



*Empowered lives.
Resilient nations.*



Multisectoral Action Framework for Malaria

ROLL BACK MALARIA PARTNERSHIP/ UNDP

Multisectoral Action Framework for Malaria

Contents

Foreword	4
Process and Acknowledgements	5
Abbreviations and Acronyms.....	7
Executive Summary.....	9
1. Introduction	11
1.1 What is Malaria, and why is it such a Difficult Disease?	12
1.2 Why is Malaria such an Important Disease?	13
1.3 Why is it so Difficult to Muster Adequate and Sustained Responses?	13
1.4 What is the Multisectoral Action Framework?	14
2. Major Determinants of Malaria	15
2.1 Society.....	15
2.2 Environment.....	18
2.3 Population Group.....	21
2.4 Households and Individuals.....	24
2.5 Summarizing: Major Determinants—Sector Matches.....	26
3. Implementable Actions.....	29
4. Governance and Institutional Processes.....	37
4.1 Coordination and Management	37
4.2 Financing.....	42
5. Knowledge Gaps and Research Needs.....	47
6. Immediate Next Steps	49
Annex A: Some examples of interventions on determinants that will impact malaria	51
References.....	57

Foreword

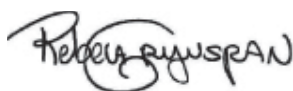
Malaria is an obstacle to both human and economic development. Although it is entirely preventable, malaria continues to cause devastation in families and communities around the world, with 219 million cases and 660,000 deaths reported each year. In Africa, it is estimated to cost more than US\$12 billion annually in lost productivity alone. Malaria impedes progress on nearly all Millennium Development Goals (MDGs) and has multiple negative impacts, with a particularly acute toll on women and children. While 90 per cent of deaths occur in Africa, malaria constitutes a significant public health problem in more than 50 countries in other regions. Around the world, malaria is associated with poor socio-economic development, marginalization and exploitation. These factors have dimensions that extend well beyond the health sector, calling for a multisectoral response.

Bed nets and better medicine are essential for countering malaria, but alone they are not enough. Europe, North America, and more recently countries such as Iran and Sri Lanka, eliminated or are eliminating endemic malaria by acting on broader socio-economic determinants. Such action includes improving living conditions, promoting smarter agricultural practices, and addressing barriers to accessing health services. Advancing gender equality, improving education, and protecting the environment are also important. Malaria has the greatest burden among poor women and children, and studies show that households where women are educated and earn an income are more likely to use bed nets to prevent malaria. Environmental factors can complicate malaria control and elimination. For example, climate change affects the geographical distribution of the malaria parasite, and population movements increase vulnerability where people with low immunity move to high transmission areas.

This *Multisectoral Action Framework for Malaria* makes a clear case for re-structuring the way countries address malaria. It presents a menu of concrete, implementable processes and actions to transform malaria responses—from being a concern of the health sector only, towards a coordinated multi-pronged effort that harnesses expertise across a range of sectors and institutions. It is a guide for policymakers and practitioners and a stimulus for innovation.

Although there has been encouraging progress over the past decade, addressing malaria must continue to have a prominent place in the global development agenda if we are to eliminate this deadly disease, prevent the risk of resurgence, and ultimately help communities to thrive and markets to reach their full potential. We must build on the results and momentum achieved through the MDGs by ensuring due attention to malaria in the post 2015 development agenda. At the same time, recognizing that malaria is a disease inextricably linked with poverty, a complementary emphasis on the social determinants of health and universal health coverage can help increase attention to a comprehensive approach.

We are pleased to present this Framework, which is the result of a collaboration between the Roll Back Malaria Partnership and the United Nations Development Programme, guided by a Steering Committee composed of the United Nations Environment Programme, the United Nations Human Settlements Programme, the United Nations Children's Fund, the World Health Organization and the World Bank – with inputs from governments at the frontline of the malaria response, development banks, the private sector and academia. It is our expectation that this Framework will contribute to realizing the vision of a world free of malaria. The response to malaria demands nothing less than our collective and sustained vigilance..



Rebeca Grynszpan
Under-Secretary-General/Associate Administrator
United Nations Development Programme



Dr Fatoumata Nafo-Traoré
Executive Director
Roll Back Malaria Partnership

Process and Acknowledgements

AUTHOR

Dr Erik Blas (*Public Health Expert, Copenhagen*)

The original idea of developing a Multisectoral Action Framework for Malaria was conceived by Ms Rebeca Grynspan (UNDP Under-Secretary-General and Associate Administrator) and Dr Fatoumata Nafo-Traoré (Executive Director, Roll Back Malaria Partnership) in 2012. The idea was based on the realization of mounting evidence suggesting that sustainable malaria control and elimination would require expanding the strategy to include socio-economic development in addition to the strategies already pursued, and that this would mean expanding the breadth and depth of multisectoral participation.

The process of developing the Framework was overseen by a dedicated steering committee, chaired by Dr Douglas Webb (UNDP, New York) and comprising: Dr Graham Alabaster (UN Habitat, Geneva); Ms Valentina Buj (UNICEF, New York); Dr Silvia Ferazzi (Roll Back Malaria Partnership, Geneva); Dr Rüdiger Krech (Ethics and Social Determinants of Health, WHO, Geneva); Dr Davison Munodawafa (WHO Regional Office for Africa, Brazzaville); Ms Anne Maryse Pierre-Louis (World Bank, Washington DC); Dr David Piper (UNEP, Geneva); Dr Pierre Quiblier (UNDP, Geneva); Dr Kumanan Rasanathan (UNICEF, New York); Ms Deena Patel (UNDP, New York) and Dr Thomas Teuscher (Roll Back Malaria Partnership, Geneva).

The process itself was participatory. First, the general outline was developed with the Steering Committee. Then, an early draft was prepared with a focus on analyzing the social and environmental determinants of malaria and providing open tools for translating the analysis into implementable actions. This early draft was discussed at a consultation held in Geneva on 1–3 July 2013. During the consultation, experience was shared, including through presentation and analysis of specific country cases. Three working groups—‘Concrete action,’ ‘Coordination and management’ and ‘Current and future financing synergies’—dived further into the analysis and evidence to propose amendments to the Framework. The participants further committed to subsequently provide examples, reviews and references. After the consultation and after having received the input from the participants, an updated version of the document was reviewed by all the participants and further input provided. As consensus was building, an updated penultimate draft of the document was then prepared and reviewed by the Steering Committee before the final version of the Framework was completed.

In addition to the Steering Committee members, the participants in the consultation and the subsequent input and review process were: Professor Kwadwo Asenso-Okyere (International Food Policy Research Institute, Accra); Mr Håkan Björkman (Global Fund to Fight AIDS, Tuberculosis and Malaria, UNDP, Geneva); Ms Mavzuna Burkhanova (UNDP, Dushambe); Dr Noel Chisaka (World Bank, Washington DC); Dr Scott Filler (Global Fund to Fight AIDS, Tuberculosis and Malaria, Geneva); Dr Etienne Fondjo (Ministry of Health, Yaounde); Ms Lisa Goldman—van Norstrand (Sumitomo Chemicals, New York); Dr Deyer Gopinath (WHO, Vientiane); Ms Susanna Hausmann (Swiss Agency for Development Cooperation, Bern); Dr Gerhard Hesse (Bayer S.A.S., Lyon); Dr Eleanor Hutchinson (London School of Hygiene and Tropical Medicine, Geneva); Mr Andrew Jack (Financial Times, London); Dr Jean Claude Kazadi (Southern African Development Community, Gaborone); Ms Caroline Kende-Robb (Africa Progress Panel, Geneva); Mr Oscar Mesones Lapouble (Ministry of Health, Brasilia); Mr Paul Libiszowski (Consultant, Ferney-Voltaire); Dr Jo Lines (London School of Hygiene and Tropical Medicine, London); Mr Michael MacDonald (Vector Control and Prevention, WHO, Geneva); Ms Marina Maiero (Environmental Health Issues, WHO, Geneva); Dr Daouda Malle (Islamic Development Bank, Jeddah); Mr Kwehangana Richard Mbabazi (Roll Back Malaria Partnership, Geneva); Dr Abraham Peter Mnzava (Global Malaria Programme, WHO, Geneva); Ms Marianne Monclair (NORAD, Oslo);

Dr Maria Nnette Motus (International Organization for Migration, Geneva); Dr Kaka Mudambo (Roll Back Malaria Partnership, Gaborone); Dr Erasto Mujemula (Prime Minister's Office for Regional Administration and Local Government, Dar es Salaam); Dr Ireen Namakhoma (Director, REACH Trust, Lilongwe); Ms Margot Nauleau (Permanent Mission of France to the United Nations Office and other International Organizations in Geneva, Geneva); Dr Mariane Ngoulla (Office of the President Malaria Elimination Task Force, ECOWAS Commission, Abuja); Dr Abdisalan Mohamed Noor (Kenya Medical Research Institute/Welcome Trust Research, Nairobi); Dr Solomon Nzioka (Climate and Health Adaptation, WHO, Nairobi); Colonel Colin Ohrt (Walter Reed Army Institute of Research, Silver Spring); Dr Peter Olumese (Global Malaria Programme, WHO, Geneva); Professor Mercedes Pascual (University of Michigan and Howard Hughes Medical Institute, Ann Arbor); Dr Ahmad Raeisi (Ministry of Health and Medical Education, Tehran); Mr Mansour Ranjbar (UNDP, Tehran); Ms Melanie Renshaw (African Leaders Malaria Alliance, Nairobi); Mr Alex Ross (WHO Centre for Health Development, Kobe); Dr Wichai Satimai (Ministry of Health, Bangkok); Ms Tilly Sellers (UNDP, Johannesburg); Atif Khurshid (UNDP, New York); Ms Erin Shutes (Global Malaria Programme, WHO, Geneva); Mr Anand Sivankara-Kurup (Ethics and Social Determinants of Health, WHO, Geneva); Mr Michel Smitall (Roll Back Malaria Partnership, Geneva); Dr Johannes Sommerfeld (Special Programme for Research and Training in Tropical Diseases—TDR, Geneva); Andrew Jack (Financial Time); Dr Ally J Mohammed Sunday (Ministry of Health, Dar es Salaam); Mr Dudley Tarlton (UNDP, Geneva); Dr Awash Teklehaimanot (Columbia University, Earth Institute, New York); Mr Mikkel Vestergaard Frandsen (Vestergaard Frandsen, Lausanne); Dr Eugenio Villar (Ethics and Social Determinants of Health, WHO, Geneva); Ms Marilena Viviani (UNICEF, Geneva); Professor Carol Vlassoff (University of Ottawa, Ottawa); Ms Carina Weber (Pestizid Aktions-Netzwerk e.V., (PAN Germany), Hamburg); Professor Carol Yuksel (Dumlupinar University, Kütahya); and Dr Feng Zhao (African Development Bank, Tunis).

The funding for the work, including the Consultation was made available by UNDP and the Roll Back Malaria Partnership.

Copyright @ UNDP and RBM 2013

United Nations Development Programme
HIV, Health and Development Group
Bureau for Development Policy
304 East 45 Street, NY, NY, 10017
New York, NY 10017, USA

Roll Back Malaria Partnership (RBM)
20, Avenue Appia
CH-1211 Geneva 27, Switzerland

Cover Photo
Benjamin Schilling | PSI

Design and Layout
Judit Kovács | Createch

Disclaimer

The views expressed in this publication are those of the authors and do not necessarily represent those of the United Nations Development Programme (UNDP) and Roll Back Malaria Partnership (RBM)

Abbreviations and Acronyms

ACT	Artemisinin-combination therapy
AfDB	African Development Bank
AIDS	Acquired immunodeficiency syndrome
ALMA	African Leaders Malaria Alliance
API	Annual parasite index
DDT	Dichloro-diphenyl-trichloroethane
DHS	Demographic and health survey
ECOWAS	<i>Economic Community of West African States</i>
ESA	East and Southern Africa
GDP	Gross domestic product
GMAP	Global Malaria Action Plan
GMAP2	Global Malaria Action Plan beyond 2015
GMS	Greater Mekong subregion
GNI	Gross national income
GPARC	Global Plan for Artemisinin Resistance and Containment
HDI	Human Development Index
HIV	Human immunodeficiency virus
IDPs	Internally displaced persons
IEC	Information, education and communication
ILO	International Labour Organization
IOM	International Organization for Migration
IPTp	Intermittent preventive treatment in pregnancy
IRS	Indoor residual spray
ITN	Insecticide-treated mosquito net
IVM	Integrated vector management
LLIH	Long-lasting insecticidal hammocks
LLIN	Long-lasting insecticidal nets
LSM	Larval source management
MDAST	Malaria Decision Analysis Support Tool
MDG	Millennium Development Goal
MMAP	Multisectoral Malaria Action Plan
MoH	Ministry of Health

MVP	Millennium Villages Project
NGO	Non-governmental organization
NMCP	National Malaria Control Programme
ODA	Official development assistance
PPHC	Priority Public Health Conditions Knowledge Network
RBM	Roll Back Malaria Partnership
RDT	Rapid diagnostic test
SES	Socio-economic status
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
WHA	World Health Assembly
WCA	West and Central Africa
WHO	World Health Organization
WMO	World Meteorological Organization

Executive Summary

Malaria is both a result and a cause of a lack of development. The malaria burden is highest in the countries with the lowest human development, within countries in the least developed and poorest areas, and within populations among the most disadvantaged. The Multisectoral Action Framework for Malaria adds this development dimension, by making actions outside the health sector essential components of malaria control. The Framework unites all efforts and builds on positive experiences, past and present.

The Framework calls for action at several levels and in multiple sectors, globally and across inter- and intra-national boundaries, and by different organizations. It emphasizes complementarity, effectiveness and sustainability, and capitalizes on the potential synergies to accelerate both socio-economic development and malaria control. It involves new interventions as well as putting new life into those that already exist, and coordinates and manages these in new and innovative ways. The Framework is a stimulant for inspiration and guidance-for-action for policy and executive decision makers as well as for practitioners in all sectors. It acknowledges that malaria takes different shapes in different contexts and that no single blueprint for action would fit in all circumstances. The Framework encourages innovation, trying and learning.

The Framework analyses the social and environmental determinants of malaria at four levels: society, environment, population group, and household and individual. The conclusion of the analysis is that the current strategies for malaria control need to be continued, but that they alone are unlikely to lead to sustained control and elimination in the countries with the highest malaria burden. They need to be complemented with a developmental approach, addressing key social and environmental determinants. The Framework proposes what these determinants are and which sectors should be involved. It provides examples of implementation in countries, as well as a simple tool for action planning.

There is a rich experience of individual interventions that have been tried over the years by countries and organizations. The Framework provides a list of examples with links to where more information can be found. For such interventions to have lasting effect, however, they need to be scaled up and implemented in a concerted manner. This requires the involvement of multiple actors. The challenge is that these actors often have different value-bases, success criteria, constraints to participation, and management cultures, often making collaboration difficult. The Framework proposes a number of tools and mechanisms that could overcome such problems.

The financing of multisectoral action for malaria involves three streams—i.e. financing for:

- conventional malaria interventions, such as long-lasting insecticidal hammocks, indoor residual spray and diagnostics/treatment;
- core functions of other sectoral actors that will impact on malaria by addressing the determinants of malaria within the purview of these sectors; and
- malaria intervention costs incurred directly by the household and the individual, including the costs of the conventional interventions as well as those related to, for example, improving housing and adopting other malaria-smart practices in the household.

A multisectoral approach to malaria control means that a wide range of stakeholders is engaged and the aims of malaria control are met by joint efforts. Resourcing such efforts is not simply a matter of securing cash

donations; major advances can be made at little or no cost to health or malaria programmes. For example, better housing is a social objective, not simply a malaria control action. For the private sector, eventual additional costs should be seen as an integral part of doing business in malaria transmission areas and areas with risk of resurgence. The return to investment may be realized even in the short term.

The document ends by listing immediate next steps. These include four key processes that need to embrace the Multisectoral Action Framework for Malaria over the coming year: the defining of the Sustainable Development Goals, the development of the next Global Malaria Action Plan, the work of the UN Platform on Social Determinants of Health, and the Third Inter-ministerial Conference on the Libreville Declaration on Health and Environment in Africa.

Finally, the Framework encourages a 'Try it, test it' approach in pathfinder countries without waiting further. There is all to win and nothing to lose.

1. Introduction

The malaria burden is highest in countries with the lowest human development, within countries in the least developed and poorest areas, and within populations among the most disadvantaged. Malaria is both a result and a cause of a lack of development.

Since 2000, spectacular progress has been made in malaria control. Globally, malaria mortality rates have declined by 25 percent and in the World Health Organization (WHO) African Region by 33 percent. Over the past decade more than 1 million lives have been saved. Fifty of the 99 countries with ongoing malaria transmission are now on track to meet the World Health Assembly (WHA) and Roll Back Malaria Partnership (RBM) targets to reduce malaria case incidence by 75 percent by 2015. However, these countries account for only 3 percent of the malaria burden worldwide. The remaining countries, although progressing, have not yet made the sustainable breakthrough [1]. There could be a number of explanations for this.

