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How Malaria is Practically Eradicated in Malaysia – A Reminiscence

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

In 2010, 99 countries reported current malaria transmission, causing an estimated 219 million cases and 660,000 deaths, the deaths mostly in young children in Africa. In Malaysia, the country started on a Malaria Eradication Programme, MEP, in the third quarter of the past century. The MEP here is very much a success in the reason that the current rate (incidence) is very low, sporadic cases in Kelantan, Selangor, Pahang, Perak and Sarawak (mostly immigrants, imported-cases and illegal-loggers) - the disease practically eradicated except in Sabah where the disease remains endemic in the interior, although here much of monkey-malaria (*P. knowlesi*) spread to human. Vector-control played a big part in the MEP - the Anopheles spp breed in a wide variety of habitat depending on the species: drains and open pools of water (including seepage rain-water) had to be regularly and routinely sprayed with oil, and large unused-pools drained. But, much had been achieved by residual-spraying of homes with insecticide, and the use of mosquito-net. Residual-spraying is a big success in the reason that the Anopheles spp habitually settle (rest) on the walls after flying over to homes before starting on feeding. Residual-spraying only requires done from time to time by a team of workers. Additional protection, achieved through community-education are: wearing fully covering light-coloured clothes in the evenings. Presently, mosquito-repellents can help - but these were unavailable in the MEP time. Chemoprophylaxis (i.e. the anti-malarial drugs) should be advised for those travelling to and through the endemic area. Armed-

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forces and Police-personnel were by regulation required to take chemoprophylaxis, besides such Government work. One additional very important success measure had been Active Case Detection, ACD, and Passive Case Detection (PCD) using slide-microscope followed by prompt treatment. Such ACD & PCD reduced the size of the human-reservoir from which transmission happened.

Keywords: Malaria Eradication Programme (MEP); Anopheles spp; oil-spraying; drainage; residual-spraying; community-education; chemoprophylaxis; active case detection; passive case detection.

1. INTRODUCTION

In 2010, 99 countries reported current malaria transmission, causing an estimated 219 million cases and 660,000 deaths, the deaths mostly in young children in Africa [1–4].

In Malaysia, the disease had been a scourge throughout the country's history affecting the country in every part and every manner.

Malaria had been reported in Malaysia even before the 1900s. In 1990, 50,500 cases had been reported [5–7]. In the year 2000, the number of reported-cases reduced to 12,705 cases; in 2012, totaling 4,725 cases which are found a 63% reduction. The rate has declined to not more than 1:1,000 population from the time of 1998. The number of malaria-death reduced from 43 in 1990 to 35 in 2000, and 16 in 2012. The mortality rate due to malaria had been around 0.001 per 1,000 population from 2006. All figures and rate are inclusive of *P. knowlesi*. The first case of *P. knowlesi* had been reported in 1965. In 2012, *P. knowlesi* totaled 38% (1813 cases) of all that is the highest among all Plasmodium spp. in this nation [8–10].

The early fight against the disease started before the country's independence, spearheaded by the Institute of Medical Research with ~~the~~ effort from the Health Ministry, the Public Work Department, the University of Malaya and various relevant Government-agencies. Malaysia started on a Malaria Eradication Programme MEP in 1967, in line with the WHO's Global MEP [5–7].

2. PRESENT EPIDEMIOLOGY

The MEP here is very much a success in the reason that the current rate (incidence) is very

