Global malaria burden and achieving universal coverage of interventions: a glimpse on progress and impact

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Malaria continues to remain a serious public health problem in many tropical and sub-tropical countries of the World with around 225 million cases and near one million deaths every year causing serious economic and man-day losses, and trapping countries in the vicious cycle of ill health and poverty. With early success of Global Malaria Eradication Programme of 1950–60s, malaria resurfaced back in 1970s due to drug and insecticide resistance and other operational constraints leading to change and re-organization of control programmes, which helped in bringing the situation under control. With re-energized efforts of global community and implementation of Roll Back Malaria Program of WHO in 1998, malaria got global recognition and many more initiatives were launched which helped in increasing the funding for malaria control and implementation of key interventions such as insecticide treated nets, indoor residual spray, artemisinin-based combination therapy, etc. in many endemic countries and they have shown promising results as indicated by the decline in the number of malaria positive cases and number of deaths all over the globe as reported in World Malaria Report (2010). However, the challenge lies in new emerging problems such as insecticide and drug resistance, new strains, climate change-related factors and achieving the universal coverage of interventions. The momentum gained is needed to be sustained to achieve the final success.

Keywords: Disease-burden, impact-assessment, key interventions, malaria, universal coverage, World Malaria Day.

An update on the global malaria situation and impact of current interventions on lowering the burden of malaria in many endemic countries was reported by de Silva and Wickremasinghe1 on the occasion of World Malaria Day (WMD) last year, including the malaria situation in the authors’ own country, Sri Lanka, where malaria cases declined drastically and the plan was to switch over from control to elimination stage. The WMD theme for this year is ‘Achieving Progress and Impact’2. The importance of WMD becomes more significant this year keeping in view that the deadline of the target of achieving universal coverage of interventions ended in December 2010 (refs 3 and 4). Hence, it is appropriate to have a glimpse of the global malaria situation, impact of ongoing interventions and challenges lying ahead in an attempt to bring the disease down to a manageable limit.

Here it is also pertinent to highlight the genesis of WMD, which goes back to 2000, when on 25 April in Abuja, Nigeria, the Heads of 44 malaria endemic countries of Africa gathered and discussed the problem and committed to halve the malaria burden by 2010 and further halve the disease burden by 2015, and interim targets were decided to be achieved by 2005 (refs. 1 and 5). Since then, 25 April was being celebrated as Africa Malaria Day (AMD) and every year specific themes were selected on each AMD (Box 1). In May 2007, in the 60th meeting of the World Health Assembly attended by delegations from all the 192 member states of the World Health Organization (WHO), latest malaria reports were considered. It was observed that global awareness of malaria remains low despite a high death toll and cost of the disease. The World Health Assembly thus resolved that WMD shall be commemorated annually in place of AMD to provide education and understanding of malaria and spread information on year-long intensified implementation of national malaria control strategies, including community-based activities for malaria prevention and treatment in endemic areas. WMD is thus an opportunity for all countries to learn about the devastating consequences of the disease and share the stories of triumph and struggles. WMD has thus replaced the AMD, which has been commemorated since 2001, and is aimed at promoting a greater awareness of the disease. It also ensures
Box 1. African Summit 2000

Themes for Africa Malaria Day (AMD)/World Malaria Day (WMD)

AMD 2001 The first Africa Malaria Day.
AMD 2002 Mobilizing communities to roll back malaria (RBM).
AMD 2003 RBM, Protect women and children.
AMD 2004 A malaria-free future: children for children to RBM.
AMD 2005 Unite against malaria: together we can beat malaria.
AMD 2006 Get your ACT together, universal access to effective malaria treatment is a human right.
AMD 2007 Free Africa from malaria now (RBM), the slogan – leadership and partnership for results.
WMD 2008 Malaria – a disease without borders.
WMD 2009 Counting malaria out.
WMD 2010 Achieving progress and impact.

that most locally and epidemiologically appropriate strategies are effectively implemented and the target population is reached.

In 2008, WHO’s Roll Back Malaria (RBM) Partnership unveiled the Global Malaria Action Plan (GMAP), which is a global framework and clearly describes what needs to be done to meet short, medium and long-term goals of malaria control, elimination and eventual eradication. The plan comprises a three-part strategy, viz. (i) aggressive control in the malaria heartland to achieve low transmission and mortality in around 61 tropical countries with highest burden of the disease; (ii) progressive elimination from endemic margins inward to shrink the malaria map and (iii) research to find a vaccine and better drugs, diagnostics, insecticides and other tools for better management and control of malaria6,7.