First, the resource flow required to reach the critical accelerated push, as estimated in the Global Malaria Action Plan (GMAP) 2008–2015 [2] did not fully materialize, and may now have peaked. Second, resistance to insecticides and antimalarial drugs, including the new artemisinin-combination therapy (ACT) drugs, has developed and is spreading. Third, malaria is closely linked to socio-economic development and inequity. The evidence is unequivocal: low socio-economic status (SES) roughly doubles the likelihood of clinical malaria or parasitaemia in children compared with children of higher status within the same locality. The probability of dying from malaria in sub-Saharan countries is inversely related to the Human Development Index (HDI) for income and education [3]. This means that in the absence of socio-economic development, failure to maintain the insecticide and drug pressure against the vector and the parasite will lead to the goals not being met and the disease resurging with dire consequences. This has already happened a number of times in the past and could be about to happen again in several countries [4].

Malaria was eliminated in many high-income countries in Europe and North America without malaria-specific interventions but as a by-product of socio-economic development. The continued prevalence of the malaria vector, albeit at low levels, without continued malaria transmission in many of these countries, shows the robustness of the achievement [5]. The 50 countries that have successfully eliminated malaria since 1948 show striking similarities to the present 'malaria-eliminating' countries. For example, the average gross domestic product (GDP) per capita¹ of the present malaria-eliminating countries is similar to the GDP per capita of the 50 countries when they eliminated malaria. Only 20 percent of the 50 countries had less than 0.5 physicians per 1000 population when they eliminated malaria. Of the present eliminating countries, this is the case for 21 percent [6].

The Multisectoral Action Framework for Malaria aims to add a development dimension to malaria control to support lasting progress and should thus be viewed as working hand in hand with and complementing existing malaria control strategies. In short, it would mean making broader development efforts work for malaria control, and malaria control work for development. The opportunities for adding this dimension are

1. Purchasing-power parity in US\$ (2005).

present through the definition of the Sustainable Development Goals (post-2015 agenda) [7], preparation of the Global Malaria Action Plan beyond 2015 (GMAP2), the background of the Rio Political Declaration on Social Determinants of Health [8] and the work of the Global Fund to Fight AIDS, Tuberculosis and Malaria.

1.1 What is Malaria, and why is it such a Difficult Disease?

Malaria is a collective name for the diseases produced by infection with any of the five *Plasmodium* parasites that can infect humans (*P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale* and *P. knowlesi*) and can be transmitted by the bite of an infectious mosquito. To date, only the *Anopheles* genus of mosquitoes has been found to transmit the parasite that infects humans, with about 60 species transmitting with varying degrees of efficiency [5]. The different vector and plasmodium species' distribution result in malaria occurring in a wide range of ecological situations, and underlies the great variability and overall resilience of the transmission chain to social or ecological change and to malaria control efforts. Malaria transmission should be seen within a social and physical environment and as a triumvirate: mosquitoes as the vector, the parasite as the aetiological agent, and humans as both the target and reservoir to continue the cycle of infections. All three parts of this triangle should be addressed to effectively control and eventually eliminate malaria as a public health problem [3;9].

The most common symptom of malaria is a severe intermittent fever. Other symptoms which may arise in conjunction or separately include: headache, lassitude, fatigue, diarrhoea, muscle and joint aches, chills, perspiration, anorexia, vomiting and worsening malaise. The non-specificity of symptoms (especially the early signs, which resemble many other causes of illness, especially viral illnesses) often leads to malaria being over-diagnosed on the basis of symptoms alone, especially in endemic areas. Failure to adequately diagnose and treat malaria, especially in the case of infection with *P. falciparum*, may lead to severe complications and death. Frequent repeated infections, common in highly endemic settings can, however, bring about immunity to being inoculated with the parasite. Prolonged disease, malnutrition, especially severe anaemia and other effects associated with being infected with the plasmodium parasite not only increase the direct risk of death but also leave the person at higher risk of morbidity and mortality from other diseases such as HIV and AIDS.

In very highly endemic areas—especially in sub-Saharan Africa and South-East Asia—children who survive beyond the age of five years will have developed a certain level of immunity. This immunity, however, can be lost as exposure decreases (e.g. when migrating to urban areas), and it is not fully protective. Everyone, therefore, remains at risk if they are not being protected (e.g. using a long-lasting insecticidal net (LLIN) or indoor residual spray (IRS), or getting rapid diagnosis and treatment after first onset of symptoms). Where there are still high levels of immunity and subclinical infection, epidemics are less likely. When transmission rates have been reduced for some time, however, the community will have lost its immunity, and increased transmission can reoccur. Reintroduction of transmission may in such cases lead to lethal epidemics if not properly addressed and controlled.

Multipleresistancetoallfourclassesofinsecticidesusedinpublichealth,includingDDTandpyrethroids, is a major concern in vector control initiatives in Asia and Africa, posing a threat to the effectiveness of IRS and insecticide-treated mosquito net (ITN)² interventions [10]. The parasite has been known to evolve resistance to antimalarial drugs extremely quickly, and artemisinin resistance has already been detected in the Greater Mekong subregion (GMS), the traditional epicentre of antimalarial resistance [6;11;11]. This poses a severe risk to further progress and maintenance of parasite control and to public health. While some progress is being made, an effective

2. The terms 'insecticide-treated mosquito net' (ITN) and 'long-lasting insecticidal nets' (LLIN) are both used, with the former used as a generic term.

antimalarial vaccine is not operationally viable, and the Global Fund stresses the need to attack from more than one angle. To move forward, work has to take place on several fronts. “There is no magic bullet against malaria.”³

1.2 Why is Malaria such an Important Disease?

Fully 3.3 billion people were at risk of malaria in 2011, and there were an estimated 219 million cases (range 154 million to 289 million) and 660,000 deaths (range 610,000 to 971,000) in 2010 [1]. Because of these numbers, malaria is frequently considered an obstacle to economic development. In Africa alone, malaria-related illnesses and mortality were estimated by the Commission on Macroeconomics and Health to cost the economy US\$12 billion per year and reduce economic growth by 1 percent per year in high-prevalence countries [12]. Business leaders are concerned about malaria, and their concerns affect their investment decisions [13].

The image is that of a vicious cycle of disease–low productivity–poverty–disease. The experience from countries that have considerably reduced malaria transmission shows that the relationship between malaria and socio-economic development is complex and varies by context. There is evidence of both ‘lack-of-development-blocks-malaria-control’ and ‘malaria-blocks-development’ [5]. This makes it extremely difficult to make a comprehensive economic analysis of malaria. For example, a part-analysis of marginal costs and cost-savings suggests that the costs of the current elimination strategies will be substantially higher than the cost of control [14]. However, if the full social and economic benefits could be taken into account together with the amplification effect coming from social development, then the cost–benefit ratio for both control and elimination would no doubt increase. Also, most cost–benefit studies on social determinant interventions fail to capture the effects on malaria and will thus understate the return on investment [15]. Further, there are indications suggesting that once elimination begins to take hold, lower transmission combined with strong health systems and socio-economic factors are mutually reinforcing, so potentially lowering the costs of sustaining elimination [16]. Finally, most development interventions are not primarily targeted at malaria. The health benefits they produce are thus additions to their core focus, and the costs do not fall within the health sector [3].

1.3 Why is it so Difficult to Muster Adequate and Sustained Responses?

In the past nearly 100 years, there have been several attempts internationally to address malaria, including the Malaria Commission of the League of Nations in the 1920s, the global eradication campaigns of the 1950s and 1960s, the Ministerial Conference on Malaria in 1992 and the creation of the RBM movement and the Global Fund at the turn of the millennium. There have been many high-level resolutions and political commitments made, and considerable amounts of money have been invested in malaria control. While it has long been recognized that malaria is a disease of poverty, hopes and programme targets have continued to be linked mainly to applying technologies to fight either the vector or the parasite and less to addressing the third part of the triumvirate: the humans. Malaria can and has indeed responded to energetic local and global campaigns. It has often re-appeared, however, with added virulence once the campaign measures have been relaxed—bringing disillusion and discouragement [5]. This, together with progress not occurring as rapidly as expected, has repeatedly led to donor fatigue and difficulties sustaining adequate resource flows and thereby programmatic efforts at scale.

3. The Global Fund, *New Advances against Old Disease*, ‘Global Fund News Flash’: Issue 24, 27 August 2013, Global Fund, Geneva, <http://www.theglobalfund.org/en/blog/33545/>.

The implementation of GMAP [2] might indeed be facing such challenges. It aims at “*reducing global malaria death to near zero by 2015,*” to “*reduce global malaria cases by 75 percent by end of 2015 (from 2000 levels)*” and to “*eliminate malaria by the end of 2015 in 10 new countries (since 2008) and in the WHO Europe Region*” [17]. The rapid improvements in programme performance up to 2010 appear to have levelled off in parallel with the funding. This means that “*millions of people continue to lack access to preventive therapies, diagnostic testing and quality-assured treatment*” [1].

1.4 What is the Multisectoral Action Framework?

Adding a development dimension to the attack—i.e. making development programmes an essential component of malaria control—is an attempt to unite all efforts and build on positive experiences from both the past and the present. It will require action at several levels and in multiple sectors, globally and across inter- and intra-national boundaries, and by different organizations. The approach will emphasize complementarity, effectiveness and sustainability and will capitalize on the potential synergies to accelerate both socio-economic development and malaria control. This will involve new interventions as well as putting new life into existing interventions and coordinating and managing these in new and innovative ways.

The Multisectoral Action Framework for Malaria is a stimulant to inspiration and guidance-for-action for policy and executive decision makers as well as for practitioners in all sectors, including public and private. The Framework proposes priority determinants to be addressed by different sectors. It will, however, also acknowledge that malaria is not one disease but takes different shapes in different contexts. Therefore, it cannot provide definitive answers to all possible questions nor a single blueprint for action that would fit in all circumstances. The Framework will encourage innovation, trying and learning, and suggest development of tools and processes for appraising, coordinating, monitoring and priority implementation.

2. Major Determinants of Malaria

The analysis takes guidance from the analytical framework of the Priority Public Health Conditions Knowledge Network (PPHC) of the WHO Commission on Social Determinants of Health [18] and has four levels of analysis: 'society,' 'environment,' 'population group,' and 'households and individuals'.

The four levels could be seen as a hierarchy of determinants, with 'society' the most upstream, and 'households and individuals' the most downstream. The higher up interventions are applied, the more profound the downstream impact will be, likely reaching beyond malaria. The aim is for each of the four levels to propose four to five important determinants of malaria and, for each of these, suggest appropriate actions.

2.1 Society

How societies are developed and organized and how individuals are positioned within them exerts a powerful influence on the type, magnitude and distribution of health in societies. Factors determining position include class, gender, ethnicity, education, occupation and income. The relative importance of these factors is determined by the national and international contexts, which includes governance, social policies, macroeconomic policies, public policies, culture and societal values [19].

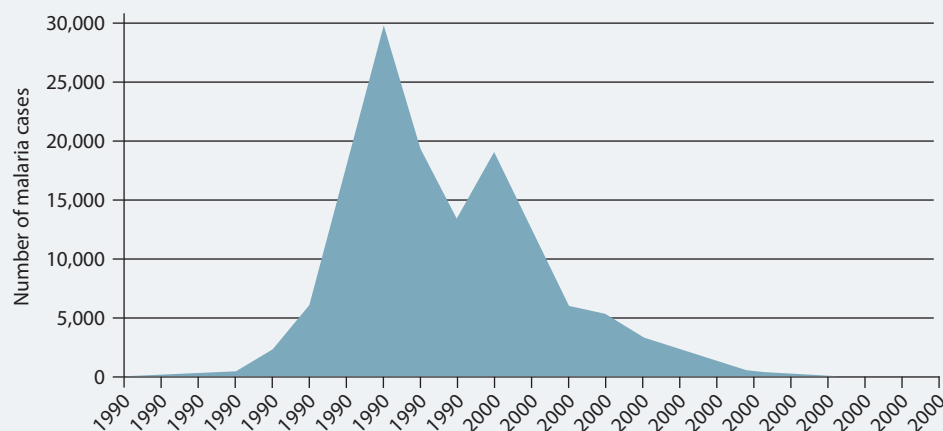
There is a direct correlation between the probability of dying from malaria and a country's socio-economic development status [3]. The ability of countries to eliminate malaria or enter into the elimination phase is closely linked to the degree of development of their economic and health systems. Between 2000 and 2010, the number of malaria cases of the 34 malaria-eliminating countries decreased by 85 percent. These achievements have been driven by several factors, including more effective vector control and treatment, and the fact that during those 10 years the GDP per capita in these countries increased by an average of 3.5 percent per annum [11].

Endemic malaria disappeared from most of Northern Europe and North America as processes of general social and economic development, including better and less crowded housing, closed windows, improved land drainage and a reduced tendency for people to live close to their livestock. Malaria did not disappear as a result of direct vector or chemoprophylactic control [5]. A study in Finland evaluated the long-term (1750–2008) significance of different factors assumed to affect malaria trends (malaria frequency per million people, temperature, animal husbandry, consolidation of land by redistribution and household size). The study showed that long-term social changes, such as land consolidation and decreasing household size, had the strongest correlation with the decline and eventual eradication of malaria in the country [20].

The period immediately following the First World War saw malaria epidemics spreading across Europe. These epidemics, however, subsided or responded easily to control interventions, suggesting that it was strong health systems (i.e. for delivery of medications) and the improvement in overall socio-economic conditions, rather than changing the vector ecology, that were responsible for alleviating the problem of malaria [5]. Transient resurgence of malaria linked to war, population movements and associated disruptions have been seen in several places, including Spain, Italy, Tajikistan, Azerbaijan and Armenia, with a quick return to the previous situation once the societies recover [4] (see Box 1).

BOX 1: Tajikistan

Following many years of absence during the Soviet period, malaria returned in connection with the civil war that broke out in 1992 after the independence of Tajikistan in 1991. From less than 200 recorded cases per year, the number peaked at almost 30,000 in 1997 when the civil war ended. During the war, 1.2 million people, or 16 percent of the total population, were internally or externally displaced, and infrastructures and services broke down.



After political stability returned, malaria responded quickly to control efforts, and in 2012 only 33 cases were recorded. Of these, 18 were indigenous and the rest imported.

The small peak in 2000 is explained as a more complete detection and recording of malaria cases following the expansion and reach of the diagnostic capacities in 1998–1999.

Source: Tajikistan Ministry of Health/UNDP

Globalization, liberalization and deregulation have both provided opportunities and posed challenges for human development. On the one hand, it has over the past more than a decade led to better aid coordination and alignment, debt relief for the most indebted countries, global development initiatives and setting of global targets, such as the Millennium Development Goals (MDGs). New global trade agreements and production patterns have contributed to economic growth, increased migration and urbanization, and at the same time deepened inequities and lowered public revenues in many low-income countries. The latter is due to tariff reductions, free movement of capital and tax transfers, combined with the tax systems in many low-income countries having insufficient strength to exercise control and tax collection. Further, market-oriented health-sector reforms in many low-income countries have led to deepening inequities in access to health services. Finally, the liberalization of financial markets has contributed to economic instability [21]

Malaria control is influenced by all the processes, and the continued aftermath of the global financial crisis of 2008 might severely impact malaria control most of all. Of the global resources available for malaria control, estimated to be about US\$2.3 billion in 2011, constituting less than half of the estimated requirement, only US\$625 million (27 percent) were from domestic sources. While these domestic resources have increased slightly in all regions (except Europe), international resources are levelling off and risk going into decline as some of the major contributors cut back on their development assistance or change priorities.

The potential implications are illustrated by trends in the procurement and replacement needs for ITN/LLINs. In 2010, 145 million nets were procured, 92 million in 2011, and by 2012 the figure had dropped to only 66 million. With an expected lifespan of LLINs of 18–36 months, the replacement needs in 2013 might exceed the total procurement of 2010. This means that unless there is a considerable increase in resources from domestic and international resources combined, the LLIN coverage is projected to go down in 2013 [1;22].

The current rates of carbon emissions will, if not effectively mitigated, lead to a much warmer world and more extreme weather. Due to these climate changes, malaria might occur in places where it has not been present previously and where there is no natural immunity. Further, climate change would affect other social, economic and environmental determinants, such as poverty distribution, agricultural practices and viability, and nutrition, which have direct bearings on malaria. A recent World Bank report indicates that by 2050, climate change alone might expose some areas in South America, sub-Saharan Africa and China to a 50 percent higher probability of malaria transmission [23].

Large-scale population movements, triggered by a number of both disaster and incremental socio-economic changes, would inevitably contribute to changes in the malaria map. A particular challenge occurs at the border between countries on track for elimination and countries in the control phase, such as in southern Africa where the Elimination 8 (E8) collaboration has been set up between the four eliminating countries (first-line) and four second-line countries to strengthen cross-border malaria control. It is not only for neighbouring countries, however, that malaria-related health insecurity is a challenge. While China, for example, has successfully eliminated *P. falciparum* from large parts of the country, it is experiencing increasing rates of *P. falciparum* malaria imported by Chinese nationals returning from endemic countries [11]. It is estimated that currently more than 1 million Chinese are residing in sub-Saharan Africa, and the number is increasing.⁴ Migrants often reside and work at development frontiers with high malaria transmission and regularly travel back and forth between high- and low-transmission areas.