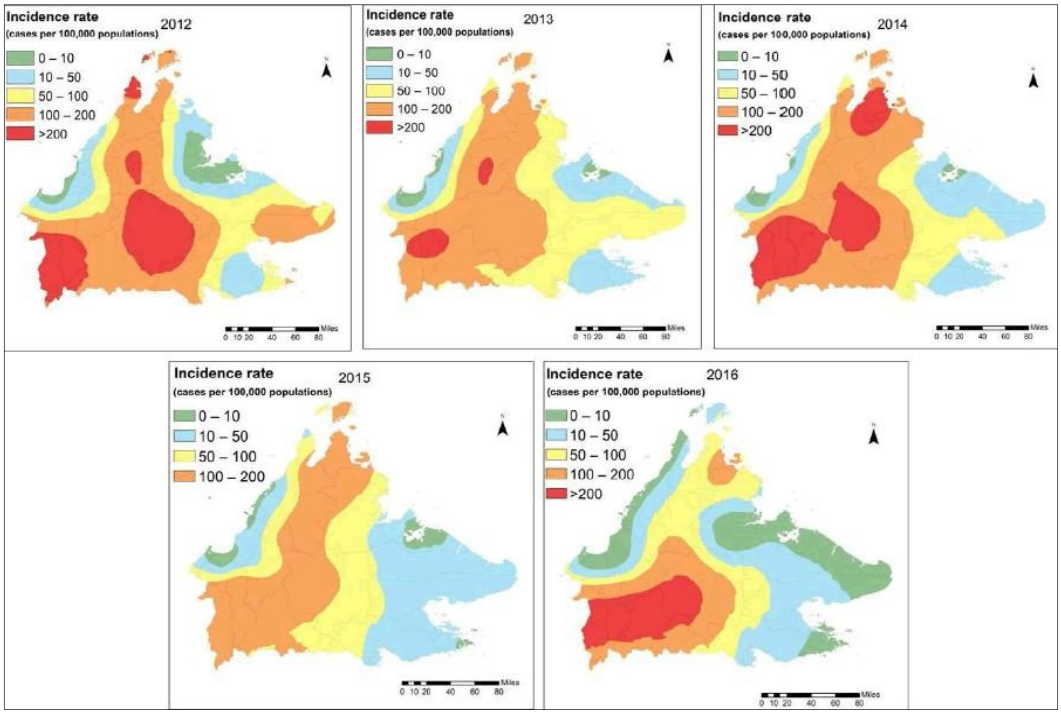

Fig. 1. Malaria infection-rate in Sabah-state, 2012 - 2016

low, just sporadic cases in Kelantan, Perak, Pahang, Selangor and Sarawak state (mostly immigrants and illegal-loggers) - the disease practically eradicated except in Sabah where the disease remains endemic in the interior of the state, although here much of just monkey-malaria (*P. knowlesi*) spread to human [8–10].

Of the 4,725 reported-cases in 2012, 61.6% had been human-malaria with a significant proportion (38.4%) zoonotic. In human malaria, *P. vivax* stood at 50.2%, followed by *P. falciparum* (30.7%), *P. malariae* (16.7%) and mixed infection (2.2%) [8–10].

Of the 2051 human-malaria cases (70.4%) had been indigenous-cases and a small proportion of 861 cases (29.6%) had been imported-cases [8–10].

Of the indigenous-malaria 74.0% had been reported from Sabah followed by 15.9% from Sarawak and 10.1% from Peninsular Malaysia. Of zoonotic malaria, 56.9 % had been reported from Sarawak followed by 23.3% from Peninsular Malaysia and 19.8% from Sabah [8–10].

In Peninsular Malaysia, Selangor, Pahang, Kelantan and Perak reported around 100 cases in the year 2012, mainly males. Plasmodium falciparum is still the predominant species at 69.6%. The case-fatality rate in 1990 had been 0.09%. There had been 43 deaths all of which had been attributed to cerebral malaria [8–10].

3. MALARIA IN THE PREGNANT AND CONGENITAL MALARIA

Around 8.5% of the female patients had been pregnant, and malaria had been found to cause much morbidity and mortality among the pregnant [11]. Children beneath the age of 5 totaled 2.5% of all cases. Those most affected had been found in the age group of 20 – 29 year (25%). Around 61.9% of the cases had been found between the age of 20 and 49 years [8–10].

Congenital malaria is not commonly found. It could be acquired by the transmission of the parasite from mother to child during pregnancy or child-birth. The rate (incidence), varying from 0.3 to 33% is reported. Congenital malaria from *P. vivax* has bigger incidence in Asia, but infection from *P. falciparum* is commoner in African countries. Most newborn present with symptom between 10 and 30 days of age (range: 14hr to several months of age). The clinical sign and symptom of neonatal malaria include anaemia (77%), fever (74%), liver and spleen enlargement (68%), poor feeding/lethargy/irritability, jaundice and severe thrombocytopenia. Congenital malaria could seem like neonatal-sepsis and need to be considered in the differential diagnosis of neonatal-sepsis. All newborn of the pregnant with malaria should be screened to exclude congenital malaria [8–10].

