

Where sources of mosquito breeding with imminent recruitment are identified, map these locations and plan for immediate larvaciding. Again the constraint is the question of capability in or near the community. As a default, a distance of 500 meters from human habitation is a default guideline.

Entomological Surveillance ... Getting Data

Where are the mosquitoes?

Entomological surveillance is used to get data about mosquitoes, the mosquito behavior and the mosquito habitat. A large mosquito population is always a nuisance ... but it is only a danger for malaria when there is also the presence of malaria parasites. Entomological data can be characterized as easy data that serve to indicate population, and easy issues to identify ... for example, presence of eggs and larvae in water bodies, etc. while more difficult and complex work is needed to identify the prevalence of parasite in the mosquito population.

Surveillance



Collecting data ... the most important part of the IMM program. With data there can be analysis, and with analysis understanding and good decisions to ensure the most cost effective results.

- ◆ Where are the sources of mosquitoes?

Entomological and medical data are at the heart of IMM decision making. Entomological surveillance gets data about mosquitoes and the habitat, and medical diagnosis and screening provides information about the disease status and population health.

Mosquito samples



Using window traps to collect mosquitoes:

- ◆ How many;
- ◆ What species;
- ◆ What sex;
- ◆ What parasite status.

Data about mosquitoes and malaria needs to be collected accurately, and there needs to be good analysis to help understand what the data mean.

Mosquito trap



Information about mosquito population is needed to

1. plan control interventions
2. determine the success of the intervention

The information needs to be time and place specific.

If an intervention works, that is good ... but if the intervention does not work, then there needs to be rapid remedial action.

The data related to mosquito population and the habitat change very rapidly ... and at critical times, the data change from day to day ... even hourly! With good data, work on malaria control can be focused where the prevalence of malaria parasite is the highest, where the transmission is the highest and where the burden of malaria is the highest.

It is sometimes said that every “hoof mark in Africa” is a potential breeding place for mosquitoes, and to the extent that this is a challenge, it need not impact success of an integrated malaria

management program because it can be handled within the context of local community clean up, or, if needed, an appropriate externally funded interventions.

Where is the malaria? Where are the mosquitoes?

Spatial information ... maps ... are a critical part of the entomological information needed for IMM planning and the management of operations. Everything has a spatial characteristic, and from a cost effectiveness and performance perspective, it is likely that spatial information can be the most valuable in ensuring that IMM is low cost and sustainable. Mosquito and malaria control has a strong spatial characteristics that have a very large impact of control results. Accordingly spatial information and mapping are a very important part of cost effective high performance integrated malaria management.

Some of the characteristics that need to be considered include the following:

1. Where are people that are host to the malaria parasite located: where do these people live, where do they work, where do they congregate together, where do they travel to;
2. Where are the sources of mosquitoes;
3. Where do the mosquitoes travel and other details of their behavior including when they travel and how they behave relative to homes, people and animals;
4. Where are infected mosquitoes located;
5. What mosquito and malaria control interventions have been done: when and where.

About the weather

The population density of mosquitoes is directly related to weather conditions, especially precipitation (irrigation), temperature and relative humidity. Monitoring these key climatological conditions can provide the necessary information to predict which sites will be producing mosquito larvae and when. These parameters coupled with a knowledge of sub-surface water (water table) can provide additional information on where and when to begin mosquito larval control applications.

Entomology labs

While many people may be able to identify a mosquito, there are few that are able to identify what specie of mosquito, and whether or not the mosquito is male or female. These are facts that are needed in the efficient management of a malaria vector control program ... and for this some lab facilities are needed and competent personnel.

As a malaria vector control program matures even more information is needed ... specifically whether or not mosquitoes are carriers of the malaria parasite or not needs to be assessed. This has to be done using appropriate lab equipment with trained staff.

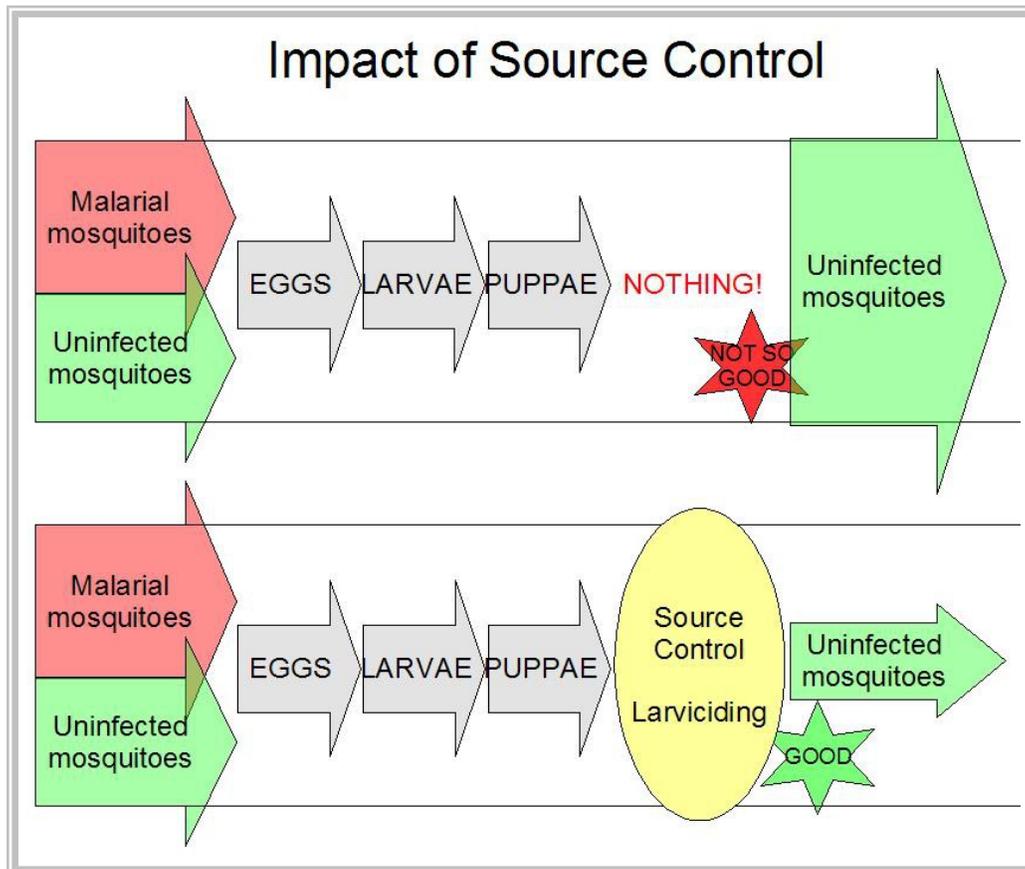
Mosquitoes are a nuisance and their bites are irritating. Mosquitoes are not dangerous, however, unless they are carrying a parasite that endangers people.