The theme ‘Counting malaria out’ was selected for 2009 and 2010 so as to ensure and realize the commitment of the global malaria community to speed up control efforts to achieve the 2010 targets. The ‘counting malaria out’ campaign enforced malaria endemic countries, RBM partners and donors to put extra efforts into comprehensively tracking progress along the way to universal coverage by 2010, near-zero deaths by 2015, and thereafter gradual elimination of malaria. Counting malaria out also requires a robust health information system to ascertain the real picture of the disease prevalence.

In fact, despite earlier neglect, re-energized efforts to improve the malaria situation globally started with a series of meetings in the 1990s such as Ministerial Conference on Malaria in Amsterdam (1992) and the Dakar Conference (1997), which led to the formation of multilateral initiatives on malaria focusing on increasing malaria control activities in Africa, the epicentre of global malaria burden. Under the auspices of WHO, the RBM Partnership was established in 1998 and the Abuja Declaration in 2000 set internationally recognized targets, including halving of malaria deaths in Africa’s people by 2010 (ref. 5). Malaria was increasingly acknowledged as a cause of global poverty and was included among UN’s Millennium Development Goals (MDGs). Although MDG6 calls specifically for halting and reversal of the malaria burden by 2015, malaria also affects most of the other MDGs as well and six out of eight MDGs can only be achieved when malaria control activities are in place. Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) was formed in 2002, creating a means to finance essential commodities for malaria control with additional mechanisms through the United States President Malaria Initiatives (USPMI) in operation since 2006 in 15 high-burden African countries; the World Bank is providing additional funds in more recent years3. In April 2008, the UN Secretary General called for universal coverage by the end of 2010 to halt malaria deaths (Box 2).

There has been significant improvement in malaria situation and control interventions worldwide with these combined initiatives8, including in the malaria heartland, Africa (Figure 1). The World Malaria Report (WMR 2009)9 shows that in 2008, of the 108 malaria endemic countries, 68 had a policy of free distribution of bed nets, while 52 had adopted the WHO recommendation to provide bed nets to all age groups at risk of malaria, and 45 used indoor residual spraying (IRS) as the primary vector-control intervention. Thirty-seven countries had adopted intermittent preventive treatment (IPT) for pregnant women by 2008. Seventy-one countries had a policy that recommended parasitological confirmation of infection prior to treatment and 77 countries recommended artesinin-based combination therapies (ACTs) for treatment of falciparum malaria. However, 44 countries had banned the use of artesimin monotherapies. Overall, 61 countries are now engaged in sustained control of malaria, whereas 39 are embarked upon elimination of the disease. The report9 notes that on comparison of the number of malaria cases and deaths in 2000 and 2008, there was a decline of over 50% in 38 countries (9 in Africa and 29 outside) in 2008, whereas there was limited evidence of decrease in case load and deaths in 55 countries (33 in...
Box 2. Global malaria control

Pre-1899  Control through change in social conditions and agricultural practices.
1950–1955  Focused attempt at malaria control in specific situations.
1969–1990  Control through treatment of clinical cases of malaria.
1998  RBM – brought malaria on the global agenda, stimulated increased financial investment and with a focus on Africa till 2006 when the WHO Global Malaria Programme was launched.
2007  Bill and Melinda Gates – Eradication was resurrected.
2008  GMAP – Road map to malaria control. Plan to promote the use of key interventions (ITN, LLIN, IRS, IPT, ACTs).

Target is to achieve universal coverage by 2010.
Reduce deaths by 50% from the 2000 level and to near-zero by 2015.
Eliminate malaria by maintaining zero death.
UN Millennium Declaration set a target to halt and begin to reverse the global incidence of malaria by 2015.

EDPT, Early Diagnosis and Prompt Treatment.

Figure 1. World malaria map (source: World Malaria Report 2008).
malaria cases to be confirmed by a diagnostic test. Malaria control interventions also had significant impact on case reduction. Morocco and Turmenistan were certified by WHO in 2009 as having eliminated malaria. In 2009 the European region did not report any case of *falciparum* malaria for the first time. The report also highlights the reduction in malaria cases from 244 million in 2005 to 225 million in 2009, and number of deaths from 985,000 in 2000 to 781,000 in 2009. The 4th WMD marks a critical moment in time as the Abuja targets adopted in April 2000 should have been reached by now and universal coverage with all malaria control interventions attained. This is the year to assess the significant progress made so far to prepare a road map towards achieving near-zero death by 2015. However, the report indicates the fragility of the gains as was evident in a rise in cases in three African countries that have recorded the most impressive progress, viz. Rwanda, Zambia, and São Tomé and Principe. The reason may be the old nets which need to be replaced or retreated. Malaria also makes a come back in Sri Lanka after initial success, which is believed to be due to climate change-related factors.

