Malaria Epidemiology and Control in South-East Asia

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Malaria is the most important tropical disease that causes enormous economic loss to mankind. Malaria is an acute disease caused by parasites in human blood, namely *Plasmodium*. Four human malaria parasites were found among which *Plasmodium falciparum* is the most common species and may lead to mortality. The disease is transmitted by anopheles mosquitoes. Globally, there are some 60 anopheles mosquitoes that can transmit the disease. There is a great diversity of vector bionomics which is a determinant factor of malaria transmission (i.e. type of breeding sites, biting habit, host preference, etc). Malaria transmission dynamics is highly affected by socio-economic and environmental factors.

It is estimated that there are approximately 300 millions clinical malaria cases worldwide. It is also estimated that malaria claimed more than one million deaths annually at the global level. 90% of malaria deaths occur in Sub-Sahara Africa whereas 10% of malaria deaths occur in Asia, South, Central Americas and other areas. The vulnerable groups that have greatest risk of deaths due to malaria are children under five years of age, pregnant women and non-immunes. In addition to the human toll, malaria is considered by health economists to be one of the four most common causes of poverty. People exposed to the infection may spend as much as 25% of their household income on malaria-related expenses.

Malaria remains one of the most serious health problems in South-East Asia Region. Every year 2.3 million cases and 4200 deaths are reported with an estimation of 18-20 million cases and 100,000 deaths. Although malaria is a major public health problem and malaria control programmes have been in place for decades the actual disease burden is unknown. This is partially due to weak surveillance and reporting system, high proportion of malaria cases seen in private sector, etc. Malaria is endemic in all countries of the WHO South-East Asia Region except Maldives where malaria transmission has ceased since 1984. There have been achievements in reduction of disease morbidity and mortality since 1950s when malaria control programmes were initiated in all countries.

In South-East Asia, malaria epidemiology is different from that in Sub-Sahara Africa. There are several ecological types of malaria, for instances: urban malaria (in India), forest malaria (in Thailand, Myanmar, etc.), coastal malaria (Indonesia, Southern Thailand, etc), malaria in developmental projects, malaria in rice field, border malaria, malaria in war zone and political disturbance areas), etc. The most important determinant factor is mosquito vector. Epidemiological characteristics of malaria in South-East Asia are summarized as follows:

- High prevalent *P. vivax*: Unlike Sub-Sahara Africa, *Plasmodium vivax* malaria is prevalent and accounts for 50% of total malaria cases. Although vivax malaria is non-fatal and does not match with *P. falciparum* in terms of mortality but economic loss due to the disease is enormous. *P. falciparum* is on the rise and nearly 50% of all malaria cases in the Region are caused by *P. falciparum*. Regarding *P. vivax*, little is known about this parasite species. There are long and short incubation period

vivax strains. The long incubation period vivax is prevalent between the international border between the Republic of Korea and Democratic People Republic of Korea and in some eastern provinces of PR China. The short incubation period vivax that exhibit frequent relapses (i.e. Chesson strain) is common in South-East Asia.

- Drug resistance: Drug resistance is well known in South-east Asia. Falciparum resistance to chloroquine and sulfadoxine/pyrimethamine has been reported in almost all countries in the Region, at different degrees of resistance. Mefloquine resistant *falciparum* has been reported in Thailand and Myanmar which are considered foci of multidrug resistant *falciparum.* Rising trends in the proportion of *P. falciparum* were observed in several countries and it is closely related to the prevalence and rapid spread of drug resistance. Besides, well known *falciparum* resistance to various antimalarial drugs, resistance of *vivax* malaria to chloroquine has been widely reported in Indonesia. India and Myanmar reported focalized chloroquine resistance vivax.

- Population at risk: In Asia, malaria problem exists among ethnic and tribal groups, migrant population, other remote populations and the urban poor. These are “hard-to-reach” population. In some areas, risk of contracting malaria is related to occupations and human behaviors. However, risk of contracting malaria is not equal even in population who live in the same geographical areas. There is a need to identify these populations at risk and understand clearly the epidemiology of malaria among these groups so the appropriate interventions are better targeted. Their behavioral risk factors in relation to malaria need to be identified. Accessibility of these groups to health care, as well malaria treatment and prevention is critical to the success of malaria control programme. Malaria problem in children under five and pregnant women is less prominent, as compared to African settlings. However, the burden of malaria in pregnancy in South-East Asia is unknown. Several studies conducted in SEA Region indicated that although prevalence of malaria in pregnancy was not enormous but this problem was not uncommon and required more attention.

- Insecticide resistance: During 1950s when most countries initiated malaria control programmed, DDT was widely used for house spraying (indoor residual spraying). DDT was highly effective and the spraying operations together with highly efficacious drug (chloroquine) successfully brought down the disease incidence to a certain level that there were high hopes that malaria could soon be eradicated. Subsequently vector resistance to DDT and other chemicals emerged in several countries, particularly India.