Darwin, Australia

In situations where malaria is endemic, but locally eradicated, as in Darwin, Australia, all possible interventions to control the spread of malaria from an infected visitor are used. Medication is used to remove the parasite from the human host, and vector control measures are used to ensure that no malarial mosquitoes will live to pass on the parasite to others. This approach has been ongoing since 1962 with success.

Source Control ... Larvaciding

It was source control that had a big impact on malaria reduction during the last century ... and it should be part of an integrated program today. Source control can be implemented successfully by local staff who have been trained in what to do.



There are two ways to optimize costs: (1) is to use larvacides in places where larvacides are needed; and (2) to have local people doing the work. For this to be possible there needs to be good surveillance information about the location of breeding sites and the stage of the life cycle, and for local people to do the work well there needs to be thorough training both in the spray work to be done and the safety protocols to be followed.

Source control can reduce the malaria population efficiently. With no source control the mosquito population stabilizes at a level that is governed by general environmental considerations. In humid tropical areas, mosquito populations increase very rapidly whenever environmental conditions are favorable. The following schematic shows how the population of mosquitoes can be substantially reduced by active source control.

Source control reduces a mosquito population by killing the mosquito in the larval stage. At this stage the pest is immobile and concentrated, and carefully targeted intervention can be very effective. The key to cost effective source control is accurate knowledge of where the sources are located and the stage of development of the larvae population. Source control reduces the population of locally produced mosquitoes that are responsible for transmission of vector-borne pathogens and associated nuisances to human and animal populations. Killing mosquitoes at their sources, when they are in the larval stages and concentrated, immobile and accessible is the key to a cost effective program. The interventions focus on reducing the incidence of adult females, both

vector and nuisance species to tolerable levels. Other measures supplement this primary intervention.

Larval elimination is the most effective and reliable way to control a mosquito population especially when directed at the young larval stages before they become more dispersed in the environment. The application of insecticide when the larvae are most concentrated in the habitat also reduces the amount of insecticide needed which has the dual effect of reducing potential environmental contamination as well as reducing costs.

Mosquito life cycle



What is the stage of the life-cycle: This sample has eggs, larvae, pupae ... it needs urgent larviciding before the mosquitoes become airborne.

Source control is an intervention that is cost effective when there is good data collection and the community knows what it is doing both from a scientific point of view, but also based on geography and spatial information. Note that the biggest costs are the expatriate staff and the chemical and biological agents. These costs are much reduced when there is good data about where larviciding should be applied and whether it is being effective.

Abatement plans for Anopheles, Culex and Aedes mosquito species depend on the pattern of annual and seasonal (dry and rain) rainfall and the incidence and distribution of the immature stages of the mosquitoes.

Anopheles and Culex species have time limited estivation and/or latency capabilities in the adult, larval or egg stages and cannot remain dormant during dry periods. The elimination of slow moving or stagnant water during dry periods has a very important impact on the wet season population. Because of this it is critical to locate and manage all water filled harborages that provide sustainable habitats during these times and eliminate these “seed populations” that are the sources for the high population densities that occur when the rainy season begins and aquatic habitats become numerous.

Eggs of the Aedes species are capable of surviving for long periods of time on soil withstanding dry conditions and hatch into larvae when flooded. Some container inhabiting aedine species survive in artificial or natural containers and natural precipitation or man-made means provide water for hatching.

Larviciding



Larviding may be done manually. It is not good for very large areas, but works very well where the area is relatively small.

Larviciding

Larviciding from a truck mounted sprayer speeds up the treatment ... but is only possible where there is good road access



About Bti

Bti is a biological agent that is very effective as a larvacide. The cost of Bti has to be given consideration ... because while most chemicals can be shipped in a concentrated form and then diluted locally for use, Bti granules are bulky and do not dilute.

There is the potential, however, to make Bti locally with guidance from people with expertise in the work. The active agent must be prepared according to a strict protocol, but the medium for the dispersion of the larvacide may be built up using any form of suitable local material that is available.

Personal Protection from Mosquitoes

Exposure to mosquito bites can be reduced by many different techniques. Some of the approaches are expensive and therefore limited to the wealthier members of society. These interventions are all possible, but only in areas where personal incomes or wealth are substantial. For most communities these interventions are not affordable, and are not suited to public subsidy.

Air conditioning

Living in air-conditioned space is one way to reduce exposure to mosquitoes ... but it is an expensive option and only available to a very few.

House construction

House construction can make a big difference to the number of mosquitoes seeking blood meals in the house

Insecticide sprays

Using insecticide sprays is another way. These are also expensive, and they have potentially bad side effects both to the people exposed to the insecticides and to the environment. Many of the sprays commonly used in malaria endemic areas are banned from the EU and the USA because of their dangerous potential.

Coils

Burning insecticide treated coils keeps mosquitoes away from possible blood meal targets.

Traps

In some situations mosquito traps can help reduce the level of mosquito bites.

Appropriate clothing

Wearing appropriate clothing that covers the legs and arms also helps keep mosquitoes from reaching a blood meal.

Prophylactics

Taking anti-malaria drugs as a prophylactic is possible ... but has the disadvantage of creating resistance which may preclude effective curative therapy if needed.