4. SEVERE MALARIA

Severe malaria usually manifests with either of the following or in combination: coma (cerebral malaria), metabolic acidosis, severe anaemia, hypoglycemia, acute renal failure or acute pulmonary oedema. In severe malaria, the case-fatality rate in people receiving treatment is typically 10–20%. But it had been left untreated, severe malaria is fatal in the majority of cases. Cognitive-impairment in the future is also commonly seen in children with cerebral malaria [9,12].

In a patient with malaria-infection, the presence of one or more of the following clinical or laboratory findings classifies the patient as suffering from severe malaria (Table 1) [9].

5. SUCCESSFUL CONTROL & PREVENTION METHODS IN MALAYSIA

Thus, malaria in Malaysia had been practically eradicated as aimed [13]. What is the reason for the success case of MEP in Malaysia?

Primary prevention is seen in two areas: Health promotion and specific protection [14]. In the case of the MEP, vector-control played a big part - the *Anopheles* spp. breed in a wide variety of habitat depending on the species: drains (mostly open storm-drains and culverts) and open-pools of water (including seepage rain-water) had to be regularly and routinely sprayed with oil, and large unused-pools drained - both by Public Work Department (PWD) work and health work [8–10].

But importantly, much had been also been achieved by residual-spraying (the walls) of homes/houses with insecticide (much of it, cheap DDT, which is still allowed today in the reason of health), and the use of mosquito-net (there did not seem a need to impregnate such nets with insecticide, but needed to be put up at dusk itself) [8–10,15]. Holed-nets needed prompt repair.

Table 1. Clinical features and laboratory findings in severe & complicated malaria*

Clinical features	• Impaired consciousness or irrecusable coma • Prostration • Failure to feed/ not tolerating orally • Convulsion • Deep breathing, respiratory distress (*acidotic breathing*) • Circulatory collapse or shock, systolic blood pressure < 90 mm Hg in adults and < 50 mm Hg in children • Clinical jaundice and evidence of other vital organ dysfunction • Hemoglobinuria • Abnormal spontaneous bleeding • Pulmonary oedema (*radiological*)
Laboratory findings	• Hypoglycemia • Metabolic acidosis • Severe normocytic anaemia • Hemoglobinuria • Hyper-parasitemia • Hyper-lactatemia • Renal impairment

**Source: Health Ministry Malaysia, 2014*

The *Anopheles* spp. bites mostly at night (mostly while sleeping) and some at dusk. Residual-spraying is a big success in the reason that the *Anopheles* spp. habitually settle (rest) on the wall after flying over to homes prior to (the females) starting on feeding [8–10,16]. Residual-spraying means the insecticide remains on the wall a length of time after spraying - thus, residual-spraying only requires done from time-to-time (in cycles) by a team of work.

Additional protection, achieved through community-education are: wearing fully-covering light-coloured clothes in the evenings. Presently, mosquito-repellents can help - but these were unavailable during the MEP-time [8–10].

Chemoprophylaxis (i.e. the anti-malarial drugs) should be advised in those travelling to and through the endemic area. In the past and during the MEP Armed-forces and Police-personnel had been by regulation required to take chemoprophylaxis, besides such Government work [8–10].

Chloroquine, proguanil, mefloquine, and doxycycline are suppressive-prophylactic - they are only effective at killing the malaria parasite once it has entered the erythrocytic-stage (blood-stage) in the life-cycle, and thus have not any effect until the liver-stage is complete. Thus, these prophylactic must continue to be taken a month still after leaving the area of risk [8–10].

Causal-prophylactic targets not only the blood-stages of malaria but the initial liver-stage also - the user may stop taking the drug seven days after leaving the area of risk. Atovaquone/ Proguanil (Malarone) and primaquine are the only causal-prophylactic in current use [8–10].

One additional very important success-measure had been Active Case Detection, ACD, (on healthy people, by active incursions of little-trained medical-personnel bringing back labeled blood-slides to examine under microscope) and Passive Case Detection (PCD) (those coming to medical/health centers suspected of malaria) using slide-microscope (blood-film, but here today rapid serological-tests are also available) followed by prompt treatment using anti-malarial drugs. Such ACD & PCD reduced the size of the human-reservoir (the infected and diseased hosts) from which transmission happened [8–10].