Sub-Saharan Africa, due to clustering of adverse socio-economic and environmental determinants, bears the greatest burden of malaria worldwide. The continent is undergoing profound demographic changes, with fast-growing populations, combined with poor access to health care; high levels of malaria and malnutrition, such as those found in Niger [24], are the result. The East African highlands are among the most densely populated regions in Africa, and have the world's highest population growth rates and highest rates of poverty. As there are few employment opportunities other than agriculture, the unprecedented pressure on the land has led to more intensive use, along with the associated transformation of forests and swamps into farm and grassland. The area harvested for food crops has increased by more than 100 percent since the 1990s. These changes have led to rising temperatures and optimized the survival of mosquitoes and transmission of parasites. While malaria has actually decreased since the mid-2000s, this has been due to intensified interventions (ITNs, IRS and treatment), which will need to be sustained with elevated levels of funding [25].

4. 'Africa and China: More than minerals,' *The Economist*, 23 March 2013.

A considerable difference exists between West and Central Africa (WCA) and East and Southern Africa (ESA) in the overall percentage of patients who seek care in the modern sector. In WCA, 43 percent of fever cases result in visits to the modern health sector, while the figure is higher at 63 percent in ESA, which also has lower levels of inequity in access to health care. Similarly, there are higher inequities in antenatal care visits in WCA than in ESA, according to data from Demographic and Health Surveys (DHS) [26]. This suggests that the ways societies and services are organized matter for how people seek care, and are fundamental to different approaches to malaria control.

Low SES is associated with about double the risk of clinical malaria or parasitaemia compared to higher status. Poorer households are not just more susceptible to disease but are also more vulnerable to the costs of disease, which might worsen the impoverishment [3]. With equal exposure, women and men are equally vulnerable to infections, except for pregnant women, who are at greater risk of severe malaria in most endemic areas. Depending on culture and societal contexts, however, women and men may have differential exposure and differential access to means of protection and treatment.⁵ Further, being in an ethnic or political minority position typically means being marginalized, socially excluded, impoverished and driven to more remote areas and risky occupations, while having less access to malaria prevention and treatment [11]. This often creates mistrust in public services and influences norms and attitudes and, as a consequence, frequently leads to higher rates of infection [26]. For example, in Panama, 85 percent of the malaria cases occur in the indigenous population, who constitute only 10 percent of the country's population.⁶

2.2 Environment

There is increasing evidence that people in disadvantaged positions are subject to differential exposure to a number of risk factors, including natural and anthropogenic crises, unhealthy housing, working and other environment conditions, thus potentially amplifying the negative effect of their socio-economic position [18].

Malaria vector control has heavily relied on the killing of adult mosquitoes with chemical insecticides and protecting humans from being bitten with either ITNs or IRS. These technologies, however, use a limited arsenal of insecticides originally developed for agriculture, and their efficacy is threatened by the spread of insecticide resistance. Resistance to all four classes of insecticides available for IRS is now documented in Africa. In 2010, 27 countries in sub-Saharan Africa reported mosquitoes resistant to pyrethroids [27]. As pyrethroids are the only class of insecticides approved for use on ITNs [28], this is a cause for some concern. Now, with the key environmental tool possibly losing its potency, it is time to accelerate efforts to use and manage the environment in ways that reduce, rather than produce, malaria. An important step in this direction is the 2012 five-element Integrated Vector Management Strategy,⁷ which takes a comprehensive view on vector control [29].

With climate change, the geographical distribution of mosquito-borne diseases seems to be expanding globally, and especially in the African region [23;30]. This means that entire new populations, health care

5. WHO, 'Gender, Health and Malaria,' *Gender and Health*, June 2007, WHO, Geneva, 2007, http://www.who.int/gender/documents/gender_health_malaria.pdf.

6. PanamaAmerica.com.pa, 'Más del 85% de los casos de malaria en Panamá se registran en poblaciones indígenas,' <http://www.panamaamerica.com.pa/notas/1571220-mas-del-85-los-casos-malaria-panama-se-registran-poblaciones-indigenas>.

7. The five elements are: advocacy, social mobilization and legislation; collaboration within the health sector and with other sectors; integrated approach; evidence-based decision-making; and capacity-building.

and socio-economic systems are being exposed. Malaria is governed by a number of environmental factors affecting its distribution, seasonality and transmission intensity, including:

- abundance of surface water, its chemical composition, pollution and vegetation, which determines the proliferation and density of the vector;
- the atmospheric humidity and temperature, determining the longevity of the vector and the ability of the parasites to develop; and
- the preference for human or animal blood, the form of human aggregation and the type of shelter, which determine the contact between the vector and humans [5].

Malaria transmission is generally higher in rural than urban Africa, and there are close links between malaria and agriculture, including intense farming, terracing, irrigation and drainage. Good agricultural practices may reduce vector presence, and improved farming productivity may contribute to increased incomes, improved nutrition and social development and thus reduced vulnerability of the people living in the area. However, the growing of certain crops and use of certain production systems, such as for the cultivation of rice, bananas, fruits and vegetables, can be associated with increased malaria due to irrigation micro water pools [31]. Maize can be directly associated with malaria incidence, as mosquito larvae feed from pollen that falls into larval habitats, in particular having an impact if the mosquito breeding season coincides with when the maize releases its pollen [32].

Urbanization, with its profound changes in the socio-economic and physical landscapes, has contributed to reduced malaria transmission in many malaria-endemic countries, and the indication is that this trend could continue, particularly if supported by increased levels of direct malaria control [33]. Yet malaria still exists in African cities and in some cases at even higher levels in peri-urban than in the nearby rural areas [34]. Movement between rural and urban areas greatly affects transmission. When people move to the city, they may bring the parasite with them in their bloodstream, and a presence of the anopheline vector will spread infection within the household and community, especially if people do not use an ITN or their houses are not protected with IRS.

Generally, parasite infection rates increase from urban centres to rural settings. This can be reversed, however, where slums are concentrated in the urban centres. Urban malaria is highly focused. Adaptation of mosquito species to the urban environment—for example, to heavily polluted breeding sites and more modest water volume requirements—has been reported [34;35]. The majority of urban and peri-urban breeding sites are artificial: urban agriculture, drains and gutters, ditches, tyre tracks, leaking water pipes, domestic containers, water tanks and reservoirs, construction sites, swimming pools, canals, foundations, septic tanks, tyres, bathtubs and dams. Further, certain commercial activities, such as washing cars or making bricks, may create breeding sites. Urban agriculture is now a regular feature in African towns and cities. While it often contributes to social development, it could increase vector breeding sites and thus outweigh the social benefits [34].

Poor quality of housing, with a greater exposure to the outdoors because of the lack of window screens, absence of ceiling boards, and presence of thatched roofs, increases the contact between the individual and the vector. Housing with greater exposure is more common among those with lower SES than with higher [26;34;36] (see Box 2: Lao PDR).

BOX 2: LAO PDR

Lao PDR experienced a rapid increase in its HDI from 0.379 in 1990 to 0.534 in 2010, with a slowdown thereafter, but reaching 0.543 in 2012. In the past decade the annual economic growth has averaged 7 percent. This, combined with malaria control efforts that included ITN distribution, early diagnosis and treatment, and malaria education through village health workers, caused the incidence to fall from 9.1 cases per 1000 population in 2002 to 3.5 in 2010. The country was thus set to reach the 2.0 cases/1000 population target by 2015.

Progress is now threatened, however, by a series of malaria outbreaks since December 2011 in the five southern provinces, associated with large-scale private mining, hydropower and intensive agricultural projects. These projects encroach on forest habitats and employ migrant workers from neighbouring countries with considerable drug resistance. Although, at present, there are no reliable estimates of the extent of the problem, it is clear that there is a change in vector ecology, and an increased use of self-medication, substandard antimalarials and monotherapies. For the local population, the projects frequently mean moving from highland to lowland areas, the loss of traditional occupations, more forest-based activities or engagement with the development projects themselves.

Some projects, however, have also brought malaria benefits. For example, in connection with the construction of the Nam Theun 2 hydroelectric project, one of the largest recent development projects in South-East Asia, a 450km² reservoir dam was created, and 6300 people in 1310 households were resettled into 16 villages along the southern shore of the reservoir. They were provided with new wooden houses with corrugated iron sheet roofs, constructed to a considerably higher standard than the traditional houses in the area. Traditional houses are usually constructed from bamboo thatch with roofs made from thatch, wooden tiles or corrugated iron sheets. A study conducted in 2010 found that the risk of mosquito entry into the house was more than twice as high in the traditional than the newly constructed resettlement houses [36].

Source: MoH/WHO, Hiscox et al. [36]

Change of land use may influence malaria transmission in a multitude of ways. It may reduce malaria breeding sites through, for example, deforestation and urbanization or create new ones through mining and desert irrigation. It may open access to and expose ecosystems that are conducive to malaria transmission, through road construction and concessions for timber logging. Sometimes, the malaria impact is part of the primary business processes. At other times, it is a side effect caused by negligence or poor or inadequate environmental management. Finally, some changes might lead to land degradation and eventual abandonment, where nobody is responsible or accountable. Poor populations are not only subject to these general effects but, being more dependent on their immediate environment, are often caught up in inefficient or destructive production systems, at the same time being both agents and victims of unfavourable land-use dynamics.

Large-scale economic development projects, involving international lenders, often require health⁸ and environmental⁹ impact assessments to be conducted. While the impacts of such assessments are inconsistent [37], especially where large institutional lenders are not involved, or national and local governments are unable to enforce adherence to established rules and regulations, they remain vital, as economic development projects provide both challenges and opportunities for malaria (see Box 2: Lao PDR).

Sawyer and Sawyer (1992, cited in [35]) describe three phases of breaking new land and forming settlements and their connection to malaria, using the case of the Brazilian rainforest. The first phase (epidemic about three years) entails a rapid and dramatic increase in the annual malaria parasite index (API). The amount of cleared land is still low, the quality of housing poor, man-made transformations cause the proliferation of mosquito breeding sites, and settlers do not have the knowledge to protect themselves. The second phase (about five years) is characterized by a significant decrease in API. The area of cleared land increases, and profit from agricultural production allows improvements of housing and personal care, and knowledge about malaria increases. The third phase (endemic) begins about eight years after the start of the settlement project and has a further reduced API. Settlers are well established in their plots, producing a variety of crops, living in better houses and able to protect themselves against malaria. Local infrastructures will also have improved, along with better organization of health care and community groups. Furthermore, with development, the mosquito breeding sites often become polluted, contributing to a decreased risk of malaria [35]. Similar phases to those described here may also apply to other land-use changes and development projects that initially increase transmission but eventually may lead to elimination or even eradication of malaria as social conditions improve to reach a certain threshold. The length of the individual phases may vary depending on the nature of the change and the effort and sustainability of vector and parasite, as well as other social and environmental, interventions.

2.3 Population Group

A clustering of risk factors in some population groups, such as social exclusion, low income, low education, malnutrition, cramped housing, poor sanitation and limited access to health services, increases their vulnerability and may be as important as the exposure itself. Coexistence with other health problems that share determinants may further exacerbate vulnerability [18].

The evidence in regard to vulnerability to malaria and its consequences by population groups with lower SES is consistent. Children with low SES have double the risk of clinical malaria than those with higher SES within the same locality [3]. Higher SES has been found to be significantly positively associated with ITN use, intermittent preventive treatment in pregnancy (IPTp) and ACT coverage and use [38]. Knowledge of malaria is positively associated with level of education and higher among those who are skilled or professional than among the unemployed or unskilled. Household income, men's level of education, and whether women have a cash income are strongly correlated with owning nets and the use of malaria prevention methods [26]. To address the inequities in ITN use, Tanzania, in 2008, with massive donor support, launched the so-called 'Catch Up and Keep Up' strategy, combining free distribution with voucher schemes and social marketing. The strategy cost 20 times more than social marketing alone, equal to 15 percent of the government's health budget. The lesson learned is that free net distribution and rural promotion campaigns can correct inequities but are dependent on unprecedented high donor inputs [39].

8. WHO, 'Health Impact Assessment', <http://www.who.int/hia/en/>.

9. UNEP, 'Environmental Impact Assessment Training Resource Manual', Second Edition, http://www.unep.ch/etu/publications/EIAMan_2edition.htm.

Crowded and flimsy shelters highly favour the transmission of malaria and other vector-borne diseases, resulting in serious epidemics [5]. Malaria risks are significantly higher among children who live near hydrographic networks, in sparsely built-up areas or irregular built areas [40] and peri-urban areas characterized by a low SES [34]. The zone of residence (rural or urban) is an important determinant for use and appropriate use of preventive methods. Expenditures on prevention and treatment increase with proximity to town centres compared to intermediate and outer zones, despite increasing malaria incidence in the outer zones. This mirrors the gradient in income and availability of services [26].

Severe malaria is less common among well-nourished children, possibly because a well-nourished individual is better able to mount an immune response and more capable of withstanding and clearing infection. Over half (57.3 percent) of malaria deaths among children under five have been found attributable to being underweight, 20.1 percent to zinc and 19.5 percent to vitamin A deficiency [41]. This stresses the importance of addressing both food security and nutrition in connection with malaria, while recognizing that they share structural determinants [40]. Pregnancy is also an important risk factor for malaria infection, again due to depressed immune status, and malaria in pregnancy affects more than 25 million women each year. Adverse pregnancy outcomes include maternal anaemia, stillbirth, preterm birth and low birth weight [42].

While children with lower SES may initially have a higher level of immunity to malaria than children in higher SES groups [26], unsustainable campaigns run the risk of replacing an endemic with an epidemic situation, causing more suffering, as the collective immunity of the population will have decreased during the period prior to the interruption of transmission [5]. Addressing the symptoms rather than the root causes of inequities underlying malaria may thus result in both high financial and moral costs.

The 'Human Development Report 2009: Human Mobility and Development' estimated that almost 1 billion people were migrants—i.e. one in seven of the total global population. Of these, 214 million were international and 740 million internal migrants [43]. Migrants, including internally displaced persons (IDPs), refugees, returnees and mobile populations are a heterogeneous group, with millions vulnerable to multiple health risks, poverty, exploitation, stigma, discrimination, social exclusion, language and cultural differences, separation from families and socio-cultural norms, administrative hurdles, and a legal status that frequently restricts access to health and other social services [44].

Population movements play an important and complex role in malaria. When travelling from low- to high-transmission areas and having no acquired immunity, they are much more vulnerable than the permanent residents of the high-transmission locations and those travelling in the opposite direction. This can lead to a sharp increase in morbidity and mortality among the migrants across all age groups, as has been seen in large resettlement programmes in Ethiopia, Indonesia and Brazil (see also Box 3: South Sudan). Those who travel from high- to low-transmission areas often carry infection and contribute to increased transmission at the destination. The higher the number of migrants, the larger is the impact. As regular or circular movements of migrants are more common than unidirectional migration, migrants infected with malaria can serve as a reservoir and seed local outbreaks or epidemics [45]. This, of course, will make it difficult for countries that are linked by human mobility patterns to eliminate malaria independently of each other. It can be shown that there are '*P. falciparum* migration communities' around the world with much more infection-migration between the countries concerned than with the surrounding regions [46]. It can further be shown that there is broad correspondence between these 'communities' and the patterns of resistance to antimalarial drugs [45;47]. Once resistance emerges, it can quickly spread along the migration lines.

BOX 3: The Republic of South Sudan (Returnees)

Since its independence in 2011, the world's newest state has been facing a fragile humanitarian situation and socio-economic strain. An estimated 2.5 million South Sudanese have returned to their homeland, mainly from Sudan. The 2005 Comprehensive Peace Agreement anticipated free and spontaneous returns, but escalating political tensions have closed all but one entry point, leaving thousands of South Sudanese stranded in Upper Nile State.

P. falciparum malaria is endemic in South Sudan, and South Sudanese grow up learning how best to prevent transmission. Conversely, returnees arriving from Khartoum, an area virtually free of malaria, have very little knowledge of malaria transmission, prevention and treatment. This limited awareness, combined with their relatively absent immunity, increases their vulnerability. For returnees, the adoption of malaria-safe practices, such as ensuring children and pregnant women always sleep under ITNs and seeking early treatment, has been minimal. If treatment is delayed, the illness can quickly develop into severe *P. falciparum* malaria, resulting in dangerous complications and potentially death. Continuity of care remains a challenge, especially as returnees reintegrate into communities already struggling with limited health and social services.

The International Organization for Migration's four clinics provide emergency health services to over 19,000 stranded returnees and vulnerable host community members. In 2012, IOM treated 14,781 cases of *P. falciparum* malaria, (confirmed by Paracheck). Over one in five of all morbidities documented during 2012 in Upper Nile State were the result of malaria.