Area Clean Up

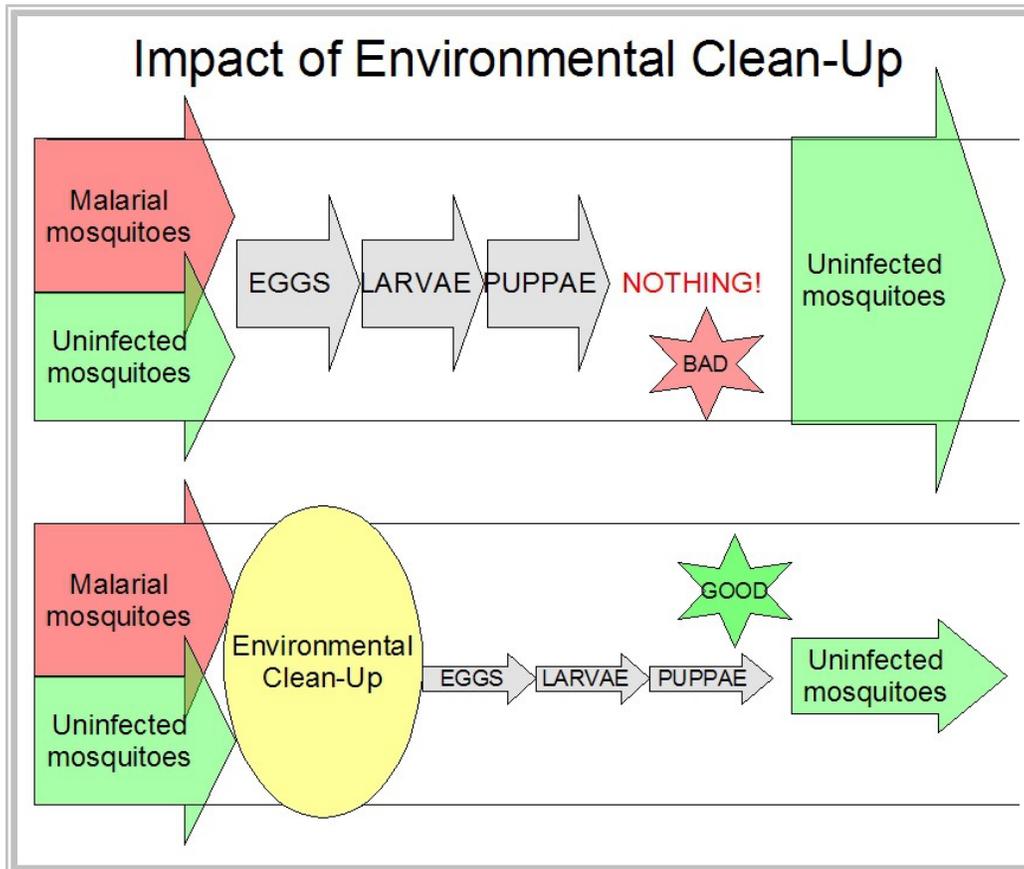
The malaria population can be very favorably impacted by environmental clean up. The following schematic shows how the population of mosquitoes can be substantially reduced by active clean up of the area. When nothing is done ... the mosquito population renews itself and a population of uninfected mosquitoes emerges to start the continuing cycle of blood meal and disease transmission.

Surveillance data identifies the locations of breeding places that result from a variety of wastes, such as automobile tires and discarded containers of all types that collect water. All of these potential breeding places can be cleaned up and will results in a reduction in malaria producing sources.



Old buckets, paint cans, plastic containers all serve to collect water and facilitate the breeding of mosquitoes.

Surveillance data will identify places where mosquitoes breed that can be eliminated by habitat modification. Poor design of structures and the area where construction has taken place often create excellent habitats for breeding mosquitoes. These situations need to be identified and modifications made, in the main to eliminate standing water.



TrueValueMetrics - Integrated Malaria Management Workbook

Area clean up requires some community spirit ... it is not something that is easy without local leadership and local commitment to a malaria abatement strategy. Area clean up does make a difference when it is done in conjunction with other efforts. Mosquito populations increase very rapidly when environmental conditions are favorable. Reducing the breeding places makes a big difference. Female mosquitoes need places to lay their eggs, and the further away these sites are from the human source of blood meals, the better. The role of environmental clean up in the history of malaria control is significant.



Old tires serve as reservoirs that collect water ... they need to be removed or buried so that water does not collect in them.



All sorts of containers serve as places for stagnant water to collect ... and for mosquitoes to breed. They need to be covered or treated with an appropriate larvicide.

The issue of malaria in urban areas versus malaria in rural areas needs to be better understood. A strategy that might work in an urban area may not be appropriate in a rural area. How do you do clean up in an urban slum? How do you do clean up in a remote rural area? They are vastly different problems and the solutions are unlikely to be the same.

Cleaning up swamps near population centers reduced insect borne disease in Europe, and the agricultural revolution cleaned up land as well as producing food. Clean up had a role in Col. Gorgas's success in reducing the burden of malaria disease during the construction of the Panama canal in the early 1900s.