- Frequent malaria outbreaks: With continuous efforts of the countries and support form WHO and other international agencies over the past 6 decades, significant progress have been made in reduction of mortality and morbidity due to malaria. Unfortunately, this success could not be sustained. Malaria outbreaks were reported in several countries. Resurgence of malaria was reported from areas where malaria had been eliminated, e.g. border between DPR Korea and ROK. Sri Lanka experienced a major outbreak (i.e. resurgence of malaria) soon after the successful malaria eradication programme in 1967-1968. The country took several decades before the incidence of malaria could be brought down to a very low level at present until it could again aim for malaria elimination. Focal outbreaks were reported in several countries such as Thailand, Myanmar and Indonesia over the past 5 years and

recently in Nepal in 2006. Malaria today is totally different from malaria in the past. The disease has great variation and is very dynamics. The frequent ecological imbalances created by human activities heavily affected the disease transmission and lead to epidemics.

Malaria profile in SEA Region, 2005

Country	Population at Risk	Blood Exam	Aber (%)	Positives	SPR (%)	API/ 1000	Pf Cases	SfR (%)	Pf (%)	Deaths
Bangladesh	108,051,000	741,638	0.69	48,121	6.49	0.45	37,754	5.09	78.50	481
Bhutan	468,000	60,152	12.85	1,825	3.03	3.9	853	1.42	46.74	5
DPR K	11,901,000	1,315	0.1	6,728	59.46	0.57	0	0	0	0
India	1007,189,000	105,369,037	9.98	1,808,217	1.72	1.80	798,456	0.08	44.16	940
Indonesia	107,785,182	1,215,294	1.13	433,326	35.66	4.02	127,290	10.47	29.38	88
Myanmar	39,015,549	424,652	1.09	151,508	35.68	3.88	114,671	27.0	75.69	1707
Nepal	19,400,000	185,372	0.93	4,962	2.68	0.25	879	0.47	17.71	10
Sri Lanka	4,217,377	973,693	23.09	1,640	0.17	0.39	133	0.01	8.11	0
Thailand	44,091,50	2,524,788	5,73	29,782	1.08	0.62	13,311	0.53	48.61	71
Timor Leste	853,800	98,994	11.59	43,857	49.84	47.33	27,318	3.20	64.20	71
SEAR	1,342,972,458	111,604,935	8.31	2,529,966	1.88	2.26	1,120,755	0.08	44.36	3,373

Malaria control programmes

There are several technical and managerial problems that hamper success of the control programmes. Malaria situation in the Region seems to be relatively static over the past five years. The following are key issues regarding malaria in SEA Region.

- Dynamics of malaria transmission due to rapid socioeconomic and ecological changes
- Focal outbreaks reported in several countries
- Underreporting of malaria cases/deaths
- Presence of *P falciparum* and *P vivax* drug resistance
- Deteriorating drug resistance situation that necessitates drug policy revision
- Mosquito vectors resistance to insecticides
- Population at risk of malaria and how to reach them

Malaria in India

Throughout history of malaria control in the country, various methods have been used. The country has been controlling malaria with modern tools (house spraying with DDT and chloroquine) since 1950s. During 1950s India accounted for 75 million malaria cases, and 800,000 deaths a year. As a result of the eradication programme, in 1964, there were only 100,000 reported cases with no deaths. At present, malaria in India accounts for some 76% of total reported cases and 22% of total reported deaths in the

Region. The country reports approximately 2 million cases and a thousand deaths annually. Proportions of *falciparum* malaria have been constantly increasing since 1970s (10% in 1970 to 50% in 2000s). These disturbing trends indirectly reflect growing drug resistant *falciparum*.

Revised Malaria Control Strategy for SEA Region during 2006-2010 by WHO

There are several new tools for treating and controlling malaria such as insecticide-treated nets, long-lasting insecticidal nets, rapid diagnostic tests, artemisinin-based combination therapy, rectal artesunate, etc. However, as the delivery of these tools to population at risk of malaria is not always easy, it is usually seen that coverage of interventions is low. The managerial problems faced by the malaria control programmes complicate the issues. The SEA Region has developed a Revised Malaria Control Strategy in consultation with malaria programme managers and developmental partners in the Region. Through concerted efforts in the implementation of the revised malaria control strategy the Member countries aim to reduce malaria morbidity and mortality by 50% of the level in 2000 by 2010 and achieve the Millennium Development Goals by 2015. (WHO SEARO Report)

The key elements of the revised strategy are:

1) *Reform approaches to programme planning and management;*

2) Revamp surveillance and strengthen monitoring and evaluation;

3) Scale up coverage and proper use of insecticide-treated mosquito nets;

4) Target interventions to risk groups; and

5) Scale up control of P vivax malaria.