Source: IOM, Mission in South Sudan

Some occupations are more exposed than others, including rice farmers (while they work and sleep), highland migration labourers, forest workers and rubber tappers [26]. As countries progress towards elimination, malaria tends to become increasingly geographically and demographically focused in population groups that share social, occupational, behavioural and geographical characteristics [11]. Exposure to malaria risk because of working practices (for example, working through the night) is higher for a low-status occupational category. Low-paid, industrial or unskilled workers living in common quarters, and unemployed people have higher malaria incidence than those in high-status categories, such as those living in government or company housing with a good facilities. Higher incidence of malaria and lower use of preventive measures are seen among hospital workers and students of lower status than among those of higher status. Low-level workers are far less likely to use methods such as repellents, antimalarials and mosquito mesh in rooms [26]. A study in Mwea division in Kenya showed that while villages with rice irrigation had many times higher prevalence of the local malaria vector than those without irrigation, they had much lower malaria prevalence, giving rise to the so-called 'paddies paradox,' as households with irrigation had higher incomes than those without (cited in [48]).

Large-scale operations, such as those for development projects, natural resource extraction (especially mining), plantation and breaking new settlement frontiers, and the deployment of military personnel, are frequently associated with malaria epidemics. These can severely hamper the whole enterprise. Some of the most well-known examples of bringing workers into malaria risk areas include the construction of the Panama Canal and the establishment of the Malayan plantations. An example where malaria has been brought into previously malaria-free areas by workforces is the establishment of the banana plantation on the east coast of Mesoamerica [5].

Weakening of village and community control over village ecosystems and irrigation systems, combined with increased population size and number of animals, as well as the migration of young people, all contribute to degradation of land, inadequate maintenance, weakening of social cohesion, changes in land tenure and use, proliferation of mosquito breeding sites and increase or resurgence of malaria transmission [5]. This suggests that the observation of a direct link between general social development and malaria made at the society level also applies at the population level.

2.4 Households and Individuals

When an individual suffering from malaria or in need of prevention interacts with the health system—be it public or private, formal or informal—they may find difficulties in accessing or using the various services, resulting in differential outcomes depending on their social status. Poor health outcomes have several social and economic consequences for the individual and the household, including loss of earnings, impaired ability to work and learn, social isolation or exclusion [18]. Moreover, people at risk of malaria may face the burden of paying for prevention and treatment. Finally, poor malaria outcomes may also have consequences in terms of lower productivity of the labour force and the educational systems, and development of drug resistance.

At the household and personal level, choices will have to be made about adopting malaria-safe habits with respect to personal protection measures, home improvement, peri-domestic sanitation, chemoprophylaxis during pregnancy, and treatment [5]. These different choices will come with some costs, and the household will have to weigh the costs against the perceived benefits and other priorities as well as against their ability to invest the time and money required.

Level of education is a predictor of the type of help first sought when a child has fever. Mothers with no formal education or primary only are less likely to visit a health facility first compared to mothers with secondary education [26]. Furthermore, studies, for example in Mali, have shown malaria as the primary cause of absence from school and in direct correlation with educational achievement and cognitive performance [49]. This has implications not only for the individual but also on the general societal development and for increasing population vulnerability.

A seven-step ladder has to be climbed to ensure a successful outcome from using health care services: availability, accessibility, acceptability and contact coverage, followed by diagnostic accuracy, provider compliance and consumer adherence. At each step there are barriers and options, and different choices will have to be made by the consumer as well as by the provider [18]. The way that health care systems are structured and operated can thus contribute to increasing health inequity and hinder successful malaria outcomes.

There is a wide range of treatment options available to an individual in need: no treatment, self-treatment or traditional treatment and a variety of formal and informal public and private pharmacies, clinics and hospitals. Treatment-seeking behaviour and choice of treatment options differ between individuals of different SES, age, sex and zone of residence, and those of lower status may be more likely to receive cheaper, possibly inferior treatment or no treatment at all [26]. The use of both private and government services increases with household wealth, despite the public nature of the latter. However, the variance across countries requires that any policy seeking to reform the health sector to better care for poor people needs to be informed by country-specific work [50].

Those in the poorest quintiles are significantly more likely to seek care from traditional providers and use hospitals less frequently than higher quintiles. The poorest are more likely to use left-over drugs, purchase drugs without proper diagnosis and prescription, purchase counterfeit drugs, and sub-treat. Price and wealth are significant determinants of choice of treatment source [26].

When using health facilities, individuals of low SES are frequently met with discrimination, difficult-to-follow procedures and adverse staff behaviours and practices. On the staff side, this might be grounded in personal norms and attitudes or institutional performance measurements, incentives or underpayment that do not favour dealing with disadvantaged people [18]. An indication of differential treatment for malaria could be the inequity ratio in perception of service quality. In a study in Nigeria the 'most poor' (Q1) quartile was considerably less satisfied with the quality of 'diagnosis' (Q1:Q4 = 0.8) and 'information given' (Q1:Q4 = 0.7) than the 'least poor' (Q4). Further, the least poor were more likely to be seen and have their medication prescribed by a doctor or a pharmacist than the most poor, who were mostly seen by lower-level staff [51]. The disadvantaged often do not get what they need or have the right to, such as fee exemptions and free malaria diagnosis or drugs [52]. Next time they might turn to other providers with whom they find it easier to interact, such as unauthorized drug sellers—even if this, from a medical perspective, means substandard or incomplete treatment.

The first areas to experience drug resistance (in the 1950s) were jungle gold mining areas with a high turnover of people, with money in relative abundance, and medicines accessible and abused [5]. Currently, *P. falciparum* resistance to artemisinins has been detected in four countries in the GMS: Cambodia, Myanmar, Thailand and Vietnam. No alternative antimalarial medicine is currently available that offers the same level of efficacy and tolerability as artemisinin-combination therapies (ACTs), and the emergence of artemisinin resistance is of great concern, particularly because resistance to other antimalarial medicine was also detected first in GMS, eventually appearing elsewhere. The reasons why this subregion has become a focus are given as a combination of loose regulation of antimalarials with large proportions being counterfeit or substandard, misuse of the drugs and poor compliance by the patients, and high levels of population mobility [53], including transient non-immune individuals and groups visiting forested areas where the extremely efficient *Anopheles dirus* can maintain transmission at very low mosquito levels. This provides a dangerous mix for the development and spread to other parts of the world of drug-resistant parasite strains. Resistance to artemisinin-based therapies that are considered the last defence against malaria will, when spread, have catastrophic consequences for efforts to control and eliminate malaria control. It is important to note, however, that drug resistance may develop and spread anywhere. Just a single mutation event is required to start a lineage of resistance [45]. Strong health care systems with universal and easy access for all in need have long been known as prerequisite societal elements in overcoming malaria [5;26]. Containment activities were initiated on the Cambodia–Thailand border in 2008 and are now being conducted in all four countries. The Global Plan for Artemisinin Resistance Containment (GPARC)¹⁰ was launched in 2011 and is a high-level plan of attack to protect ACT as an effective treatment for *Plasmodium falciparum* malaria, and the Emergency Response to Artemisinin Resistance in the Greater Mekong Subregion (ERAR)¹¹ was launched in 2013 and is a framework that identifies four priority areas for action¹² to contain artemisinin resistance and move towards elimination of malaria.

10. WHO, 'Global Plan for Artemisinin Resistance Containment', WHO, Geneva, 2011, <http://www.who.int/malaria/publications/atoz/9789241500838/en/index.html>.

11. WHO, 'Emergency Response to Artemisinin Resistance in the Greater Mekong Subregion. Regional Framework for Action 2013–2015', WHO, Geneva, 2013, <http://www.who.int/malaria/publications/atoz/9789241505321/en/index.html>.

12. Reach all at-risk groups with full coverage of quality interventions in priority areas; achieve tighter coordination and management of field operations; better information for artemisinin resistance containment; and strengthen regional oversight and support.

2.5 Summarizing: Major Determinants—Sector Matches

Table 1 proposes four to five important social and environmental determinants for malaria at each of the four levels of analysis, and matches these with the sectors that could potentially take action. Within each sector, there will be several stakeholders or actors: government, public; private-for-profit; private-not-for-profit; non-government organizations; civil society, including consumers groups. Thus, 'sector' is used as an inclusive term.

Table 1: The Determinants Matrix—Important social and environmental determinants for malaria by level according to the analysis in Sections 2.1 to 2.4 and sector

Analytical level and major determinants for malaria	Potential sector matches															
	Foreign affairs & int. cooperation	Finance & economy	Food & agriculture	Trade, Industry, etc.	Infrastructure, transport, works	Education	Social protection	Justice	Science & technology	Environment	Water & sanitation	Communication & information	Security (military & police)	Community development	Health	Public admin., including local government
1. Society																
• Inequitable distribution of power and resources across countries	✓	✓		✓				✓		✓		✓	✓			
• Demographic change: population growth, family/household size and structural population movements			✓			✓	✓	✓				✓	✓	✓	✓	✓
• Government's ability to manage land, tax revenues and to regulate	✓	✓		✓				✓							✓	✓
• Organization of societies and services		✓			✓	✓	✓	✓		✓	✓			✓	✓	✓
• Social status: gender, ethnicity, and distribution of power and resources within countries		✓			✓	✓	✓	✓					✓	✓	✓	✓
2. Environment																
• Agricultural practices and production systems			✓		✓					✓						
• Urban and peri-urban settings and infrastructures		✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓
• Housing					✓	✓	✓			✓	✓			✓		✓
• Land use/management			✓	✓	✓			✓		✓	✓	✓	✓	✓		✓
• Economic development projects		✓	✓	✓	✓			✓	✓	✓			✓	✓	✓	✓

Analytical level and major determinants for malaria	Potential sector matches															
	Foreign affairs & int. cooperation	Finance & economy	Food & agriculture	Trade, Industry, etc.	Infrastructure, transport, works	Education	Social protection	Justice	Science & technology	Environment	Water & sanitation	Communication & information	Security (military & police)	Community development	Health	Public admin., including local government
3. Population group																
• Poverty and education		✓	✓	✓	✓	✓	✓	✓						✓	✓	✓
• Population mobility (internal and international migration)	✓		✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓
• Nutrition		✓	✓	✓		✓	✓					✓		✓	✓	✓
• Occupation			✓	✓	✓		✓	✓				✓	✓	✓	✓	
• Community control							✓	✓						✓		✓
4. Households and individuals																
• Choice and adoption of malaria-safe habits		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
• Awareness and knowledge						✓	✓					✓		✓	✓	
• Access to and use of health care		✓				✓	✓					✓		✓	✓	✓
• Provision of health care		✓						✓	✓						✓	✓

3. Implementable Actions

Being ‘malaria smart’ means making actions and operations in all relevant sectors contribute to reducing, rather than producing, malaria, while achieving their sector-specific outcomes as well as the malaria-specific outcomes. The latter will in turn benefit all stakeholders.

There are very few, if any, social and environmental determinants of malaria (Table 1) that are the sole responsibility of a single sector. Similarly, most sectors will be required to act at different levels from policy to action concerning their own employees, from global to local, and from ‘society’ to ‘household and individual’ (Table 1). Effectiveness and sustainability will depend on the concerted efforts of several actors. However, different sectors and different actors within a given sector may have different entry points to and motives for addressing the same determinant. Only if there is a positive correlation between the expected action and the benefit, can an engaged and sustained effort be expected. This section will describe principles and approaches and propose a tool and a menu to plan concrete interventions. It will further provide some examples of real-life achievements and illustrate the potential complexities.

The Millennium Villages Project (MVP) is an example of multisectoral action carried out in 10 African countries representing different agro-ecological systems (Ethiopia, Ghana, Kenya, Malawi, Mali, Nigeria, Rwanda, Senegal, Tanzania and Uganda). The multisectoral action includes empowerment and governance in each of the villages. Empowerment and governance action involves setting up committees from the village population on health, water and sanitation, education, fertilizer distribution, irrigation and water distribution and joint planning with the Millennium Project by identifying needs and priorities. The villages have also had roads constructed to connect to each other and to markets and electricity connected to the villages from the national grid. Thus one action feeds to another. These villages (except for those in Mali and Nigeria, due to insecurity) will meet the MDGs by 2015.¹³ Box 4 below illustrates the intervention by, and specific outcomes for, each sector from one of the MVP demonstration sites. It further highlights the key coordination and management issues and the malaria outcomes.

13. Center for National Health Development in Ethiopia, ‘Millennium Villages Project (MVP)’, CNHDE, Addis Ababa, 2013, http://www.cnhde.org.et/?page_id=44.

BOX 4: MVP Sauri, Kenya

The aim of the MVP is to provide proof-of-concept that a modest investment of \$110 per capita per year on an accelerated time-frame over 5–10 years in an integrated package of interventions will empower rural communities to lift themselves out of poverty and achieve the MDGs.

The below table summarizes the interventions with respect to the Determinants Matrix levels 2, 3 and 4: 'agricultural practices and production systems', 'land use/management', 'poverty and education', 'community control', 'choice and adoption of malaria-safe habits', 'education and knowledge', 'access to and use of health care', and 'provision of health care' (Table 1) as well as the achievements with respect to the interrelated health outcomes of nutrition and malaria of the first MVP sites after two years of operation.

Sector	Intervention	Sector-specific outcomes	Coordination and management	Health/malaria outcomes
Agriculture	<ul style="list-style-type: none"> Subsidized inputs: hybrid maize seeds, basal and top-dressing fertilizer Training: farming techniques, market diversification and non-farm income generation 10 percent harvest surplus to community 	<ul style="list-style-type: none"> Achieved food security Increased agricultural production and productivity Increased household income 	<ul style="list-style-type: none"> Building local understanding of complementarity and dependency of action to achieve sector-specific outcomes District government and decentralized district offices are key Village sector committees and producer groups are essential for ensuring community participation and link with authorities 	<p>Nutrition (for two-year-olds):</p> <ul style="list-style-type: none"> Underweight reduced from 17 percent to 5 percent Stunting reduced from 55 percent to 30 percent <p>Malaria</p> <ul style="list-style-type: none"> High-density parasitaemia prevalence among infants under three years of age reduced by 92 percent General high-density parasitaemia prevalence reduced by 86 percent Non-zero parasitaemia prevalence reduced by 79 percent Non-zero parasitaemia prevalence difference between those with income of less \$1/day and those with more than \$1/day disappeared

Sector	Intervention	Sector-specific outcomes	Coordination and management	Health/malaria outcomes
Education	<ul style="list-style-type: none"> • Building renovation and construction, including kitchens and pit latrines • Removal of school fees • Secondment of teachers • Sanitary napkins for girls • Provision of school meals (from the 10 percent harvest surplus) • Deworming in primary schools every four months 	<ul style="list-style-type: none"> • School attendance increased from 76 percent to 93 percent 	<ul style="list-style-type: none"> • Building local understanding of complementarity and dependency of action to achieve sector-specific outcomes • District government and decentralized district offices are key • Village sector committees and producer groups are essential for ensuring community participation and link with authorities 	<p>Nutrition (for two-year-olds):</p> <ul style="list-style-type: none"> • Underweight reduced from 17 percent to 5 percent • Stunting reduced from 55 percent to 30 percent <p>Malaria</p> <ul style="list-style-type: none"> • High-density parasitaemia prevalence among infants under three years of age reduced by 92 percent • General high-density parasitaemia prevalence reduced by 86 percent • Non-zero parasitaemia prevalence reduced by 79 percent • Non-zero parasitaemia prevalence difference between those with income of less \$1/day and those with more than \$1/day disappeared
Environment	<ul style="list-style-type: none"> • Clearing of mosquito breeding sites • Indoor residual spraying 	<ul style="list-style-type: none"> • Not available 		
Health	<ul style="list-style-type: none"> • Health clinic for every 5000 people • Free health care service • Community health worker for every 200 households—outreach • Free long-lasting insecticide-treated nets 	<ul style="list-style-type: none"> • After an initial increase, the health service utilization stabilized at a lower level 		

While marked progress was achieved in a fairly short period of time, it must be understood that poor rural communities will not be able at the end of a five-year demonstration project to pay for their own health and educational services. More and a more appropriate distribution of donor and government money will be required for a foreseeable future. Further, for agriculture to become a sustainable vehicle for rural economic and social growth, investments in physical and logistics infrastructures needs to come forward together with ensuring economically viable sizes of land plots.

Source: Tozan et al. [54]

However, while the Sauri case example in Box 4 provides proof-of-principle, it also suggests that sustained outcomes, whether sector- or malaria-specific, will only be possible if level-1 determinants (see Table 1) are also successfully addressed. One example of moving beyond demonstration is to show application in a more complex real-life situation. Such an example is provided by the national malaria control programme of Iran. Here, in addition to intervening at determinants at levels 2, 3 and 4, the determinant of 'distribution of resources and power within the country' is also addressed through a preferential focus on malarial areas within the poverty alleviation and electrification programmes (see Box 5).

BOX 5: Iran

Iran has recently moved from pre- to elimination phase, and malaria is now concentrated in the least developed provinces of Sistan and Baluchestan, Hormozgan, and the southern part of Kerman, with a combined population of 3.5 million people at risk. The area is bordering the Persian Gulf to the south and Pakistan to the east. The Pakistani side is also a high-transmission area. Almost all financing for malaria comes from the government, with a small part from the Global Fund. The risk of reintroduction of malaria through migrant workers from Pakistan and population movement within Iran is high. Important obstacles to malaria elimination are urbanization with marginalized people and suburban slums, farming (banana, rice) water storage and unprotected houses. An in-depth assessment of social determinants of malaria was started in 2012 and is still ongoing.