Malaria Eradication Research Agenda (MalEra) has been recently launched, thus developing a comprehensive research agenda to ensure that we have the technologies to free the planet of malaria. ‘Malaria no more’ has already raised over US$ 37 million and aims to create a US$ 100 million malaria fund. Most endemic African countries have developed national plans for achieving the universal coverage targets, including monthly distribution plans of ITNs. Since malaria is a disease of poverty, its control will help reduce the gap between the poorest and least poor households. Regular use of ITNs has been shown to reduce child mortality by around 20%. According to the joint report by UNICEF and RBM Partnership entitled ‘The World Malaria Day 2010: Africa update’ showed that global production of ITNs has increased five-fold since 2004, rising from 30 million to 150 million in 2009. UNICEF, the largest global procurer of ITNs purchased more than 40 times more nets in 2009 than in 2000. From 2000 through 2009, UNICEF purchased a total of 141 million nets for malaria endemic countries. Use of ITNs by children rose from 2% in 2000 to 22% in 2008. Of nearly 350 million ITNs needed to achieve universal coverage, nearly 200 million were delivered to African countries by manufacturers during 2007–2009, and are available for use. Results from USPMI, which support National Malaria Control Programme IRS activities in its focus countries indicate that in 2008 alone, nearly 25 million people were protected as a result of these efforts. There has been a recent and rapid rise in ACT procurement since 2009 from 0.5 million in 2001 to 160 million in 2009 (refs 4, 12). Affordable Medicines Facility for Malaria (AMFM) managed by Global Fund has been launched to scale up access to ACT. The AMFM will support countries with the monitoring of drug resistance and pharmaco-vigilance; the first phase of AMFM will be rolled out in 11 endemic countries. Worldwide Anti-Malaria Resistance Network (WARN) is a global collaboration generating quality assured and timely information to track the emergence and spread of resistance.

Outside Africa, it is the thickly populated South East Asia where 30% of the global population is estimated to be at risk of malaria, of which India contributes most cases (80%). In the Asia-Pacific region, malaria is present in 20 countries/territories, including five in South Asia, viz. Bangladesh, Bhutan, India, Nepal and Sri Lanka. Ten out of 11 countries of WHO South East Asia region are endemic for malaria, but vast majority of the cases occurs in India and Bangladesh. While Bhutan, Nepal and Sri Lanka reported a reduction of more than 50% cases between 2000 and 2008, the reported reduction in India was greater than 25% but less than 50%. In 2006, the WHO Regional Office for SE Asia published a revised strategy for malaria control which focuses on local specific measures based on ecological, environmental and behavioural determinants prevalent in the area and the inter-sectoral response to malaria with full engagements of government ministries, NGOs, civil society and private sector.

India has the largest population in the world at risk of malaria, with 85% people living in malarious zones. The National Vector Borne Disease Control Programme (NVBDCP) is an umbrella programme for the prevention and control of vector borne diseases, including malaria and is an integral part of India’s National Rural Health Mission (NRHM). The activities of NVBDCP are in tandem with National Health Policy (2000) and NRHM goals as well as to focus on MDGs of halting and reversing the incidence of malaria by 2015 (ref. 14). The programme has also been supported by the World Bank and GFATM in highly endemic areas (Box 3).

In India, about 65% of all malaria cases are reported from Orissa, Jharkhand, Chhattisgarh, Madhya Pradesh, West Bengal and states of the North East. High burden populations are ethnic tribes living in difficult, inaccessible forested pockets of the above-mentioned states, with 20% of the population contributing 80% of the cases. There has been significant improvement in malaria situation over the years. The number of malaria cases declined from 2.08 million to 1.56 million during 2001–2009 and *Plasmodium falciparum* (Pf) cases from 1.00 million to 0.84 million. Annual Parasite Incidence (API) has consistently come down from 2.12 per thousand to 1.36 per thousand in 2009. The number of districts with API > 2 continuously decreased from the year 1995 to 2009. The country Slide Positivity Rate (SPR) has declined from 2.31 to 1.51 and Slide *falciparum* Rate (Sfr) from 1.11 in 2001 to 0.81 in 2009. However, the number of deaths has been fluctuating around 1000 (ref. 16). In Sonapur PHC, Assam, a declining trend in Pf from 70% in 1991 to 44%
Box 3. Chronology of malaria control in India