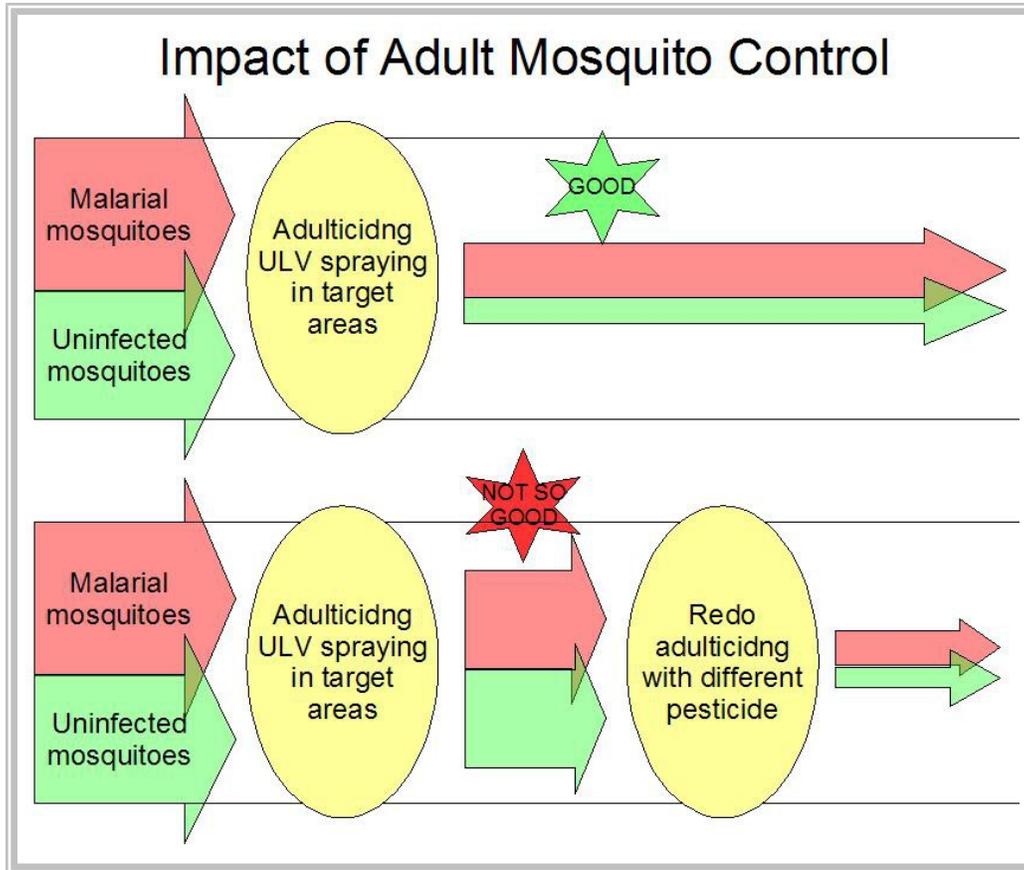


Many of the sources of mosquitoes are man made. Construction works that do not include adequate drainage are perfect places to hold stagnant water and become the breeding places for mosquitoes.

ULV Adulthooding

When there are an abundance of adult mosquitoes, the use of adulthooding will reduce the mosquito population. This has been a central intervention in the USA, though it is not being used to any extent in the current Africa malaria crisis.

On its own adulthooding is going to have little impact on the ultimate goal because there will be rapid reestablishment of the mosquito population and because there will also be rapid reinfection of the mosquitoes with the parasite. However, the use of adulthooding might accelerate the impact of other interventions, specifically medical treatment of active cases and source control of the mosquito population.



While mosquito population control is best controlled at the larval stage before they fly and disperse, modern ultra-low volume (ULV) spray technology makes it cost effective to control flying mosquitoes. This technique is used in the USA to control mosquitoes where West Nile Virus has been located, or merely to control “nuisance” mosquitoes. ULV is very cost effective for large areas that are difficult to access. ULV spraying creates very small droplets that attach to the hairs on the mosquito. This intervention provides for a quick knock down of the mobile adult population.

Cost effectiveness

The cost and immediate result of adulthooding suggests that this should be a significant part of integrated malaria control interventions. Modern spray techniques available are very effective and very low cost. The cost can be as low as \$2.50 per acre treated, and the per-capital cost very low depending on the population density.

The unit cost depends very much on the way the ULV capacity is organized. A small spray plane can treat 5,000 acres per hour and bring about a 90% reduction in the mosquito population.

However, because there are high fixed costs, a price of \$2.50 per acre is only possible when the plane and the organization are achieving a high utilization of the equipment ... say aircraft use of more than 100 hours per month.

Setting up a ULV spraying operation requires a substantial capital outlay ... around \$ 2 million for two aircraft and spray gear, plus another \$2 million for working capital (spare parts, inventory, fuel, accounts receivable, etc.)

Expenses like insurance are substantial even when risk is managed well with experienced pilots, good aircraft and maintenance ... in large part because of the inefficiency of the modern insurance market.

Application methods

There are several ways to treat an area. The selection depends on what methods are available and the scale of the vector control required.

Ground fogging

Very common ... and well suited to places where the vector control is localized.



Ground fogging equipment may be used for small areas. It is very effective but is limited to ground accessible areas and takes a lot of time.

Aerial application

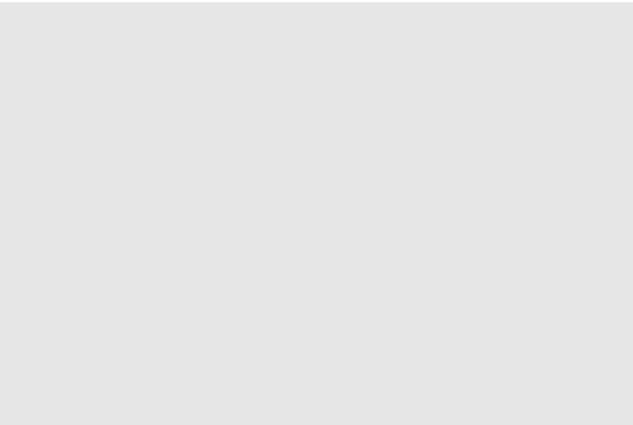
The fastest and least cost method for ULV spraying over a large area is by plane. It is accurate and efficient. A large area can be done in a short time.

Aerial application



In the right circumstances, aerial application is very cost effective, and can have a major impact on the speed that the mosquito and malaria disease is brought under control.

The use of aerial ULV is essential for long term cost effective sustainable malaria control ... in its modern form ULV aerial application is accurate and a cost effective tool.



Modern ULV navigation equipment allows the pilot to program the GPS onboard computer so that the spraying will treat all the area as required without drift into other areas. The area of potential high mosquito population is identified and a possible area to be treated laid out. With modern GPS equipment it is possible for the aircraft navigation system to be programmed so that



spray is accurately delivered to the target area taking into account airspeed and wind over the ground.

Safety ... impact of the environment

Pesticides used today like Dibrom are safe but very toxic to mosquitoes. Chemicals such as Dibrom are used extensively in the United States for mosquito and vector control.

Also important is that the impact of ULV spraying is very fast. If an area is correctly sprayed tonight, the mosquito population will be significantly lower next morning, usually a reduction of more than 80%. If the reduction is less than this, there is a resistance problem that needs to be addressed, and changing to a different family of insecticides and respraying will probably deliver a reduction in the mosquito population.

Environmental danger

The environmental dangers associated with ULV spraying are extremely small. A typical chemical Dibrom is toxic to mosquitoes, but not to most other insects and animal life. The concentrations used are very small ... around 1 oz of active pesticide per acre.