National and provincial poverty alleviation programmes aim to increase the capacity of the malarial areas, and collaboration of all stakeholders towards eliminating malaria is a pivotal element of the national strategic plan. In each province and in each district within the province, there are multisectoral malaria elimination committees chaired by the respective Governors. Members are: departments of education, energy, water supply, broadcasting, agriculture, and municipal and community-based Islamic councils. At the provincial level, the Chancellor of the Medical Sciences University is the Secretary, and at the district level it is the Chair of the District Health Centre. These committees integrate means and measures to eliminate malaria in all development projects and facilitate community involvement. In practice, however, much could still be done to make full use of all potential across sectors, notably in agriculture.

Schools teach pupils about malaria as part of the curriculum from age 11, and the rural teachers are involved in community education through their students. The local broadcasting centres provide malaria information and education prepared by the provincial and district health centres during the malaria transmission seasons. The energy department prioritizes connecting residences of malaria endemic areas in their electrification projects. Elected local Islamic councils work with health staff to mobilize communities and households for safe water storage, including larviciding with *Bacillus thuringiensis* and peer-to-peer education to adopt malaria-safe practices and care-seeking behaviours.

Source: National Malaria Control Programme, Iran

Brazil has gone one step further upstream, addressing more determinants at levels 1 and 2, including using policy, legal and regulatory instruments for direct transfer of resources and ensuring that economic, social and environmental developments are malaria-smart (see Box 6). This requires a strong role of the State and leadership by the central government in defining and using the instruments, while delegating and holding local authorities accountable for their implementation.

BOX 6: Brazil

The Amazon region covers 50 percent of the land, 14 percent of the population and 99.7 percent of the reported malaria cases in Brazil — most occurring in rural areas with poor infrastructure and low income. The annual number of cases has decreased from about 615,000 in 2000 to about 242,000 in 2012.

Strong malaria efforts are ongoing in various sectors. *Brasil Sem Miséria* (Brazil Without Destitution), a federal programme started in 2011 to bring people out of absolute poverty and incorporating *Bolsa Família*, a highly effective conditional cash transfer programme started in 2003. Nearly half of the municipalities targeted are also priorities for malaria control. Enterprises located in the Amazon region are subject to federally monitored licensing, according to which they, in collaboration with the municipal administrations, must control malaria in their areas of operation. Agrarian reforms are also bound by environmental laws, and the Ministry of Agrarian Development is responsible for integrating malaria components following state administration instructions.

Further, regional development plans, including for areas of big enterprise operations, have strong malaria elements and are implemented under the direction of the Chief of Staff of the President; Ministry of Planning, Budget and Management; Ministry of Agrarian Development; Ministry of National Integration; and Ministry of Health. Finally, the Navy and Army provide diagnosis and treatment in areas with difficult access.

New collaborations on the drawing board include: *Minha casa, minha vida* (My house, my life), a federal social programme in partnership with state and municipalities' administrations and non-profit organizations aiming to help people with few resources to acquire quality housing; Ministries of Agriculture, Fishing and Social Development to make fish farming malaria-safe; FUNASA (National Health Foundation) and Ministry of Cities to improve basic sanitation in municipalities; and tourism authorities to make the upcoming large public events malaria-safe.

Source: The National Malaria Control Programme, Brazil

Effective action for a determinant starts with identifying the promising entry points, moving on to defining the concrete action and desired malaria outcome, and ending with establishing what the incentives of the action will be for the actor engaging—i.e. the desired sectoral outcome. An obvious lesson learned from the PPHC¹⁴ [55] is that other sectors than health do not have 'health' or malaria control as their primary objective and competence. While they still might have an interest in collaborating around 'malaria' anyway, they will legitimately ask: 'Where can I contribute?,' 'What can I do?,' 'How can I show that I am making a difference?'

14. One of the nine knowledge networks of the Commission on Social Determinants of Health particularly focusing on public health programmes.

and ‘Why should I engage?’ These questions need to be addressed as one of the first steps to engage multiple sectors for malaria. The advantage of a multisectoral development approach to malaria is that the benefits of action potentially can show up both with respect to malaria control and the primary ‘businesses’ of the various sectors. Table 2 below provides an illustrative example for how this could work for one determinant.

Table 2: Example of multisectoral malaria action for determinant ‘Urban and peri-urban settings and infrastructures’ (see also Table 1)

Sector	Entry point	Action	Malaria outcome	Sectoral outcome
Finance and economy	Planning and budget process	Earmark resources to develop the most deprived areas	Decreased malaria morbidity and mortality	Increased equity and social and economic productivity
		Earmark resources for malaria-smart development in sectoral budgets		
		Earmark property taxes for mosquito abatement activities		
Food and agriculture	Research and guidelines	Guidance for introduction of malaria-smart crops and production systems	Reduced vector load and human contact with vector	Increased productivity and social and economic development
	Extension work	Increase efficiency, introduce improved and malaria-smart crops and production methods		
		Identify and eliminate anopheline larvae in urban agriculture		
Trade, industry etc.	Research and guidelines	Guidelines for introduction of malaria-smart methods	Reduced vector load and human contact with vector	Increased productivity and social and economic development
		Reduce local barriers for malaria commodities		
	Extension work	Increase efficiency, introduce improved production methods		
		Implement workplace protection programmes (e.g. provision of LLINs, IRS, diagnosis and treatment)		
		Ensure larval source management (LSM) in pits used for brickmaking, rock quarries and construction		
Infrastructure, transport, works	Research and guidelines	Develop norms and standards for malaria-safe housing, buildings and land use	Reduced vector load and human contact with vector	Better functioning urban and peri-urban settings and social and economic growth
	Planning	Separate residential and productive areas		
		Improve urban drainage, ensure LSM as part of infrastructure development		
	Upgrade, maintenance	Clear drains of blocking garbage, plant eucalyptus to drain swampy areas		
		Improve housing (ceiling and screens)		

Sector	Entry point	Action	Malaria outcome	Sectoral outcome
Education	Enrolment	Target poor and disadvantaged areas and households	Reduced vector load, human contact with vector, and parasite load	Improved equity and enrolment rates
	Curriculum	Include malaria-safe habits and information on the malaria community project in teaching		Improved educational achievement and cognitive performance
Environment	Research and standards	Develop norms and standards for inclusion in sectoral guidelines and procedures	Reduced vector load and human contact with vector	Safer urban and peri-urban environments
		Regulate private pest control operators as part of national insecticide-resistance management plan		
	Inspection	On-site control of compliance with norms and standards		
		Improve pesticide management		
Water and sanitation	Planning	Adequate capacity and access to water and sanitation services	Reduced vector load and human contact with vector	Enhanced social development, more business and less waste
		Ensure vector-safe domestic water storage and removal of garbage that can block drains		
	Upgrade, maintenance	Quick repair of leaking clean- and waste-water pipes; clearance of blocked drains; and LSM on oxidation ponds		
Security	Collaboration	Ensure health care and other services for military, police and prisons collaborate with NMCP, local authorities and communities	Reduced vector load, human contact with vector, and parasite load	Social growth
Community development	Extension	Support the strengthening of community structures for empowerment, responsibility, compliance and self-control	Reduced vector load, human contact with vector, and parasite load	Social growth
Health	Health service delivery	Avail access to quality primary health care services, ensure specific diagnosis for urban fevers of unknown origin in both public and private sectors	Reduced parasite load and reduced risk of drug resistance	Improved health and social growth
	Inspection	On-site control of compliance with norms and standards in public and private health-sector actors		
Local government	Planning phase	Bring stakeholders together, and establish priorities, indicators and targets	Reduced vector load, human contact with vector, and parasite load	Social and economic growth
	Implementing phase	Ensure stakeholder accountabilities		

Effective multisectoral action requires that the answers to all four of the above questions are clarified and known to each actor. Within each sector there might be several actors: government, international development agencies, NGOs, faith-based and private for-profit organizations, among others. The particular incentives may vary across such actors.

If it is not possible to address all four levels and all determinants or involve all sectors of Table 1, getting started will have a positive reinforcing effect on both malaria and social and economic development. A pragmatic way of getting started would be sector by sector to go through the five steps of becoming a 'malaria-smart' sector, which starts with the near and obvious (Box 7).

BOX 7: Five steps to becoming a malaria-smart sector

- 1. Own staff and their families:** it is of obvious benefit to a sector and its actors that its staff and their families are free of malaria, as it directly improves the productivity of the individual actor. The sectoral actors should promote malaria-safe behaviours and provide support and means for prevention, protection and treatment to their staff.
- 2. Clients and their families:** it is also of obvious benefit to a sectoral actor if its clients (business relations, students, farmers, small-scale entrepreneurs etc.) and their families are free of malaria, as it will improve the overall sectoral productivity. The sectoral actors should promote malaria-safe behaviours, prevention, protection and treatment, and, if relevant, provide the support and the means.
- 3. Malaria-producing activities:** the sector should review its ways of operation, practices, procedures and production systems to identify those that are potentially contributing to sustaining or increasing vector load, parasite transmission or insecticide and drug resistance. The sector should develop and promote the use of approaches that do not produce malaria.
- 4. Malaria-reducing potentials:** the sector should review its current activities to identify those that could be modified or added to have a malaria-reducing effect. Each sector will have some comparative advantages with respect to malaria control that can be released with no or limited additional costs.
- 5. Socio-economic development for malaria and synergies with other sectors:** the sector should review its potential and role in addressing those determinants of malaria where concerted efforts by multiple sectors are required. It should then actively engage nationally and locally in addressing the priority determinants, including defining indicators, and setting and reporting on targets.

The more that relevant sectors can come together nationally or locally, around specific determinants, such as the illustrative example in Table 2, the greater the synergetic effect will be. Annex A provides a list of examples of possible actions to each of the determinants in Table 1 and where more information on the proposed actions can be found.

4. Governance and Institutional Processes

Governance and institutional processes for a multisectoral approach to malaria have synergies with multisectoral approaches to other health and development issues. There are several global and regional processes and forums embracing malaria within a broader development perspective, as well as processes and forums that are specific to malaria. The former includes the MDGs [56], the post-2015 development agenda process [7], the Abuja Declaration 2001 [57] and the Libreville Declaration on Health and Environment in Africa [58]. The latter included the launch of the RBM movement in 1998, the African Summit on RBM in 2000 [59], the Global Alliance for Alternatives to DDT established under the Stockholm Convention,¹⁵ subregional collaborations, such as Elimination 8 in Southern Africa¹⁶ and the Asia Pacific Malaria Elimination Network (APMEN),¹⁷ just to mention a few.

While an unprecedented level of international funding has become available since 2000, this funding has been driving a focused range of interventions, such as LLINs, IRS and malaria treatment. It has been much more challenging to make the intersectoral and broader development link and work effectively at national and decentralized levels. In recognition of this, the African Leaders Malaria Alliance (ALMA), during the Assembly of the African Union in 2010, called for strengthening decentralization and linkages with other health and development sectors, civil society and private entities [60]. To make it work, it will be important to innovate, explore, develop and test options and tools for more effectively harnessing the potentials of all relevant sectors and governance mechanisms to prevent, control and eliminate malaria. This section looks first at coordination and management and then at financing.

4.1 Coordination and Management

Identifying promising entry points and actions (see Section 3) is not enough to actually make coordinated multisectoral action happen. Experience from the PPHC case study research [55] has shown that there are also organizational issues posing challenges to coordinated joint action, including:

- differences in value-bases (for example, whether social justice is an implicit or explicit goal or neither);
- differences in how success is judged;
- different constraints to participation; and
- different management cultures, disciplinary tools and conventions (language, evidence metrics etc.).

These findings are similar to the results of a consultation with sectoral executives on implementing action on social determinants of health that grouped the challenges for multisectoral collaboration into structural, cultural and language, process, and capacity and technical [61].

15. <http://chm.pops.int/Implementation/DDT/GlobalAlliance/tabid/621/mctl/ViewDetails/EventModID/1421/EventID/136/xmid/6821/Default.aspx>.

16. <http://tis.sadc.int/english/sarn/elimination-eight-e8/>.

17. <http://apmen.org/>.

BOX 8: Tanzania

Malaria control in Tanzania has, since 2003, focused on provision and use of LLINs, ACT, IRS and environmental management. The government distributed 27 million nets for free to households through national campaigns between 2009 and 2011. By 2011, it was estimated that 80 percent of all households had at least one net and that about 15 percent of the population at risk were protected by IRS, reducing outpatient visits, hospital admissions and death due to malaria [1]. However, almost all of the financing came from external sources, and at the same time as the distributed LLINs are coming to the end of their useful lifespan, the country is facing financial constraints. This affects the health sector, including the control of malaria, threatens the sustainability of the achievements and might lead to resurgence.

Unlike the fight against HIV/AIDS, which has a relatively long multisectoral tradition in Tanzania, the fight against malaria has primarily focused on the above selective interventions. However, the formal structures for a broader-based approach to malaria are in place. With the reform of the public service in 1992, the responsibility for health was delegated to the multi-functional District Councils. These were later, as part of the health-sector reform, charged to develop Comprehensive Council Health Plans. However, as the Treasurer of Muheza district said to researchers: "... how comprehensive is it if there are no clear guidelines on how different stakeholders can be brought on board?". Since the 1970s, Tanzania has had an elaborate structure of intersectoral Primary Health Care Committees, reaching almost every village and hamlet. However, while they formally still exist, they are not functioning optimally. Committee members and peripheral health workers report the main reasons as a lack of guidance and involvement.

Revitalizing and guiding existing mechanisms for a multisectoral social and environmental determinants approach to malaria thus appears to be a viable opportunity in Tanzania.

Sources: Prime Minister's Office, Ministry of Regional and Local Governments, Mubyasi et al. [62], World Malaria Report [1]

There is a long history of attempts to form multisectoral committees—for example, for primary health care and HIV/AIDS (see Box 8). However, the question is what will drive the approach: 'a unifying theme' or 'self-interest'? Health for All [63] and the Commission on Social Determinants of Health [19] both had 'equity' as the unifying theme in their call for intersectoral collaboration, while the Commission on Macroeconomics and Health [12] had 'economic development' as the overriding theme. The challenge of such 'big themes' is that they are often value-based and tend to divide when it comes to the details and when choices have to be made under resource-constrained circumstances.

The work on defining the post-2015 development agenda is based on three core values: human rights, equality and sustainability [7;64]. Given the analysis of the social and environmental determinants of malaria in Section 2, these values appear to constitute a suitable 'overriding theme' for engaging the wide range of sectoral actors required for realizing the vision of a malaria-free world.

'Self-' or 'intrinsic interest' according to the core purpose of the individual sectors and actors is the strongest driver for individual action, but without orchestration this will not necessarily yield the desired results for malaria. In summary, there could be three themes for coordinating a multisectoral action for malaria:

- an overriding theme: human rights, equality and sustainability;
- an action theme (vision): a malaria-free world (country); and
- a collaborative theme: orchestrate the 'intrinsic interests'.

The overriding theme is important for identifying if there are already existing coordination mechanisms in a country that could be asked, guided and resourced to take on the malaria-action theme—or if there is a need for establishing a new mechanism.

The experience from PPHC also showed the importance of leadership. Individual leadership capacities can greatly drive forward a collaborative agenda. However, too strong an identification with a single leader might eventually backfire. It is vitally important that leadership is quickly institutionalized. Otherwise, the approach will blossom and wither with the rise and fall of the leader or their interest [55]. Important leadership functions include: Carrying the 'vision torch,' and orchestration of the 'intrinsic interests'. These two leadership functions could be carried out by two different institutions—for example, the Ministry of Health/Malaria Control Programme and the Prime Minister's Office. In particular, the former will, in some cases, have to reform and expand the way it thinks and works to embrace the multisectoral approach as proposed in the Multisectoral Action Framework for Malaria.

A number of mechanisms and tools will be required to fully capitalize on the potential of a multisectoral approach to malaria—for example:

- Joint appraisal and consensus building, covering all the main determinants identified for a country. A lot of the information is already being collected for other purposes by different sectors and actors. The core could possibly be pulled together from existing tools and processes. However, there will be a need for rapid appraisal and analytical tools to, for example, map the key socio-environmental determinants for malaria in each country, identifying the common interests of different sectors, the expected impacts etc. (see Box 9). The collection of the information would provide a first opportunity for intersectoral dialogue, followed by consensus-building, action, mutual accountability and continuous action analysis.
- Joint evaluation and learning. Malaria is complex, and so is effective multisectoral action on malaria. There will be a need for regular evaluations and continuous learning, addressing not only 'if an action takes place,' but also 'why the action works or why it does not' (see also Section 5).
- Monitoring and accountability would include monitoring on success criteria (malaria outcomes) as well as the 'intrinsic interest' (sectoral outcome). An important role of the 'orchestrating leader' is to hold sectors and actors 'accountable' by measuring, and providing feedback (praise and sanction).
- Capacity-building and cross-training would include both managers and staff of the different sectors involved in policy formulation and delivering the multiple intervention packages, to appreciate the perspectives of the different sectors and the interlinkages and potential synergies between them.