Before 1940s No organized National Malaria Control Programme (NMCP).
1945 Insecticide properties of DDT were identified.
Before 1953 Estimated malaria cases in India – 75 million and deaths, 0.8 million.
1953 Launching of the NMCP.
1958 Launching of the National Malaria Eradication Programme.
1966 Cases reduced to 0.1 million.
Early 1970s Resurgence of malaria.
1976 Malaria cases reached 6.46 million and deaths also increased (highest in post-DDT era, the reason thought to be the development of resistance in vectors).
1977 Modified Plan of Operation (MPO) implemented.
1994 Resurgence of malaria in some states.
1997 World Bank-assisted Enhanced Malaria Control Project.
2005 Global Fund-assisted Intensified Malaria Control Project (IMCP) – 100 million population in 106 districts in 10 states being covered from 2005 to 2010.
2006 ACT introduced in areas showing chloroquine-resistant Pf malaria.
2008 ACT extended to high-risk Pf districts covering about 80–90% infection.
2010 As per revised drug policy (2010), 1st line treatment for all confirmed Pf cases is ACT.

Figure 2. Trend of malaria cases and deaths 2001–2010 (Source: National Vector Borne Disease Control Programme; http://www.nvbdcp.gov.in). (Figure shows that the malaria cases have consistently declined from 2.08 to 1.49 million during 2001–2010. Similarly, Plasmodium falciparum (Pf) cases have declined from 1.0 to 0.77 million during the same period. Less than 2000 deaths were reported during all the years within this period with a peak in 2006, when an epidemic was reported in the NE states.)
(LLINs) have also been introduced in high-risk areas. These nets are more effective as they have insecticide incorporated into the fabric during the manufacturing process, they do not require frequent reapplication and possess long efficacy of at least 4–5 years. Artesunate plus sulphadoxine Pyremethamine combination was initially rolled out in 67 P. falciparum-endemic district of the NE states and 50 predominant districts of AP, MP, Chhattisgarh, Jharkhand and Orissa apart from chloroquine-resistant foci in the country. Now according to the Revised Drug Policy (2010), the first line of treatment for all confirmed P falciparum cases is ACT. Apart from these interventions, other measures such as source reduction, use of larvivorous fishes and community awareness are also being attempted in feasible areas. GFATM-assisted intensified Malaria Control Project has been implemented from 2005 to 2010 in 10 high endemic states covering a population of 100 million in 106 districts. The results have been quite encouraging.

Malaria control has always been a challenging and daunting task, and new challenges make its control a difficult enterprise. The development of insecticide resistance in mosquito vectors and drug resistance in malaria parasite are known problems and the focus has been on the development of an effective and safe insecticide, and new drugs. The pyrethroids were developed in the 1970s and remain the only insecticide recommended for use in mosquito nets. Pyrethroid resistance clearly threatens the control and elimination initiatives. The development of new insecticides is thus a priority. Innovative Vector Control Consortium (IVCC) funded by the Bill and Melinda Gates Foundation is an opportunity to work in this area. Artemisinin resistance in Plasmodium falciparum malaria has emerged in the Thai–Cambodia border. This is the same area where chloroquine resistance arose 50 years ago and spread to Africa and caused havoc. If artemisinin resistance spreads widely, it will derail the current ongoing initiatives. Artemisinin monotherapy, counterfeits and substandard artemunate have been found to be used in many African countries, which also needs to be stopped. Poor quality and counterfeit medicines not only jeopardize the lives of the patients, but also have the potential to fuel drug resistance. Alternative approaches such as ITNs, environment-friendly control methods like the use of larvivorous fishes, source reduction, health education, community involvement and use of new combination drugs like ACTs have shown promising results and should be used judiciously. The challenge in the development of malaria vaccine lies in the complexity of the Plasmodium parasite. P falciparum has about 6000 genes; hence it is difficult to induce a protective immune response. However, there is some glimmer of hope and RTS, S plus adjuvant AS01 vaccine developed by GlaxoSmith Kline Pharmaceuticals Ltd with support from the Malaria Vaccine Initiative is a first-generation pre-erythrocytic stage vaccine with modest and time-bound limited efficacy. It entered phase-3 clinical trials in 16,000 children in 11 African countries in May 2010 (refs 3, 22, 23). Malaria vaccine technology road map launched in 2006 provides a coherent framework for aligning resources, facilitating partnerships and identifying pathways to a viable malaria vaccine. Malaria Atlas Project, a collaboration between Kenya Medical Research Institute and the University of Oxford, and funded by Welcome Trust, is involved in the production of a map of global burden of malaria and its risk to help rationalize control operations. The infection of P. knowlesi in humans in Kapit Division of Sarawak, Malaysian Borneo is also posing a new challenge and recently, the identification of a new species of Anopheles gambiae which is more susceptible to malaria parasite is likely to pose a new problem.


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