Managing resistance ...

The following shows two situations. In the first case the adulticiding is successful and mosquitoes are killed and the population is reduced. In the second case there is resistance to the first chemical used, so the procedure is repeated using a different chemical treatment.

Interior Residual Spraying (IRS)

Personal protection using interior residual spraying (IRS) of the home is a proven way of reducing the impact of the mosquito vector on people in the home. There are several ways in which IRS impacts on the mosquito and malaria:

1. By the repellent effect which helps to keep mosquitoes out of the home,
2. By the toxic effect which kills the mosquito when they try to rest on the treated surfaces, as they would do after a blood meal.

In the event that the mosquito was not malarial before the blood meal the human subject will not become infected, but if the mosquito is malarial before the blood meal the human subject will be at risk of infection. If the human subject is host to the parasite before the blood meal, then the IRS toxicity will stop the mosquito transmitting the parasite to others.

IRS treatment



Spraying inside a house ... the effectiveness of the spraying depends a lot on the surfaces being treated. Spray staff need to be trained in the best way to apply under different circumstances

IRS and bednets

Both bednets (ITNs) and interior residual spraying (IRS) are personal protection interventions that aim to reduce the number of mosquito bites and thus, the transmission of malaria. Data that are available suggest that IRS is more cost effective than ITNs. Data suggest that ITNs on their own are not very effective, but when used in conjunction with IRS there is a very good outcome.

The repellent effect

IRS and bednets operate by having a repellent effect and a toxic effect. In addition the bednet provides a physical barrier to keep mosquitoes away from the person.

According to studies, bednets and IRS have a community impact that goes beyond the individual benefit when there is a high coverage of bednets or IRS in the community. These studies show that this is very much more pronounced in the case of IRS than for bednets.

Whether there are any behavior change in the mosquito as a result of these personal protection interventions is not known though it is likely that there will be substantial changes if the availability of easy blood meals is constrained.

Interior residual spraying (IRS) is a well established way of reducing malaria transmission. There are a multiple actions that affect mosquito behavior and survival. The repellent effect is perhaps the most important, because this keeps mosquitoes away from the human source of a blood meal.

If the mosquito does bite and gorges itself on a blood meal and alights on the treated surfaces, the toxic action will kill the mosquito and stop onward transmission of the parasite.

Training

Training is a prerequisite to successful use of IRS ... but training is not difficult when the trainers and trainees are competent and motivated. Training needs to be ongoing because there is a turnover of staff, and people forget over time. Effectiveness of training is also linked to the ongoing oversight and supervision of the program, and how staff are managed.

What spray chemicals?

There are several spray chemicals that can be used. The use of chemicals has to comply with the legal arrangements in the location ... not all chemicals that work for IRS are legal in all locations.

Some chemicals work better than others ... a matter of biology and chemistry ... toxicity, repellancy and length of effectiveness.

By most accounts DDT is the most cost effective chemical for IRS. But though the data show DDT is effective, its use is a contentious issue. The arguments go back to the early 1970s when the new US Environmental Protection Agency (EPA) made the decision to ban the use of DDT in the USA because of the dangers alleged because of its persistence in the environment. While there is no question that the heavy use of DDT in agriculture was having an impact on the prevalence of DDT in the food chains, any negative impact of DDT being used for vector control in public health was less clear. Even though the data showed that DDT saved lives in public health, the US EPA decision effectively ended use of DDT for public health.

DDT

- ◆ DDT is a very effective repellent;
Mosquitoes stay away from areas where there is DDT. This is a very desirable behavior and reduces contact between mosquito and humans in the location.
- ◆ DDT is longer lasting than most other chemicals;
It has the potential to be effective for a full 12 months ... and in almost all cases a single spraying will last for the whole of the mosquito season.
- ◆ DDT has a low price;
DDT is the most cost effective active agent for IRS.

Related interventions

Protection derived from using insecticide treated panels

One of the behaviors associated with some insecticides ... especially DDT ... is a repellent effect, which keeps mosquitoes away and stops them taking blood meals. DDT treated fabric panels can be hung around openings in the house structure to keep mosquitoes out of the house. The technique has been used on an experimental basis with success.

Safety

IRS should, of course, be conducted with trained personnel who know and practice safety. Personnel should be trained about safety practices so that they work safely both for themselves and the people they serve.

Safety



IRS spray staff need to work using safe methods. The chemicals used are safe to use as intended ... but care must be taken during the application while the chemicals are airborne. These IRS spray staff are wearing protective gear.

IRS should be done carefully so that there is no environment impact. The environment should be monitored to ensure that there are no unintended consequences.

Insecticide Treated Bednets

Insecticide Treated Bednets (ITNs) have now come to dominate the dialog ... and more recently long lasting insecticide treated bednets (LLITNs).

Bednets have become the most well-known of anti-malaria interventions. Programs of fund raising for bednets has been a great success. Part of the success can be attributed to the very simple message that buying a bednet for \$10 will save a child's life in Africa. The idea is easy to grasp, and fund raising based on this premise has been successful both at the individual level and with the major donors, institutions and governments involved with international aid. The simple concept that investing in insecticide treated bednets will save lives has helped build funding for malaria at an unprecedented rate. The lesson is clear ... simple messages sell.

How cost effective are bednets?

During the five years 2002 to 2007 the distribution of ITNs increased more than tenfold. In 2007 alone, maybe as much as \$1 billion was spent on bednets. This was a bonanza for those that are involved in the bednet industry ... bednet manufacturers ... chemical manufacturers ... and distribution organizations. There was a level of “busyness” that has not been seen in the malaria control industry for decades.

Early on there was considerable activity to document the potential for bednets to be a very cost effective solution to the malaria health problem ... and especially for young children. While the studies seemed to suggest that bednets would be of value ... they also made it equally clear that the value might not be very much.

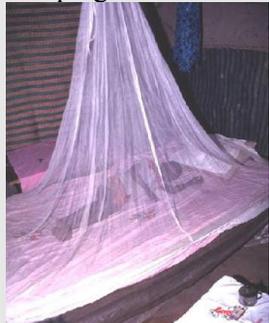
Bednets ... a Projection of Failure

A well known researcher, Christian Lengeler, has observed in the Cochrane Review that, in plain English, with an 80% coverage of insecticide treated bednets, there would be a 25% reduction in child mortality due to malaria. (see ref: xxxxxxxxxxxxxxxxxxxx). Where the starting point is 3,000 children dying every day from malaria, this means that success is when only 2,250 children are dying every day from malaria. SORRY ... but this, in my book, is failure!