BOX 9: Malaria Rapid Appraisal and Consensus-Building

A lot of data on social and environmental determinants of malaria are already available in different databases and from different sources. However, the data are rarely systematically and comprehensively put together, analysed and used to inform decision-making at national and local levels, including identifying malaria hotspots and hot-pops [11;65]. Further, managers from outside the health sector often do not know what they can do to reduce the malaria burden and how much malaria affects their 'core business' [55]. Finally, data—even if plentiful—will always be incomplete. To move forward, effectively engaging multiple sectors in a process leading to consensus about the problem, its root causes and the necessary action will be required:

- **Rapid appraisal** [29;66–68] to analyse the level, geographic and population distribution of malaria; the social and economic impact of malaria; the adequacy and sustainability of current interventions and the risk and implications of eventual resurgence; and the key national and local determinants. The national malaria control programmes and local malaria focal points should be able to undertake the appraisal by reviewing existing documentation and databases and interviewing key sectoral informants.
- **Malaria Decision Analysis Support Tool (MDAST)** is a newly developed tool to evaluate health, social and environmental impacts and policy trade-offs. The tool can thus test different options for policy and action and generate scenarios accordingly.¹⁸
- **Consensus**—grounded in the findings of the appraisal and the scenarios generated by the MDAST agreement—should be sought on whom among the stakeholders can and should do what—additionally or differently—about the identified determinants. The consensus-building process would bring together key leaders and senior managers from government, NGOs, business and civil society at national and district levels. The process would be led by the Prime Minister's Office, local government, and the Malaria Control Programme/Ministry of Health as the secretariat.

A multisectoral approach to malaria, based on social and environmental determinants will remain a dream unless the relevant communities are empowered, engaged and effectively play their role. Community participation is not about giving them tasks to do, but involves communities taking active part in the analysis, decision-making about priorities and resources, doing and monitoring, as well as holding authorities and others accountable [69]. Therefore, the processes and tools described in Box 9 also apply to the community level. In addition, a community log, as described in Box 10 could be helpful for rooting and sustaining multisectoral action.

18. <http://sites.duke.edu/mdast>.

BOX 10: Community Log

Not all data need to be collected by statisticians, epidemiologists or administrators and aggregated to national or international levels for producing reports and analyses before action can be taken. In fact, data for local action on malaria are better in disaggregated form, and can be collected by ordinary people. Ordinary people will better know the local determinants of malaria and will be able to follow how the determinants are evolving, being dealt with or not. Having fresh community data will enhance the local ownership, responsibility and accountability for action.

Many malaria-affected communities already have access to computers and internet—and each day more are coming. Everywhere there are people, young and old, who are capable of, interested in and willing to take on active local malaria determinants surveillance and record the findings in, for instance, a web-based community log. Such a log could show the actual situation as well as changes over time in tabular or graphic formats or as singular or layered local maps.

Examples of what could be recorded in the community logs include mosquito breeding sites, change of land use, malaria-smart versus non-smart farming practices, enterprises producing or reducing malaria, unprotected housing, malaria-related risky behavioural practices, and delivery on sectoral malaria plans and promises. The primary user of the information of the log will be the community itself—for its own action as well as to hold authorities accountable. District and municipal authorities should also use the information for management and planning purposes.

Finally, because of the nature of some of the social and environmental determinants of malaria, including in particular those at levels 1 and 2, it will be important for the global monitoring, such as the 'World Malaria Report,' also to take into account and monitor multisectoral action (see Box 11).

Integrating multisectorality and the development dimension into the global monitoring framework will help pushing for and encouraging donors and lenders to include malaria considerations into their non-health funding streams and drive countries to plan and implement multisectoral action.

BOX 11: Global Monitoring of Multisectoral Action for Malaria

Currently, the global malaria intervention monitoring comprises ITN/LLIN, IRS, IPTp and case management only [1]. This reflects the present focus on a limited number of biomedical intervention strategies. If a multisectoral action framework addressing the social and environmental determinants of malaria is to be successful, it will require an expansion of the globally monitoring framework (indicators).

As the possible interventions on the determinants are many and setting-specific, there is no universally applicable blueprint. The globally monitored multisectoral intervention indicators, therefore, have to be high-level, as suggested below.

Planning and coordination	Yes/No	Year
National appraisal of malaria determinants and inequities (using recommended appraisal tool) ¹⁹		
National Multisectoral Malaria Action Plan (MMAP)		
MMAP annual implementation report		

Sectoral participation	No. of sectors with concrete MAPs
1. Society	
2. Environment	
3. Population groups	
4. Households and individuals	

Number of active web-based community logs per 100,000 population

4.2 Financing

Malaria transmission can be suppressed by effective control measures. However, in the absence of active intervention, malaria will return to an intrinsic equilibrium determined by factors related to ecology, efficiency of mosquito vectors, and socio-economic characteristics. A review of 75 resurgences in 61 countries between 1930 and 2000 showed that 68 out of 75 of the resurgences (91 percent) were attributed at least in part to weakening of malaria control programmes. Of these, 37 out of 68 (54 percent) were due to funding shortages [4]. Given the potential severity of resurgence, engaging in but not continuing funding of conventional malaria control programmes may raise ethical concerns. Looking into the future from a vantage point of a multisectoral approach to malaria that, in addition to the conventional malaria control strategies has added a development dimension, there are three main streams of financing in question:

19. To be developed.

- financing for conventional malaria interventions, such as LLIN, IRS and diagnostics/treatment as reflected in the GMAP 2008–2015;
- financing of core functions of other sectors and sectoral actors that will impact on malaria by addressing the determinants of malaria within the purview of these sectors, i.e. co-financing for co-benefits; and
- financing of malaria intervention costs incurred directly by the household and the individual, including the costs of the conventional interventions as well as interventions related to, for example, improving housing or adopting other malaria-smart practices in the household.

Resource requirements for implementing the GMAP 2008–2015 were estimated to amount to some US\$6.1 billion annually between 2012 and 2015, including US\$5.3 billion on average for programme costs in endemic countries and US\$700–800 million for global research and development of new GMAP technologies [2]. Funding for malaria has increased dramatically in the past decade—with commitments of less than US\$200 million in 2004 to US\$1.8 billion in 2010—and has led to an unprecedented record of results and impact. However, international funding for malaria may now be levelling off, making the mobilization of resources that are needed to achieve the GMAP targets more uncertain, while the risk of resurgence is increasing.

Many resource-constrained countries will, for the foreseeable future, need external support, both bilateral and multilateral. Long-term, predictable and sustainable funding for LLIN, IRS and diagnosis/treatment, however, will increasingly have to come from domestic sources, thus making adequate allocations in the national budgets, increased tax collection as well as the search for innovative financing mechanisms important pieces of the puzzle (see Box 12).

The good news is that several malaria endemic countries are among the fastest growing economies in the world, boosted by new discoveries of oil, natural gas and strategic mineral reserves as well as growing revenues from tourism, agribusiness and other strategic economic sectors. Over the past decade, all countries have accelerated their achievements in education, health and income dimensions of the Human Development Index (HDI). With faster progress among the low-HDI countries, the gap has narrowed [70]. The investments made as well as the incomes generated in these growing economies have a huge potential to support human development, including contributing to resolving priority public health problems such as malaria, which affect both the social and the business environments. Releasing this potential, however, requires a combination of different conditions, including: governments' ability to collect and allocate taxes and revenues, fair pay and employment conditions for those working in the growth sectors, and non-health sectors and businesses playing their part to make their operations malaria-smart.

A multisectoral approach to malaria control means that a wide range of stakeholders is engaged and that the aims of malaria control are met by joint efforts. Resourcing such efforts is not simply a matter of securing cash donations; in some cases, major advances can be made at little or no cost to the health or malaria programmes themselves. For example, encouraging better housing is a social objective, not simply a malaria control action—changing national building codes and promoting government programmes could be achieved with 'non-traditional' efforts and financing directly to ministries and agencies other than health. Similarly, changes in the environmental-safeguarding routines at the development banks could ensure that infrastructure projects they finance have to consider impacts on malaria incidence and be designed to avoid any increase. Similarly, for the private sector the eventual additional costs of being malaria-smart should be seen as an integral part of doing business in malaria transmission areas as well as in areas with risk of resurgence. In many cases the return to investment will be realized in the short to medium term.

BOX 12: Drivers for financing multisectoral action

Governments of endemic countries, within the boundaries of their financial rules and capabilities:

- Prompt legislation to manage joint budgets across sectors for health and malaria outcomes.
- Incorporate financing of health and malaria outcomes in the management of resource revenue flows from exploitation of natural resources in malaria endemic areas.
- Design national innovative financing mechanisms for health and malaria outcomes, e.g. in the form of components of national sovereign wealth funds governed by social responsibility rules.

International financing institutions and other donors:

- Identify ways to mainstream financing of health and malaria outcomes through multisectoral action into funding mechanisms, operational policies and guidelines for seeking grants.
- Advise governments on designing and implementing tax provisions and other mechanisms aiming at financing health and malaria outcomes.

Corporate sector:

- Maintain a high standard of corporate responsibility in compliance to rules of fiscal transparency and taxation to allow revenue to flow smoothly to countries to finance social development, including health and malaria outcomes.
- Support development of public–private partnership initiatives with governments of hosting countries around innovative financing mechanisms for health and malaria outcomes.

Regional organizations:

- Promote regional resource mobilization in support of health and malaria outcomes.
- Facilitate regional-level lessons learning and technology transfers for the design of financing mechanisms in support of health and malaria outcomes through multisectoral action.

RBM Partnership and international organizations:

- Develop and disseminate data and guidelines, share best practices and promote political commitment to financing health and malaria outcomes through multisectoral action.
- Support countries with technical support to design and utilize international financing mechanisms for health and malaria outcomes through multisectoral action.

Civil society:

- Advocate for adequate, predictable and sustainable financing for health and malaria outcomes from national and international sources.

As discussed in Section 2, households that are better-off economically, with higher education and better employment, also tend to be better-off in terms of malaria. They live in malaria-safer houses and environments; they can better afford having malaria-safe habits and getting appropriate diagnosis and treatment should they fall ill with malaria. For the disadvantaged populations that carry the bulk of the malaria burden, this is often not the case, and they have to make short-term decisions and trade-offs for immediate survival. Governments or donors have to step in to target development activities, make direct cash transfers, or provide or subsidize protection measures, as in Brazil (Box 6) and Tanzania (Box 8).

5. Knowledge Gaps and Research Needs

There is a vast pool of knowledge and data available on malaria. At the time of writing, a MEDLINE search on the word 'malaria' provided links to 66,714 published scientific articles, while a Google internet search gave about 32,200,000 hits. Further, there is nearly 100 years of international malaria programme experience to draw on. Nevertheless, the RBM–UNDP consultation held in Geneva in July 2013, with the participation of malaria programme managers and experts from multiple sectors, as well as other work in preparation of this document, found important knowledge gaps that need further exploration and research.

The largest unknown with respect to a multisectoral approach to malaria that adds a development dimension to the traditional malaria control strategies is how to make it happen. Many of the promising interventions and ideas are not new, but it requires management innovation to apply them in the concerted large-scale and sustained effort needed for a lasting impact on malaria. The proposal is 'try it—test it' internationally, nationally and locally through a pathfinder real-life approach as opposed to pilot or demonstration projects. An important element of this would be 'learning cycles' with near real-time digestion and sharing of experiences locally, nationally and internationally, taking advantage of the borderless information and communication technologies.

Furthermore, in a world that calculates investments and returns, the question of the cost of sectors doing things differently (being malaria-smart) will be raised. It is expected that these costs, in most cases, will be marginal to the core operations of the sectors. However, little is actually known about these costs and the short- and long-term returns on investment for the individual sectoral actor. Therefore, researchers are encouraged to generate evidence on economic return and value for money of multisectoral action where the health and malaria outcomes are additional benefits to the sector-specific outcomes.

Finally, there is a need to better understand causality, including identifying those multisectoral interventions that have the greatest impact on malaria. This could be done through learning from outlier countries—i.e. countries that have done better in elimination than their economic indicators predicted—what did they do right? The answers to this question are likely to be found at the society and environment levels of the analytical framework (Table 2) and will require multidisciplinary research.

6. Immediate Next Steps

A detailed road-map for operationalizing and implementing the Multisectoral Action Framework for Malaria is being prepared. However, Table 3 below lists five processes that are on critical paths of the road-map.

Table 3: Key processes to embrace the Multisectoral Action Framework for Malaria 2013–2014

Key processes	Lead organizations
Sustainable Development Goals: the process for their definition is already well underway. Malaria elimination should be seen as an end in itself, as well as a measure of development. Malaria as a specific target (currently MDG6.C) should be maintained.	UNDP, WHO, UNICEF, UNEP and RBM
Global Malarial Action Plan (GMAP2): the integration of the Multisectoral Action Framework for Malaria into the GMAP2 will start with its endorsement by the RBM Partnership Board in November for it to be fully integrated into the GMAP2 that will be launched in 2014 .	RBM, led by the RBM Board
The UN Platform on Social Determinants of Health: ²⁰ is an agreement between UN agencies to work together on social determinants of health to reduce health inequities and promote development, and support countries to implement the Rio Political Declaration (2011).	WHO, ILO, UNDP, UNFPA and UNICEF
The Libreville Declaration on Health and Environment in Africa (Third Interministerial Conference): the conference provides an opportunity to unite ministers behind the Multisectoral Action Framework for Malaria, to facilitate the adoption in countries across the African continent.	WHO, UNEP, AfDB, WMO
'Try it—test it' in real-life situations in pathfinder countries: the proof of the Framework will be in its implementation, and, to get early learning results, it will be essential that some countries are willing to try it out at local or national level.	Governments of endemic countries, supported by UNDP and RBM

For each of the five processes, lead organizations are proposed. Their role will be to use their comparative advantages in relation to the processes to mobilize other organizations and actors behind multisectoral action for malaria and engage actively in the processes.

20. http://www.who.int/social_determinants/implementation/un_platform_Social_determinants/en/index.html

Annex A: Some examples of interventions on determinants that will impact malaria

This annex brings examples of actions at each of the four levels from ‘society’ to ‘household and individual’ for their respective main determinants. The lists can never be exhaustive and are meant to inspire and generate ideas, and to provide initial references and links to where more information can be found.

Society	
Inequitable distribution of power and resources across countries	
	Potential interventions include: implement the 0.7 percent of GNI target for Official Development Assistance (ODA); ²¹ fulfil the 10 commitments in the Copenhagen Declaration on Social Development; ²² implement the Paris Declaration on Aid Effectiveness and the Accra Agenda for Action; ²³ meet the Millennium Development Goal (MDG) targets, including eventual ‘unfinished agenda’; ²⁴ base the post-2015 agenda on the values of human rights, equity and sustainability [64]; improve developing countries’ access to industrial countries’ markets, including for agricultural products and labour-intensive manufactures ²⁵
Demographic change—population growth, family/household size and structural population movements	
	Potential interventions include: accelerate achievement of universal access to reproductive health (MDG5.2) [71]; eradicate extreme poverty and hunger (MDG1); achieve full and productive employment and decent work for all, including women and young people (MDG1.2); achieve universal primary education (MDG2) and gender equality and empowerment of women (MDG3) ²⁶ ; registration and titles to land ²⁷
Governments’ ability to manage land and tax revenues and to regulate	
	Potential interventions include: pursue good governance; ^{28,29} strengthen developing countries’ tax systems; ³⁰ strengthen regulatory systems and governance in developing countries ³¹

21. <http://www.oecd.org/dac/stats/the07odagnitarget-ahistory.htm>
22. <http://www.earthsummit2002.org/wssd/10commitments/10commitments.html>
23. <http://www.oecd.org/dac/effectiveness/parisdeclarationandaccraagendaforaction.htm>
24. <http://www.undp.org/content/undp/en/home/librarypage/mdg/the-millennium-development-goals-report-2013/>
25. <http://www.imf.org/external/np/exr/ib/2001/110801.htm>
26. <http://www.undp.org/content/undp/en/home/mdgoverview/>
27. <http://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?article=1358&context=auilr>
28. <http://www.unescap.org/pdd/prs/ProjectActivities/Ongoing/gg/governance.asp>
29. <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/EXTMNAREGTOPGOVERNANCE/0,,contentMDK:20513159~pagePK:34004173~piPK:34003707~theSitePK:497024,00.html>
30. http://www.oecd-ilibrary.org/development/tax-and-development_9789264177581-en
31. <http://jacobsandassociates.com/pdfs/Regulatory%20Governance%20Jacobs%20Ladegaard%202010.pdf>