Malaria control programmes need to be reformed

New ways to estimate the disease burden of malaria must be established. Outdated surveillance techniques used during the eradication era need to be replaced by carefully-designed surveys. Practical and user-friendly indicators should be introduced and replace the several confusing sets of existing indicators. Programme management should be strengthened. Malaria control programmes should be responsive to the dynamics of evidence-based interventions. Malaria control programmes need to be decentralized in the absence of a strong health system, and revitalization within the context of existing health systems. Capacity building in programmes planning and management will be critical. Operational research capacity should be an integral part of the programme. Additional staff with appropriate technical knowledge technical knowledge needs to be recruited and this would only be possible through financial resources.

Identification of vulnerable populations

It is estimated that 85% of the malaria problem exists among ethnic minorities, other remote populations and the urban poor, as in India. There is a need to identify these

populations at risk and understand clearly the epidemiology of malaria among these groups so that appropriate interventions are better targeted. A standardized definition of population at risk needs to be developed. In addition, their behavioral risk factors in relation to malaria need to be identified. This requires the involvement of experts in sociology such as social scientists and social anthropologists.

Focusing on *P. vivax*

The enormous burden imposed by *P. vivax* malaria in Asia and the adverse health and socio-economic and developmental consequences need to be understood and communicated. There is currently insufficient knowledge on its epidemiology, course, impact, response to drugs and effective means of control.

Balance of prevention and treatment

As the Region is facing high proportion of *P. vivax* malaria, malaria control programmes should shift emphasis from a mainly treatment-oriented approach to a well-balanced combination of prevention and treatment.

Integrating malaria into healthy public policy

Prevention of malaria should be considered as a public health issue and adopted as an integral part of Healthy Public Policy. Communities need to be mobilized for the implementation of Integrated Vector Management (IVM) strategies incorporating effective risk assessment and management. In recent years, Healthy Public Policy has emerged as a means for promoting equity-focused social responsibility for health and safeguarding people from negative health impacts of development policies, programmes and projects. Healthy public policies are intended to create supportive environments, develop individual skills, strengthen community action, and reorient health services. The Jakarta Declaration on Health Promotion in the 21st century (1977), and the Adelaide Recommendations on Healthy Public Policy (1998), place high priority on health and equal access to health services to all sections of the society, particularly the disadvantaged.

Integrated vector management strategy

Integrated Vector Management (IVM) strategy has been promoted based on selective application of various control measures which are determined by the epidemiological situation of malaria, vector biology and the socio-behavioral characteristics of the community. The SEA Region has experience based on Integrated Pest Management (IPM) in agriculture, which can be emulated where relevant. The IPM programme can benefit IVM in many ways, for example, mosquito management in rice fields, water management and judicious use of insecticides in agriculture. Community mobilization for implementation and a multisectoral approach are key elements of success.

Insecticide-treated nets and indoor residual spraying

Insecticide-treated mosquito nets (ITNs) have been proven to be very effective, well-accepted and practical in several countries. However, coverage is very low at about 10%. In order to scale-up malaria control in the Region, it is critical that ITN coverage is increased to cover at least 80% of population at risk. It is essential that national authorities, other government agencies, NGOs, private sector and civil society are convinced about the importance of promoting increased coverage of ITNs. Indoor

residual spraying (IRS), which remains the mainstay of vector control measures in SEA Region, should be retained and applied on a selective and complementary basis.

Partnerships and multisectoral approach

Malaria is not just a public health problem but a disease retreated to development, social ecological and environmental changes. Revamping the malaria control programme, with an emphasis on partnership and multisectoral collaboration within the health and other sectors, is essential if the programme is to be more responsive to the challenges posed by changing ecology and environments.

Raising visibility of malaria in SEA Region

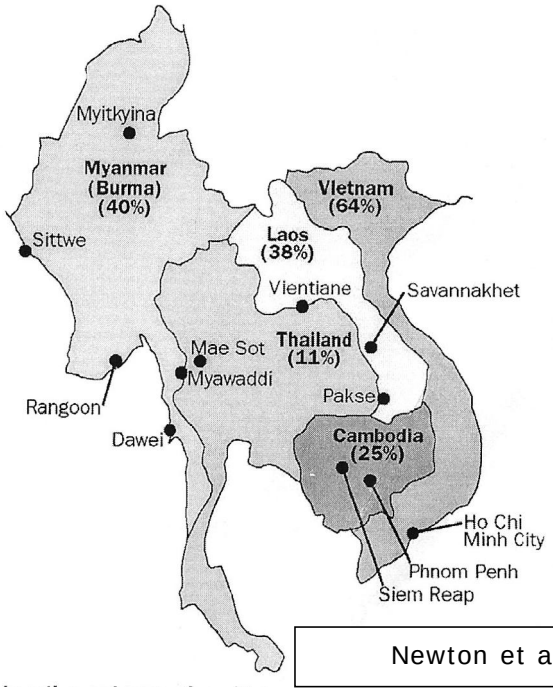
Malaria in SEA Region is different from malaria in Sub-Sahara Africa. Although malaria mortality in Asia is low compared to Africa, the burden is very high and the economic loss enormous. The Asian malaria problem has little international visibility. The disease does not receive sufficient attention and resources for the control programme are inadequate. Asian malaria needs repositioning in the global context. Strong advocacy actions should be initiated and targeted at different audiences: political, national and international, partner agencies, and civil society.