After some billions of dollars of bednet expenditure ... it is not at all clear that bednets have set the stage for a reduction in malaria, and certainly not a sustainable reduction in malaria.

Long lasting insecticide impregnated bednets (ITNs) (LLITNs)

Sleeping under bednet



Modern bednets are impregnated with insecticide and keep mosquitoes away not only physically but also by chemical action. For the past several years personal protection using an insecticide treated bednet has been a widely used intervention. There are several styles of bednet and a variety of chemicals are used. Not all the the chemicals being used have been approved for use by the WHO and/or UNICEF.

Standard bednets

Bednets have been used for a very long time by people who could afford them. They help ... and certainly they reduce the nuisance of insect bites.

Local bednet production

Many communities in developing countries have had small-scale bednet production that has served local markets. Malaria control programs that have introduced various forms of bednet distribution at highly subsidized prices ... in many cases 100% subsidy ... has been devastating to these local producers.

The socio-economic advantage of local bednet production has been ignored in the strategic planning for malaria control. To the extent that there has been local production of ITNs in Africa, it has not been obviously a cost advantage to African users.

Retreatment of bednets

The retreatment of bednets is required in order for them to have the greatest effect. This must be done as frequently as every six months. Generally speaking this is a challenge because of cost and administration rather than anything else. In socio-economic terms the process of retreatment has a job creating aspect that is valuable ... but the prevailing institutional arrangements for funding such activities really do not work.

Treating bednets

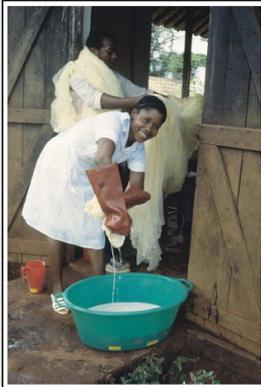


Figure 1. The nets from all houses in a Tanzanian village are given their annual retreatment free of charge by a nurse from the health centre. Photograph taken by T.J. White.

A standard bednets needs to be retreated from time to time with insecticide. While this is important to the effectiveness of the bednet, and needs some organization and funding ... the costs are quite low and the employment is local. It is, however, almost totally excluded from donor funded initiatives.

The use of bednets

Bednets only work when they are used. There are many anecdotes about the use of bednets for almost everything except as a mosquito barrier.

Hanging bednets



Here are staff demonstrating how the bednet is used. When the distribution of bednets includes getting people to understand and appreciate the benefits of bednet use, there is more use of bednets

Awareness is important. It is critically important that there is awareness in the community about malaria and how it may be prevented. The process for distributing bednets should recognize that the quality of awareness training is very important and include appropriate interventions. The popular mass distribution of bednets widely used in donor funded bednets programs usually do little or work on awareness.

Methods of distribution

Is it a myth or reality that people only value things they pay for? There is the notion that people use what they pay for ... and people do not use anything they get for free. But this is not the whole story. People buy things that they know are valuable ... but there are many ways to help people to understand that bednets are valuable other than the price approach. Most people will not

buy them because (1) they do not know they are valuable and (2) they are not able to afford them anyway!

Superstition may also play a part. There are cultural issues related to color and covering up that make use of bednets problematic without adequate awareness training. Many do not know it is mosquito bites that help transmit malaria ... rather they may know, for example, that it is eating mangoes is the causal factor. Why not? Mangoes grow profusely with the rains, just as mosquitoes multiply and transmit malaria during the rains!

Focus on high risk vulnerable groups

A focus on high risk vulnerable groups has some merit ... but it is a fatally flawed strategy for sustainable reduction in the burden of malaria.

Getting vulnerable groups to have access to bednets and malaria treatment is a good way to maximize reduction in mortality now ... but the approach does not help to reduce transmission in the population at large and sets the stage for the emergence of resistance.

Programs to get young children who are at the highest risk of dying from a malaria attack to sleep under a bednet and be protected seems to have been positive in that it seems that less children are dying of malaria in the critical first year, or even two or three. It is less clear that children as a whole are growing up to adulthood. The possibility is that children survive initially, but subsequently die because malaria is so prevalent in the society at large. The possibility also exists that these young vulnerable children survive malaria, but succumb quickly to some other preventable childhood disease like diarrhea or respiratory infection.

Another group being targeted for bednet use are pregnant women who are also highly vulnerable to malaria. Again, the reports suggest that sleeping under a bednet reduces the incidence of malaria for the person involved, but this does not translate into less malaria in the community as a whole, and is probably unsustainable for the individual when they are no longer in the vulnerable group of pregnant women.

How much do bednets cost?

The cost of a bednet should be quite easy to determine ... but there is a chronic lack of transparency about this.

Transparency about Bednet Costs

In the audit world, there used to be an assumption that something bad was going on whenever data were inaccessible ... so it is in the broader world when there is a lack of transparency. Inquiry suggests that the bednet supply chain has evolved into a profit bonanza for most of the participants ... and while there has been a high volume of bednet distribution ... its cost efficiency is not readily apparent.

The cost of bednets ex-factory (that is the price billed by the manufacturer) is believed to have increased substantially in the five years since 2002. While the manufacturers were probably earning inadequate profits prior to 2002, the unit cost of a bednet at the manufacturing stage have probably declined significantly while the prices, revenues and profits have increased.

In most places, import taxes and duties have been reduced significantly for malaria related supplies over the past several years ... but other logistic costs have not decreased much, if at all. Part of this is because the planning for distribution has been based on approaches that are inherently inefficient and expensive. Mass distribution may be a good way to run a vaccination program, but the same approach is not well suited to the distribution of bednets.

Resistance

Mosquitoes

Mosquitoes are likely to become resistant to the pesticides being used in the bednets ... especially where the type of pesticide is similar to pesticides being used in agriculture.

What chemicals are most prone to resistance?