Society (continued)	
Organization of societies and services	
	Potential interventions include: fulfil the 10 commitments in the Copenhagen Declaration on Social Development; ³² implement the Paris Declaration on Aid Effectiveness and the Accra Agenda for Action; ³³ meet the MDG targets, including eventual 'unfinished agenda'; strengthen the capacity of civil society, the media, parliament, local communities and the private sector to hold authorities accountable for better development results ³⁴
Social status—gender, ethnicity, and distribution of power and resources within countries	
	Potential interventions include: implement the Rio Political Declaration on Social Determinants of Health [8]; meet the MDG targets, including eventual 'unfinished agenda'; ³⁵ base future development plans on the values of 'human rights, equity and sustainability' [7]
Environment	
Agricultural practices and production systems	
	Potential interventions include: water-management-based interventions; ³⁶ think malaria and increase productivity and food security ^{37,38} ; collaborate with agrichemical business to integrate better malaria control; ³⁹ collaborate with farmers' field schools for integrating malaria with pest management programmes; ⁴⁰ intermittent wet/dry irrigation [72]; increase distance between residential areas and crops/methods that increase malaria; improve farming productivity [73]
Urban and peri-urban settings and infrastructures	
	Potential interventions include: tailor existing tools for diagnosis, treatment and vector control to focused urban settings [74]; preserve livelihoods for vulnerable populations, and build conditions for economic growth [74]; involve the substantial private sector [74]; community stakeholder participation [74]; source reduction (use of larvicides, use of larvivorous fish, minor engineering, de-weeding, weekly dry day, cleaning of ditches, waste removal, legislative measures); ⁴¹ creation of dry-belts between breeding sites and settlement [75]; (see also Table 2)
Housing	
	Potential interventions include: establish or change national building codes/inexpensive house models using better construction materials and sustaining financing initiatives [76]; limit number of people sleeping in each house/room [76;77]; close eaves [76;77]; improve housing design and materials [36;75–77]; ⁴² use mosquito repellent/ITN at night [76;77]; community sensitization [75;76;78]; (see also Table 2 and Boxes 2 and 6)

32. <http://www.earthsummit2002.org/wssd/10commitments/10commitments.html>

33. <http://www.oecd.org/dac/effectiveness/parisdeclarationandaccraagendaforaction.htm>

34. <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSOCIALDEVELOPMENT/0,,contentMDK:21533728~pagePK:210058~piPK:210062~theSitePK:244363,00.html>

35. <http://www.undp.org/content/undp/en/home/librarypage/mdg/the-millennium-development-goals-report-2013/>

36. <http://www.iwmi.cgiar.org/issues/water-and-health/malaria-and-water-management/>

37. www.ifpri.org/sites/default/files/publications/oc69ch15.pdf

38. <http://www.gbchealth.org/asset/linkages-between-malaria-and-agriculture/>

39. http://www.croplife.org/public_health_and_vector_control

40. <http://www.fao.org/docrep/005/ac834e/ac834e06.htm>

41. <http://www.nvbdcp.gov.in/UMS.html>

42. <http://www.malariaworld.org/blog/video-house-improvement-will-bring-malaria-elimination-africa-two-decades-forward>

Environment (continued)	
Land use/management	
	Potential interventions include: prevention of deforestation, reforestation of waterlogged ground with forest cash crops, e.g. eucalyptus to shade and drain [3]; environmental modification (drainage, filling of swamps, borrow pits, pools and ponds, modification of river boundaries or other engineering approaches) [75]; environmental manipulation (water management, intermittent irrigation, vegetation management) [75]; ⁴³ community participation and intersectoral cross-training [75]; (see also IVM [29])
Economic development projects	
	Potential interventions include: conduct health, ⁴⁴ social, ⁴⁵ and environmental ⁴⁶ impact assessments and require documentable positive effect on equity and malaria before funding; strengthen the presence and capacity of national and local inspection, regulation and enforcement of compliance [37;58]; form partnerships with private businesses and developers ^{47,48,49} [13]
Population Group	
Poverty and education	
	Potential interventions include: target development, poverty alleviation and nutrition programmes to poor communities with high malaria transmission ⁵⁰ (see also Box 6); credit with education (combining micro-finance with education); ⁵¹ commercial loans for low-income groups (small and medium-size enterprises, smallholder farmers, and home loans). ⁵² Cash transfer conditional on health and education [79]; integrate health, malaria and nutrition into school curriculum ^{53,54}
Nutrition	
	Potential interventions include: integrate nutrition and malaria programmes; ^{55,56} provide vitamin A and zinc supplements in high-transmission areas/to high-risk population groups [80]; ⁵⁷ conditional cash transfers to poor at-risk families conditional on nutritional actions; ⁵⁸ leverage agriculture for improving nutrition and health; ⁵⁹ women's empowerment and community participation [81]

43. <http://www.gbchealth.org/asset/linkages-between-malaria-and-agriculture/>
44. <http://www.who.int/hia/en/>
45. http://lsi.mckinsey.com/what_is_social_impact_assessment
46. http://www.unep.ch/etu/publications/EIAMan_2edition.htm
47. <http://capmalaria.org/news-center-mobile/recent-news/108-cap-malaria-project-engages-the-private-sector-in-malaria-control-in-burma>
48. <http://www.rbm.who.int/ProgressImpactSeries/docs/report7-en.pdf>
49. <http://www.gbchealth.org/our-work/collective-actions/cama/>
50. <http://www.voanews.com/content/malaria-risk-spikes-for-worlds-poorest-children-study/1684911.html>
51. www.freedomfromhunger.org/credit-education
52. <http://sustainability.standardbank.com/socioeconomic-development-overview/>
53. [http://www.schoolsandhealth.org/Documents/Malaria%20control%20in%20schools%20in%20Mali%20\(English\).pdf](http://www.schoolsandhealth.org/Documents/Malaria%20control%20in%20schools%20in%20Mali%20(English).pdf)
54. <http://www.freshschools.org/Pages/default.aspx>
55. <http://www.dcp2.org/file/31/>
56. <http://www.action.org/blog/post/undernutrition-and-malaria-a-vicious-circle>
57. <http://www.news-medical.net/news/20090629/Vitamin-A-supplements-can-reduce-malaria-cases-in-children-by-one-third-study-finds.aspx>
58. <http://www.ifpri.org/book-765/ourwork/program/bolsa-alimenta-o>
59. <http://2020conference.ifpri.info/>

Population Group (continued)	
Population mobility (internal and international migration)	
	Potential interventions include: introduce rights-based, migrant-inclusive policies, including universal health coverage regardless of legal status, and build capacities of local authorities, key stakeholders and migrant communities; ⁶⁰ instigate malaria control (use of ITN, vector control and early diagnosis and treatment) quickly in emergencies and breakdown of infrastructure; ⁶¹ identify high-volume transit and migration networks, apply interventions across areas, identify mobile communities and provide targeted information and health care to these communities[45]; ⁶² (see also Box 3)
Occupation	
	Potential interventions include: identify and target at-risk groups [11]; improve staff housing/quarters, including screens, fewer staff members sleeping per room [77]; long-lasting insecticidal hammocks (LLIH) for workers who sleep outside or in makeshift accommodation [82;83]; use of insecticide-treated clothes (ITC) [84]; use of mosquito-repellent soap [85]; improve employment and working conditions, and implement employer-based malaria control programmes, including awareness, prevention and treatment, and engaging workers, senior management and partners[86]; ^{63,64,65,66} IRS in prisons ⁶⁷
Community control	
	Potential interventions include: fundamentals (community participation, broadening partnership, building on experience, developing community-level interventions, improving links between the community and the district health system, strengthen district capacity for malaria community action, strengthen community self-monitoring and decision-making, effective communication strategy) [87]; NGOs and governments work together to effectively reach community level ⁶⁸
Household and Individual	
Choice and adoption of malaria-safe habits	
	Potential interventions include: NGO housing projects with low-cost financing [88]; ⁶⁹ commercial house improvement loans for low-income people, ⁷⁰ social marketing of materials for making homes malaria-smart; ⁷¹ environmental management [89]; ⁷² ITN distribution [90] ⁷³ through commercial [90;91], social marketing[92;93], discount voucher [94], ⁷⁴ or free [92;95]; conditional cash transfer for changing behaviour; ⁷⁵ community participation [29;87] ⁷⁶

60. <http://www.iom.int/files/live/sites/iom/files/What-We-Do/docs/REPORT-14Aug2013-v3-FINAL-IOM-Global-Report-Population-Mobility-and-Malaria.pdf>
61. <http://www.malariaconsortium.org/pages/111.htm>
62. <http://www.malariaconsortium.org/news-centre/burmese-migrant-workers.htm>
63. http://www.gbchealth.org/files/reports/GBC_Malaria_benchmarks_2-2011_final.pdf
64. <http://www.gbchealth.org/asset/linkages-between-malaria-and-agriculture/>
65. <http://www.nestle.com/csv/rural-development>
66. http://www.illovosugar.co.za/files/SOCIAL_IMPACT.pdf
67. <http://crofsblogs.typepad.com/h5n1/2013/03/uganda-prisons-adopt-residual-spraying-against-malaria.html>
68. <http://www.coregroup.org/>
69. <http://www.habitat.org/>
70. <http://sustainability.standardbank.com/socioeconomic-development-overview/>
71. <http://faculty.mu.edu.sa/public/uploads/1358239148.7214Kotler-Zaltman.pdf>
72. <http://www.fao.org/docrep/v5406e/v5406e02.htm>
73. <http://www.networksmalaria.org/>
74. <http://healthmarketinnovations.org/program/tanzania-national-voucher-scheme>
75. http://www.development.wne.uw.edu.pl/uploads/Courses/DW_cash_transfers2.pdf
76. <http://www.coregroup.org/>

Household and Individual (continued)	
Awareness and knowledge	
	Potential interventions include: dedicated multisectoral community-focused malaria awareness programmes; ^{77,78} improved use of community radio ^{79,80} to raise malaria awareness among staff and customers; ⁸¹ targeting IEC through voucher system for ITN [96]
Access to and use of health care	
	Potential interventions include: malaria-sensitive universal health coverage; ⁸² Village Health Workers and community participation to perform rapid diagnostic test (RDT), treatment and referral; ^{83,84} delivery of subsidized ACT through private drug shops [97]; public–private partnerships to improve access to quality malaria case services; ⁸⁵ strategies to improve access to treatment at all levels of health care—(coming); ⁸⁶ provider guidelines for improving patient adherence to treatment; ⁸⁷ use of mobile phones to improve patient adherence and provider compliance [98]
Provision of health care	
	Potential interventions include: using an integrated management of malaria curriculum to train multidisciplinary health staff [99]; improve quality and reach of malaria care provision through private and community channels; ⁸⁸ transform the RDT market from a low-volume, high-margin market for poor-quality RDTs to one where customers have easy access to affordable, quality-assured RDTs; ⁸⁹ improve quality of malaria management by private general practitioners; ⁹⁰ micro-franchise schemes to improve reach and quality of private providers; ⁹¹ improve services of medicine sellers [100]

77. <http://www.modernghana.com/news/33064/1/malaria-awareness-programme-launched.html>
78. <http://www.malariaconsortium.org/news-centre/raising-awareness-of-malaria-in-southern-ethiopia.htm>
79. http://www.share4dev.info/telecentres/index.php?option=com_seyret&Itemid=85&task=videodirectlink&id=179&lang=en
80. <http://www.cmfed.org/what-we-do/docs-and-mags/malaria-toolkit-for-radios>
81. <http://www.malariafreefuture.org/standard-bank>
82. http://www.who.int/universal_health_coverage/en/
83. <http://www.mchip.net/node/1838>
84. <http://www.theguardian.com/global-development-professionals-network/2013/feb/12/malaria-control-prevention-africa-community-health-workers>
85. <http://partnerships.ifpma.org/partnership/access-improving-access-to-effective-malaria-treatment>
86. <http://www.rollbackmalaria.org/mechanisms/cmwgWorkstream2.html>
87. <http://labspace.open.ac.uk/mod/oucontent/view.php?id=439266§ion=20.6>
88. <http://www.psi.org/our-work/healthy-lives/malaria>
89. <http://www.unitaid.eu/en/creating-a-private-sector-market-for-quality-assured-rdts-in-malaria-endemic-countries>
90. <http://www.searo.who.int/myanmar/areas/malariaqualitymgnt/en/index.html>
91. <http://www.cfwsshops.org/>

References

- [1] WHO, 'World Malaria Report 2012,' World Health Organization, Geneva, 2012.
- [2] Roll Back Malaria Partnership, 'The Global Malaria Action Plan—for a Malaria-free World,' Roll Back Malaria Partnership, Geneva, 2008.
- [3] Tusting, L.S., Willey, B., Lucas H., Thompson, J., Kafy H.T., Smith, R. et al., 'Socioeconomic development as an intervention against malaria: a systematic review and meta-analysis,' *Lancet*, 2013, 18 Jun.
- [4] Cohen, J.M., Smith, D.L., Cotter, C., Ward, A., Yamey, G., Sabot, O.J. et al., 'Malaria resurgence: a systematic review and assessment of its causes,' *Malaria Journal*, 2012;11: 122.
- [5] Najera, J.A., 'The control of tropical diseases and socioeconomic development [with special reference to malaria and its control],' *Parassitologia*, 1994, Aug; 36(1–2): 17–33.
- [6] Feachem, R.G., Phillips A.A., Hwang, J., Cotter, C., Wielgosz, B., Greenwood, B.M. et al., 'Shrinking the malaria map: progress and prospects,' *Lancet*, 2010, Nov 6; 376(9752): 1566–78.
- [7] UN System Task Team, 'A renewed global partnership for development,' UNDP, New York, 2013.
- [8] WHO, 'World Conference on Social Determinants of Health,' World Health Organization, Geneva, 2012.
- [9] Thomas, M.B., Godfray, H.C., Read, A.F., van den Berg, H., Tabashnik, B.E., van Lenteren, J.C. et al., 'Lessons from agriculture for the sustainable management of malaria vectors,' *PLoS Medicine*, 2012; 9(7): e1001262.
- [10] UNEP, 'Plan of Action for the Implementation of Thematic Group on Reducing Barriers to Bringing New Chemicals and Products to Market,' UNEP, Stockholm Convention Secretariat, Geneva, 2011.
- [11] Cotter, C., Sturrock, H.J., Hsiang, M.S., Liu, J., Phillips, A.A., Hwang, J. et al. 'The changing epidemiology of malaria elimination: new strategies for new challenges,' *Lancet*, 2013, Apr 15.
- [12] Sachs, J., 'Macroeconomics and Health: Investing in Health for Economic Development,' WHO Commission on Macroeconomic and Health, Geneva, 2001.
- [13] Bloom, D.E., Bloom, L.R., Weston, M., 'Business and Malaria—A Neglected Threat?,' World Economic Forum, Geneva, 2006.
- [14] Sabot, O., Cohen, J.M., Hsiang, M.S., Kahn, J.G., Basu, S., Tang, L. et al., 'Costs and financial feasibility of malaria elimination,' *Lancet*, 2010, Nov 6; 376(9752): 1604–15.
- [15] WHO, 'The Economics of Social Determinants of Health and Health Inequalities,' World Health Organization, Geneva, 2013.
- [16] Smith, D.L., Cohen, J.M., Chiyaka, C., Johnston, G., Gething, P.W., Gosling, R. et al., 'A sticky situation: the unexpected stability of malaria elimination,' *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, 2013; 368(1623): 20120145.
- [17] RBM Board, 'Refined/Updated GMAP Objectives, Targets, Milestones and Priorities Beyond 2011,' Roll Back Malaria Partnership, Geneva, 2011.

- [18] Blas, E. and Sivasankara Kurup, A., 'Equity, social determinants and public health programmes,' World Health Organization, Geneva, 2010.
- [19] Commission on Social Determinants of Health, 'Closing the gap in a generation,' World Health Organization, Geneva, 2008.
- [20] Hulden, L., 'The decline of malaria in Finland—the impact of the vector and social variables,' *Malaria Journal*, 2009; 8: 94.
- [21] Labonte, R., Blouin, C., Chopra, M., Lee, K., Packer, C., Rowson, M. et al., 'Towards Health-Equitable Globalisation: Rights, Regulation and Redistribution,' University of Ottawa, Institute of Population Health, Ottawa, 2007.
- [22] Brieger, W., 'Who will pay for malaria programmes,' *African Health*, 2013.
- [23] The Potsdam Institute for Climate Impact Research and Climate Analytics, 'Turn-down the Heat—Why a 4 degree Warmer World Must be Avoided,' International Bank for Reconstruction and Development and World Bank, Washington, DC, 2012.
- [24] Burki, T.K., 'Malaria and malnutrition: Niger's twin crises,' *Lancet*, 2013, Aug 17; 382(9892): 587–8.
- [25] Himeidan, Y.E. and Kweka, E.J., 'Malaria in East African highlands during the past 30 years: impact of environmental changes,' *Frontiers in Physiology*, 2012; 3: 315.
- [26] Worrall, E., Basu, S. and Hanson, K., 'The relationship between socioeconomic status and malaria: a review of the literature,' London School of Hygiene and Tropical Medicine, London, 2002.
- [27] Ranson, H., N'guessan, R., Lines, J., Moiroux, N., Nkuni, Z. and Corbel, V., 'Pyrethroid resistance in African anopheline mosquitoes: what are the implications for malaria control?,' *Trends in Parasitology*, 2011, Feb; 27(2):91–8.
- [28] Thomas, M.B., Godfray, H.C., Read, A.F., van den Berg, H., Tabashnik, B.E., van Lenteren, J.C. et al., 'Lessons from agriculture for the sustainable management of malaria vectors,' *PLoS Medicine*, 2012; 9(7): e1001262.
- [29] WHO, 'Handbook for Integrated Vector Management,' World Health Organization, Geneva, 2012.
- [30] WHO and UNEP, 'Health Security through Healthy Environments—First Interministerial Conference on Health and Environment in Africa,' World Health Organization, Regional Office for Africa, Brazzaville, 2009.
- [31] Basurko, C., Demattei, C., Han-Sze, R., Grenier, C., Joubert, M., Nacher, M. et al., 'Deforestation, agriculture and farm jobs: a good recipe for Plasmodium vivax in French Guiana,' *Malaria Journal*, 2013; 12: 90.
- [32] Kebede, A., McCann, J.C., Kiszewski, A.E. and Ye-Ebiyo, Y., 'New evidence of the effects of agro-ecologic change on malaria transmission,' *American Journal of Tropical Medicine and Hygiene*, 2005, Oct; 73(4): 676–80.
- [33] Tatem, A.J., Gething, P.W., Smith, D.L. and Hay, S.I., 'Urbanization and the global malaria recession,' *Malaria Journal*, 2013; 12: 133.
- [34] De Silva, P.M. and Marshall, J.M., 'Factors contributing to urban malaria transmission in sub-saharan Africa: a systematic review,' *Journal of Tropical Medicine*, 2012; 2012: 819563.