Lessons learned from Roll Back Malaria Mekong

1. Efforts against counterfeit/substandard antimalarial drugs : Greater Mekong Sub-region (GMS) consists of 6 countries that shared the Mekong River. It consists of Cambodia, Lao PDR, Myanmar, Thailand, Vietnam and PR China (Yunnan Province).

Multi-drug resistant *P. falciparum* is one of the important challenges to the achievement of Malaria Control in the GMS. There has been substantial evidence on counterfeit/ substandard drugs in the Region. In particular, counterfeit/substandard anti-malarial drugs were found in both public and private sectors in various areas especially at the international borders in the GMS (Newton et.al, WHO Report). The presence of counterfeit/substandard drugs obviously deteriorates health status of the population of the GMS.

Artemisinin and its derivatives are new drugs that have been introduced into the GMS countries for more than a decade to combat against the multi-drug resistant parasites. It is one of the effective tools for malaria control today. Some evidences regarding counterfeit/substandard antimalarial drugs: 38% of artesunate samples bought in shops in 5 Mekong countries were fake and contained no artesunate; forged holograms were found in Cambodia and Vietnam, while the others had no hologram. The prevalence and extent of counterfeit/substandard drugs and complicated by misuse of drugs although are not fully known but presumed to be reasons for persistent high mortality rates regardless of provision of early diagnosis and treatment.



Newton et al, 2001

There have been several development activities initiated by WHO and other partners in combating counterfeit/substandard drugs (all drugs in general); assessment of the problem of counterfeit drugs through rapid surveys. Participating agencies besides malaria control programmes in these countries were the national Food and Drug Administration (FDA), the United States Pharmacopeia, USAID, AUSAID, SIDA, Wellcome Trust Research Unit, European Union, etc. This is a bi-regional collaboration between WHO Regional Offices of the Western Pacific (WPRO) and the South-East Asia (SEARO). Simplified and user-friendly tools for detecting counterfeit/substandard drugs were introduced, i.e. Minilab ® test kit, Dye test for detection of Artesunate, etc. National capacity was strengthened for monitoring of antimalarial drug quality (systematic surveys for drug samples collection and testing). Recently the national capacity on laboratory services on drug testing was built up and strengthened. In this bi-regional collaborative project, the WHO collaborating center on drug analysis in Bangkok served as regional reference laboratory. As the production and dissemination of counterfeit drugs are criminal issues, the project has progressed into the next phase which is law legislation and advocacy against counterfeit drugs. Regarding substandard drugs, the main strategy is to assist local drug manufactures in the Region to improve the drug production towards the good manufacturing practice (GMP) which is a long term goal.

2. IEC project targeted at ethnic groups along the international borders in GMS countries : As tribal population is at risk of malaria in several countries in SEA and the Greater Mekong Sub-region (GMS), there have been several efforts to map out and profile these groups and involve social scientists in order to understand their behavioral risk factors so that interventions can be properly targeted. Some common problems are

language difficulties and illiteracy that require special attention. Proper IEC (Information, Education and Communication) Strategy is the key for success in controlling diseases among this group.

The Asian Development Bank (ADB) agreed to provide financial support through WHO to the GMS countries, through the Project Strengthening Malaria Control for Ethnic Minorities in the GMS. The Project put emphasis to enhance national capacity to improve health among ethnic minority and hard-to-reach population related to malaria prevention and control. This project is a continue effort based on the success and outcomes of the ADB/WHO Mekong Malaria IEC Project implemented since November 2002.

The Strengthening Malaria Control for Ethnic Minorities in the GMS Project aims to reduce malaria burden among poor ethnic minority groups living in malaria-prone areas. The specific objectives are to (1) build capacity of national malaria institutions to develop acceptable, affordable and effective strategies for malaria control for ethnic minorities; (2) scale-up malaria control efforts for these populations through national Malaria Control Programmes; and (3) promote regional collaboration for malaria control. Outcomes of this project were prototypes of suitable IEC materials developed by project teams in collaboration with malaria ethnic communities. There were pre-tested in ethnic communities. The national capacity in community analysis, participatory action research and social science, is strengthened.

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