The chemicals that are used in both public health and in other areas like agriculture are most prone to rapid development of resistance

Pyrethroids

Pyrethroids are at risk as a chemical family that is widely used both for public health and for agriculture [CHECK THIS?]

Behavior change

Mosquitoes are known to change behavior rapidly in response to the habitat ... probably something to do with the need to find blood meals easily and without aggravation. This may be used to encourage mosquito behavior that reduces transmission of malaria in humans or could aggravate the transmission problem

What to do?

An effective program that rapidly reduces the need for chemical interventions is a big help ... careful surveillance to identify resistance build up early ... rapid change to other chemicals when resistance build up is detected ... development of a pipeline of alternative chemical and other interventions.



Both bednets and interior residual spraying (IRS) are personal protection interventions that aim to reduce the number of mosquito bites and thus, the transmission of malaria.

They are being presented as being very effective, but the data are weak.

IRS and bednets operate by having a repellent effect and a toxic effect. In addition the bednet provides a physical barrier to keep mosquitoes away from the person.

According to studies, bednets and IRS have a community impact that goes beyond the individual benefit when there is a high coverage of bednets or IRS in the community. These studies show that this is very much more pronounced in the case of IRS than for bednets.

Whether there are any behavior change in the mosquito as a result of these personal protection interventions is not known though it is likely that there will be substantial changes if the availability of easy blood meals is constrained.

Studies show that using bednets reduces malaria mortality ... especially insecticide treated bednets. However, the studies are rather small relative to the number of bednets that have now been distributed.

While Lengeler is widely quoted as a source of justification for the ubiquitous bednet focus ... other studies seem to show that bednets work best in an environment where other mosquito control strategies are also in place. In fact, over the past three years it seems to becoming clear that every success is a result of multiple interventions rather than a simple singular bednet focus.

Research

IMM's Research Focus

IMM's research focus is on determining the optimum use of available knowledge to achieve the best possible malaria control outcomes. Science is important as the foundation for success ... and critically also for ensuring that success will be possible in the future.

Arguable, there must be effort to ensure that most resources get allocated to research that has potential to be of value, if not now at some time in the future. There must be effort to identify those that merely want research simply it is an area where there is rather less accountability for progress and performance than in other areas.

It is also necessary to manage the matter of money. Research is needed because there are problems that needed to be solved now, and there are problems that need to be addressed because they are likely to emerge in the future. The research agenda needs to be driven by what is scientifically and socially important. It is, however, a challenge to get the funding to be on the same agenda and with the same priorities as the priorities for an optimum research agenda.

Operations Research

Some of IMM's research may be characterized as operations research. What works best? How much does it cost and what outcomes are being achieved. The hypothesis is that there can be cost effectiveness optimization that is based not only on the average of intervention and outcome behavior, but especially based on the physical and biological conditions of any specific location.

It is known that mosquito population control may be done in several ways, notably (1) by source control such as larvaciding which kills larvae; (2) by spraying that kills the adult mosquitoes while they are flying or exposed; and (3) by cleaning up the environment so that there are less breeding places. The cost effectiveness of these interventions depends not only on the nature of each intervention, but also the situation in the area and the way interventions are planned and implemented.

Reducing mosquito bites depends on knowledge of mosquito behavior. The bednet puts a barrier between the human and the mosquito making access to a blood meal more difficult. An insecticide treated bednet may be toxic to the mosquito and kill it, or it may serve to repel the mosquito. Similarly interior residual spraying (IRS) may kill the mosquito when it rests on a sprayed surface, or it may repel the mosquito so that it does not come into the house. The cost effectiveness of these interventions depends on the situation in the area and the way these interventions are planned and implemented.

Intervention optimization ... what works best?

Research is needed to help determine what works and what does not. There is a lot known ... and we should use data to choose what seems to be best intervention in the prevailing local circumstances based on what we already know. Advanced multivariate analysis helps to predict what might be the best set of interventions in any specific circumstance in the future.

IMM Data for Research

Data acquisition is expensive, albeit less costly with modern electronic devices that it was in the past, but it is also essential for optimum performance. The cost effectiveness of data is reduced substantially when data are used both to support local decisions about local operations, and as well being consolidated and used for broader scientific research. Local data that are used only for local analysis is not an optimum data framework. The IMM data framework allows for local data

to be used for local analysis and for the data also to be used in a large database with data mining agents.

The data collected to manage local malaria control activities may be used more than once. After immediate use to determine plans for today and tomorrow, the data may also be used for advanced study within a comprehensive academic data store. This makes it possible to address on a continuing basis the important questions that will determine long term success and sustainability.

Managing Research

It is important to manage research. Research is a vital part of tomorrow. It is only because of yesterday's research that so much that is important today is known. As in any field, research is best when it is well managed ... but the methods of management for research are way more subtle than anything that ever gets taught in a business school.

Great research does not neatly fit into a box in a business process flow chart ... or in the 9 to 5 work-day syndrome. Research progress happens when it is ready to happen. Great research is motivated by something more than merely money ... but money reward should not be ignored ... nor is it sufficient on its own.

And great research that does not yield a great outcome is sometimes as important as that that does yield the great outcome. Knowing what does not work is knowledge just as knowing what does work. And, of course, knowledge has most value when there is free and open collaboration and cooperation.

There is research that has little potential either for meaningful progress for science, or for valuable application. Good managers of research are able better than others to identify this and guide the research into a better path. This is not easy ... but some individuals and institutions do this much better than others.

Managing research is not easy. It may well be that modern society would not have its capacity for today's productivity if basic research done years ago had never been done. Some ... maybe a lot ... of what is being researched today is going to be critical for the productivity of tomorrow ... and a hundred years from tomorrow. But that does not mean that a strong discussion should not be going on to sort out what is likely to be a waste of resources and what is likely to be the foundation for something better for the future. This should not mean that a disproportionate amount of available health resources should flow into research at the expense of resources that could be used for programs that have immediate health benefit.

Core Research Topics for IMM

There are a range of research topics that are central to the IMM approach. These are the topics that related to operational performance and sustainability. While scientific knowledge about malaria improves, the issues of malaria control evolve, especially as it relates to resistance and the behavior of mosquitoes and humans. There is a lot to learn.