- [35] de Castro, M.C. and Singer, B., 'Migration, urbanization and malaria: A comparative analysis of Dar es Salaam, Tanzania, and Machadinho, Rondônia, Brazil,' Princeton University, Johannesburg, 2003.
- [36] Hiscox, A., Khammanithong, P., Kaul, S., Sananikhom, P., Luthi, R., Hill, N. et al., 'Risk factors for mosquito house entry in the Lao PDR,' *PLoS One*, 2013; 8(5): e62769.
- [37] Jobin, W., 'Health and equity impacts of a large oil project in Africa,' *Bulletin of the World Health Organization*, 2003; 81(6): 420–6.
- [38] De, A.M., Louis, V.R., Tiendrebeogo, J., Souares, A., Ye, M., Tozan, Y. et al., 'Moving towards universal coverage with malaria control interventions: achievements and challenges in rural Burkina Faso,' *International Journal of Health Planning and Management*, 2013, Jan; 28(1): 102–21.
- [39] Koot, J., Mtung'e, R. and Miller, J., 'Insecticide-treated Nets in Tanzania Mainland,' in *Social Determinants Approaches to Public Health—From Concept to Practice*, edited by E. Blas, J. Sommerfeld and A. Sivasankara Kurup, World Health Organization, Geneva, 2011: 161–73.
- [40] Baragatti, M., Fournet, F., Henry, M.C., Assi, S., Ouedraogo, H., Rogier, C. et al., 'Social and environmental malaria risk factors in urban areas of Ouagadougou, Burkina Faso,' *Malaria Journal*, 2009; 8: 13.
- [41] Caulfield, L.E., Richard, S.A. and Black, R.E., 'Undernutrition as an underlying cause of malaria morbidity and mortality in children less than five years old,' *American Journal of Tropical Medicine and Hygiene*, 2004, Aug; 71(2 Suppl): 55–63.
- [42] McClure, E.M., Goldenberg, R.L., Dent, A.E. and Meshnick, S.R., 'A systematic review of the impact of malaria prevention in pregnancy on low birth weight and maternal anemia,' *International Journal of Gynaecology and Obstetrics*, 2013, May; 121(2): 103–9.
- [43] UNDP, 'Human Development Report 2009—Overcoming Barriers: Human Mobility and Development,' United Nations Development Programme, New York, 2009.
- [44] WHO, Government of Spain, IOM, 'Health of Migrants—The Way Forward,' World Health Organization, Geneva, 2010.
- [45] Lynch, C. and Roper, C., 'The transit phase of migration: circulation of malaria and its multidrug-resistant forms in Africa,' *PLoS Medicine*, 2011, May; 8(5): e1001040.
- [46] Tatem, A.J. and Smith, D.L., 'International population movements and regional Plasmodium falciparum malaria elimination strategies,' *Proceedings of the National Academy of Sciences of the United States of America*, 2010, Jul 6; 107(27): 12222–7.
- [47] Pearce, R.J., Pota, H., Evehe, M.S., Ba, E., Mombo-Ngoma, G., Malisa, A.L. et al., 'Multiple origins and regional dispersal of resistant dhps in African Plasmodium falciparum malaria,' *PLoS Medicine*, 2009, Apr 14; 6(4): e1000055.
- [48] Hawkes, C. and Ruel, M., 'The links between agriculture and health: an intersectoral opportunity to improve the health and livelihoods of the poor,' *Bulletin of the World Health Organization*, 2006, Dec; 84(12): 984–90.
- [49] Thuilliez, J., Sissoko, M.S., Toure, O.B., Kamate, P., Berthelemy, J.C. and Doumbo, O.K., 'Malaria and primary education in Mali: a longitudinal study in the village of Doneguebougou,' *Social Science and Medicine*, 2010, Jul; 71(2): 324–34.

- [50] Filmer, D., 'Fever and its treatment among the more and less poor in sub-Saharan Africa,' *Health Policy and Planning*, 2005, Nov; 20(6): 337–46.
- [51] Onwujekwe, O., Obikeze, E., Uzochukwu, B., Okoronkwo, I. and Onwujekwe, O.C., 'Improving quality of malaria treatment services: assessing inequities in consumers' perceptions and providers' behaviour in Nigeria,' *International Journal for Equity in Health*, 2010; 9: 22.
- [52] Uzochukwu, B., Onwujekwe, O. and Eriksson, B., 'Inequity in the Bamako Initiative programme--implications for the treatment of malaria in south-east Nigeria,' *International Journal of Health Planning and Management*, 2004, Oct; 19 Suppl 1: S107–S116.
- [53] Cui, L., Yan, G., Sattabongkot, J., Chen, B., Cao, Y., Fan, Q. et al., 'Challenges and prospects for malaria elimination in the Greater Mekong Subregion,' *Acta Tropica*, 2012, Mar; 121(3): 240–5.
- [54] Tozan, Y., Negin, J. and Waiero, J., 'The Millennium Villages Project' in *Social Determinants Approaches to Public Health—from Concept to Practice*, edited by E. Blas, J. Sommerfeld and A. Sivasankara Kurup, World Health Organization, Geneva, 2011: 92–104.
- [55] Blas, E., Sommerfeld, J. and Sivasankara Kurup, A., 'Social determinants approaches to public health: from concept to practice,' World Health Organization, Geneva, 2011.
- [56] United Nations, 'The Millennium Development Goals Report 2012,' United Nations, New York, 2012.
- [57] WHO, 'The Abuja Declaration: Ten Years On,' Geneva, World Health Organization, Geneva, 2011.
- [58] WHO/AFRO, 'Libreville Declaration on Health and Environment in Africa,' World Health Organization—Regional Office for Africa, Brazzaville, 2008.
- [59] WHO, 'The Abjua Declaration and the Plan of Action,' World Health Organization, Geneva, 2003.
- [60] Sambo, L.G., Ki-Zerbo, G. and Kirigia, J.M., 'Malaria control in the African Region: perceptions and viewpoints on proceedings of the Africa Leaders Malaria Alliance (ALMA),' *BMC Proceedings*, 2011; 5 Suppl 5: S3.
- [61] WHO, 'The Contribution of Collaborative Work Between Sectors,' World Health Organization, Geneva, 2011.
- [62] Mubyazi, G., Kamugisha, M., Mushi, A. and Blas, E., 'Implications of decentralization for the control of tropical diseases in Tanzania: a case study of four districts,' *International Journal of Health Planning and Management*, 2004; 19(S1).
- [63] WHO, 'Intersectoral Action for Health,' World Health Organization, Geneva, 1986.
- [64] UN System Task Team, 'Realizing the Future We Want of All,' UNDP, New York, 2012.
- [65] Aagaard-Hansen, J. and Chaignat, C.L., 'Neglected tropical diseases: equity and social determinants,' in *Equity, Social Determinants and Public Health Programmes*, edited by E. Blas and A. Sivasankara Kurup, World Health Organization, Geneva, 2010.
- [66] Annett, H. and Rifkin, S.B., 'World Health Organization Guidelines for rapid participatory appraisals to assess community health needs a focus on health improvements for low-income urban and rural areas,' World Health Organization, Geneva, 1995.

- [67] Manderson, L. and Aaby, P., 'An epidemic in the field? Rapid assessment procedures and health research,' *Social Science and Medicine*, 1992, Oct; 35(7): 839–50.
- [68] Wang, S.J., Lengeler, C., Smith, T.A., Vounatsou, P., Cisse, G., Diallo, D.A. et al., 'Rapid urban malaria appraisal (RUMA) in sub-Saharan Africa,' *Malaria Journal*, 2005; 4: 40.
- [69] Rifkin, S.B., 'Paradigms lost: toward a new understanding of community participation in health programmes,' *Acta Tropica*, 1996, Apr; 61(2): 79–92.
- [70] UNDP, 'Human Development Report 2013. The Rise of the South: Human Progress in a Diverse World,' United Nations Development Programme, New York, 2013.
- [71] UNFPA, 'How Universal is Access to Reproductive Health—A Review of the Evidence,' United Nations Population Fund, New York, 2010.
- [72] Keiser, J., Utzinger, J. and Singer, B.H., 'The potential of intermittent irrigation for increasing rice yields, lowering water consumption, reducing methane emissions, and controlling malaria in African rice fields,' *Journal of the American Mosquito Control Association*, 2002, Dec; 18(4): 329–40.
- [73] Ijumba, J.N. and Lindsay, S.W., 'Impact of irrigation on malaria in Africa: paddies paradox,' *Medical and Veterinary Entomology*, 2001, Mar; 15(1): 1–11.
- [74] Donnelly, M.J., McCall, P.J., Lengeler, C., Bates, I., D'Alessandro, U., Barnish, G. et al., 'Malaria and urbanization in sub-Saharan Africa,' *Malaria Journal*, 2005; 4(1): 12.
- [75] Keiser, J., Singer, B.H. and Utzinger, J., 'Reducing the burden of malaria in different eco-epidemiological settings with environmental management: a systematic review,' *Lancet Infectious Diseases*, 2005, Nov; 5(11): 695–708.
- [76] Lwetoijera, D.W., Kiware, S.S., Mageni, Z.D., Dongus, S., Harris, C., Devine, G.J. et al., 'A need for better housing to further reduce indoor malaria transmission in areas with high bed net coverage,' *Parasites & Vectors*, 2013; 6: 57.
- [77] Kirby, M.J., Green, C., Milligan, P.M., Sismanidis, C., Jasseh, M., Conway, D.J. et al., 'Risk factors for house-entry by malaria vectors in a rural town and satellite villages in The Gambia,' *Malaria Journal*, 2008; 7: 2.
- [78] Keiser, J. Singer, B.H. and Utzinger, J., 'Reducing the burden of malaria in different eco-epidemiological settings with environmental management: a systematic review,' *Lancet Infectious Diseases*, 2005, Nov; 5(11): 695–708.
- [79] Rasella, D., Aquino, R., Santos, C.A., Paes-Sousa, R. and Barreto, M.L., 'Effect of a conditional cash transfer programme on childhood mortality: a nationwide analysis of Brazilian municipalities,' *Lancet*, 2013, Jul 6; 382(9886): 57–64.
- [80] Zeba, A.N., Sorgho, H., Rouamba, N., Zongo, I., Rouamba, J., Guiguemde, R.T. et al., 'Major reduction of malaria morbidity with combined vitamin A and zinc supplementation in young children in Burkina Faso: a randomized double blind trial,' *Nutrition Journal*, 2008; 7: 7.
- [81] Khan, K.S. and Ajmal, A., 'Women's Empowerment and its Challenges,' in *Social Determinants Approaches to Public Health—from Concept to Practice*, edited by E. Blas and A. Sivasankara Kurup, World Health Organization, Geneva, 2011: 117–28.

- [82] Grietens, K.P., Xuan, X.N., Ribera, J., Duc, T.N., Bortel, W., Ba, N.T. et al., 'Social determinants of long lasting insecticidal hammock use among the Ra-glai ethnic minority in Vietnam: implications for forest malaria control,' *PLoS One*, 2012; 7(1): e29991.
- [83] Thang, N.D., Erhart, A., Speybroeck, N., Xa, N.X., Thanh, N.N., Ky, P.V. et al., 'Long-Lasting Insecticidal Hammocks for controlling forest malaria: a community-based trial in a rural area of central Vietnam,' *PLoS One*, 2009; 4(10): e7369.
- [84] Kimani, E.W., Vulule, J.M., Kuria, I.W. and Mugisha, F., 'Use of insecticide-treated clothes for personal protection against malaria: a community trial,' *Malaria Journal*, 2006; 5: 63.
- [85] Rowland, M., Freeman, T., Downey, G., Hadi, A. and Saeed, M., 'DEET mosquito repellent sold through social marketing provides personal protection against malaria in an area of all-night mosquito biting and partial coverage of insecticide-treated nets: a case-control study of effectiveness,' *Tropical Medicine & International Health*, 2004, Mar; 9(3): 343–50.
- [86] Kim, D., 'Guidelines for Employer-Based Malaria Control Programmes,' World Economic Forum, Geneva, 2006.
- [87] Muhe, L., 'Community Involvement in Rolling Back Malaria,' World Health Organization, Geneva, 2002.
- [88] Wolff, C.G., Schroeder, D.G. and Young, M.W., 'Effect of improved housing on illness in children under 5 years old in northern Malawi: cross sectional study,' *British Medical Journal*, 2001, May 19; 322(7296): 1209–12.
- [89] WHO, 'Manual on Personal and Community Protection against Malaria in Development Areas and New Settlements,' World Health Organization, Geneva, 1974.
- [90] Khatib, R.A., Killeen, G.F., Abdulla, S.M., Kahigwa, E., McElroy, P.D., Gerrets, R.P. et al., 'Markets, voucher subsidies and free nets combine to achieve high bed net coverage in rural Tanzania,' *Malaria Journal*, 2008; 7: 98.
- [91] Beiersmann, C., De, A.M., Tiendrebeogo, J., Ye, M., Jahn, A. and Mueller, O., 'Different delivery mechanisms for insecticide-treated nets in rural Burkina Faso: a provider's perspective,' *Malaria Journal*, 2010; 9: 352.
- [92] Ruhago, G.M., Mujinja, P.G. and Norheim, O.F., 'Equity implications of coverage and use of insecticide treated nets distributed for free or with co-payment in two districts in Tanzania: A cross-sectional comparative household survey,' *International Journal for Equity in Health*, 2011; 10: 29.
- [93] Nathan, R., Masanja, H., Mshinda, H., Schellenberg, J.A., De, S.D., Lengeler, C. et al., 'Mosquito nets and the poor: can social marketing redress inequities in access?,' *Tropical Medicine & International Health*, 2004, Oct; 9(10): 1121–6.
- [94] Mushi, A.K., Schellenberg, J.R., Mponda, H. and Lengeler, C., 'Targeted subsidy for malaria control with treated nets using a discount voucher system in Tanzania,' *Health Policy and Planning*, 2003, Jun; 18(2): 163–71.
- [95] Renggli, S., Mandike, R., Kramer, K., Patrick, F., Brown, N.J., McElroy, P.D. et al., 'Design, implementation and evaluation of a national campaign to deliver 18 million free long-lasting insecticidal nets to uncovered sleeping spaces in Tanzania,' *Malaria Journal*, 2013; 12: 85.

- [96] Mushi, A.K., Schellenberg, J.R., Mponda, H. and Lengeler, C., 'Targeted subsidy for malaria control with treated nets using a discount voucher system in Tanzania,' *Health Policy and Planning*, 2003, Jun; 18(2): 163–71.
- [97] Cohen, J.M., Sabot, O., Sabot, K., Gordon, M., Gross, I., Bishop, D. et al., 'A pharmacy too far? Equity and spatial distribution of outcomes in the delivery of subsidized artemisinin-based combination therapies through private drug shops,' *BMC Health Services Research*, 2010; 10 Suppl 1: S6.
- [98] Zurovac, D., Otieno, G., Kigen, S., Mbithi, A.M., Muturi, A., Snow, R.W. et al., 'Ownership and use of mobile phones among health workers, caregivers of sick children and adult patients in Kenya: cross-sectional national survey,' *Global Health*, 2013; 9: 20.
- [99] Namagembe, A., Ssekabira, U., Weaver, M.R., Blum, N., Burnett, S., Dorsey, G. et al., 'Improved clinical and laboratory skills after team-based, malaria case management training of health care professionals in Uganda,' *Malaria Journal*, 2012; 11: 44.
- [100] Goodman, C., Brieger, W., Unwin, A., Mills, A., Meek, S. and Greer, G., 'Medicine sellers and malaria treatment in sub-Saharan Africa: what do they do and how can their practice be improved?,' *American Society of Tropical Medicine and Hygiene*, 2007, Dec; 77(6 Suppl): 203–18.