Resistance to drugs

Early warning about resistance emergence is valuable ... and unlikely to be done where the data are processed for analysis in small sets. The IMM framework allows for data to be used locally and used within a large scale data mining system as well.

Resistance to pesticides

Early warning about resistance emergence is valuable ... and unlikely to be done where the data are processed for analysis in small sets. The IMM framework allows for data to be used locally and used within a large scale data mining system as well.

Behavioral science

The behavior of people must not be ignored. There is a lot that people can do to reduce their risk of contracting malaria. A lot of the failure of development can be attributed to the lack of understanding of human behavior, especially when different cultures are involved. Awareness applies not only to teaching scientific facts, but also appreciating the complex dynamics of human society.

Computer science

Computer science has facilitated paradigm shift in other sciences, and in some parts of industry and commerce. The potential of technology that applies modern computer science to deliver paradigm shift that serves public health is enormous. Computer science has become an integral part of modern society and the global economy ... it is ubiquitous. However the power and the potential value of computer science applications is largely unrealized.

Other Fields of Research

There are many fields of research that need to be pursued to set the stage for sustainability of malaria control success. These are not central to the core IMM program, though they will influence the IMM process of planning for optimized results where the research is delivering new scientific knowledge.

Malaria Vaccine Research

Vaccines have been developed for many diseases. However, up to now there has not been the development of an effective vaccine for malaria. The development of a vaccine for malaria is a costly program ... and it may be that a malaria vaccine will not be needed if existing malaria control techniques are deployed optimally.

Mosquito Biology

The treatment of malaria has been possible for a long time ... quinine based formulations have been used for about a century. Over time, these formulations have become less effective because of the emergence of resistance.

Entomological Science

If you manage the mosquito ... you manage malaria. Malaria is transmitted by a mosquito ... and knowing the behavior of the mosquito makes it possible to control the transmission of malaria. The life cycle of the mosquito is well known. Less well known is exactly the behavior of the mosquito in a specific setting ... and without this it is impossible to make the best decisions about mosquito control. There are significant differences in the behavior of mosquitoes from place to place, but we know very little about specific places so that we can predict behavior and optimize interventions for cost effectiveness based on these data.

New Drug Research

New drugs have been discovered that treat malaria, including artemisinin based combination therapy (ACTs). There is ongoing research to find new drugs, and to find ways to reduce the potential for resistance.

The presumptive treatment of malaria is commonplace in resource poor settings, and this accelerates the emergence of resistance. Effective methods for the reliable diagnosis of malaria is a way to improve treatment and reduce the risk of resistance.

Diagnostic Testing Research

The importance of accuracy in diagnostic testing is clear from the IMM cost effectiveness modeling ... but work already done shows that some diagnostic procedures are more effective than others. For success there needs to be both accuracy, low cost and ease of use.

Parasitology Research

Maybe there will be breakthroughs in parasitology so that the malaria parasite can be controlled in new and innovative ways. This may be important if resistance to the prevailing treatments for malaria becomes widespread.

Resistance Research

Resistance is a major concern. Resistance emerges when a drug is used over and over again and there is an incomplete cure. In the case of malaria, there may be a complete cure within the one patient, but the disease emerges again from an untreated person with malaria, and transmitted by the mosquito vector. Where there is re-infection ... eventually there will be resistance.

Pesticide Research

The resistance of mosquitoes to pesticides is a concern, but normally resistance management has a low priority until the damage is done. Good field practices are needed to slow the pace of the emergence of resistance. At the same time there needs to be development of new approaches to pest control so that emerging resistance for established pesticides can be managed.

Research Institutions

Universities and research institutions have become a big part of the modern malaria sector. While the role of research in modern society, and in modern health is important, it is also expensive.

The research institutions are mainly Universities and Teaching Hospitals around the world. There are many institutions and many departments and programs within the institutions. Some of the most prominent are:

- ◆ In the USA:
 - Johns Hopkins
 - University of Alabama at Birmingham
 - University of Illinois
 - University of Washington
 - MORE
- ◆ In the UK
 - The London Institute of Tropical Hygiene and Medicine
 - The Liverpool Institute of Tropical Hygiene and Medicine
 - Durham University
 - Oxford University
 - MORE
- ◆ In France:
 - Ordstom
 - a
 - MORE
- ◆ In Switzerland:
 - Swiss Tropical Institute
 - a
 - MORE

There are research institutions in developing countries that are also important and engaged in teaching ... but usually rather inadequately funded. Some of them are:

- ◆ Kenya:
 - University of Nairobi
 - ICIPE
 - KEMRI
 - MORE
- ◆ Uganda:
 - University of Makerere, Kampala
 - a

- MORE

Some of the work being done by these institutions may be outstanding ... but data about performance are lacking. Accountability to the broader public on the use of scarce resources is minimal ... and it is generally accepted that this accountability is a private matter between the funding organization and the implementing organization.

Old Material

The health infrastructure is a critical element of success ... no infrastructure ... no success. The health infrastructure has many components including:

- ◆ Community
- ◆ Organizations
- ◆ Clinics,
- ◆ Hospitals
- ◆ People
- ◆ Medical supplies, drugs
- ◆ Knowledge
- ◆ Support structures
- ◆ etc.

The activities are the process that fits with the infrastructure to provide healthcare. Activities without infrastructure are not effective ... nor is infrastructure without activities effective.

The health sector structure is impossibly complex when all elements are tabulated at a national or international level ... but much simpler when the data are compiled for a community. At the community level the absence of critical infrastructure and capacity for effective activities becomes very apparent, and the impact on health outcomes obvious. In turn, this facilitates effective action.

What Health Goals?

Healthcare is about good health ... the product of a good healthcare system is a healthy population. This is very different from having a big health sector ... though a big health sector might be a prerequisite for having a healthy population. The goal is for the costs of the health sector to be modest and the health of the population is excellent.

There needs to be clarity about the goals of society for health ... and the goals of organizations and individuals working in the health sector ... and the goals of investors associated with the sector ... and the goals of various suppliers in the health sector. Profits and remuneration are necessary ... but it should be that profits and remuneration are reasonableness in the context of the socio-economic environment.

Heading 1

Heading 2

Heading 3

Heading 4

Heading 5

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