A classical-case of little-trained personnel helping in had been the training of long-house village-headmen in Sarawak found trained in obtaining preparing blood-film slides to be collected by health-officers [14].

Common anti-malarial used during the MEP were chloroquine, primaquine, sulfadoxine-pyrimethamine (Fansidar), mefloquine and quinine (particularly in severe malaria including cerebral malaria) [8–10].

Although here in Malaysia, the concept of eradication had changed to one of control in the early 1980s, anti-malaria activities had remained the same. But, additional supplementary-activity such as the use of the impregnated bed-net, and the Primary Health Care approach, became introduced in the malarious and malaria-prone area [8–10].

The problems faced in the prevention and control of malaria include such associated with the opening of land in agriculture, and immigrants (legal and illegal), beside nomadic-movement of the aborigines of Peninsular Malaysia [8–10].

In Malaysia, malaria is a notifiable disease under the Communicable Diseases Control Act 1988 that here mandate notification within 7 days. But, to facilitate early investigation and implementation of control measures, all practitioners are required to notify malaria-cases to the nearest health office within a day [8–10].

6. CONTROL-PROGRAMME RE-ORIENTED TO ELIMINATION-PROGRAMME

In 2011, the Malaria Control Programme again became re-oriented from control to elimination, and the Health Ministry produced the National Strategic Plan for the Elimination of Malaria (NSPEM) (2011 – 2020) - to eliminate indigenous human-malaria (only) by 2020 [8 – 10].

Seven strategies are outlined in the NSPEM (2011 – 2020) [8–10]:

- strengthen the Malaria Surveillance System
- intensify control-activity using the Integrated Vector-Management approach
- early-detection of cases and prompt-treatment
- heighten preparedness and early response to the outbreak
- enhance community become aware and knowledgeable on malaria toward social-mobilization and empowerment
- strengthen the human-resource capacity, and
- conduct relevant research.

7. RESISTANCE TO ANTIMALARIALS

One of the seven main-strategies is early-detection of cases and prompt treatment that require the use of Artemisinin-based Combination Therapy (ACT) as first-line treatment in all species, resistance to anti-malarial being found as a problem in this [8–10].

Resistance to anti-malarial has been documented in *P. falciparum, P. malariae and P. vivax*. In *P. falciparum*, resistance has been observed to all currently-used anti-malarial (amodiaquine, chloroquine, mefloquine, quinine, and sulfadoxine-pyrimethamine) - recently yet, resistance in artemisinin-derivatives in ~~a~~ certain area of the world. The geographical-distribution and rate-of-spread of anti-malarial drug-resistance have varied much [8–10].

P. vivax has developed resistance rapidly to Fansidar (sulfadoxine-pyrimethamine) in many areas, while resistance to chloroquine is seen largely in South-east Asia and various parts of Oceania. There is also found the report on resistance from Brazil and Peru. Chloroquine-resistant falciparum-malaria had been first reported in Peninsular Malaysia in 1963. Studies on chloroquine-resistant falciparum-malaria in the 1960s to 1970s revealed the range of resistance-rate from 3.9% to 50.7%, most of it being mild R1 type [8 – 10].

A study in Peninsular Malaysia in 1993 documented the overall resistance to chloroquine as 63.3% and to Sulfadoxine-pyrimethamine as 47.4%. RI, RII and R III1 rate in chloroquine had been 9.1%, 42.4% and 12.1% and in sulfadoxine-pyrimethamine, they had been 10.5%, 21.1% and 15.8%. Degree and rate-of-resistance to chloroquine had been found significantly correlated with pre-treatment parasite-density, but not those to sulfadoxine-pyrimethamine [8–10].

The classification of resistance are: RI, Delayed Recrudescence i.e. the asexual-parasitemia reduces to < 25% of pre-treatment in 48 hours but reappears between 2-4 weeks; RI, Early Recrudescence i.e. the asexual-parasitemia reduces to < 25% of pre-treatment in 48 hours but re-appears earlier; RII Resistance i.e. marked-reduction in asexual-parasitemia (decrease >25% but <75%) in 48 hours, without complete clearance in 7 days; RIII Resistance i.e. minimal-reduction in asexual-parasitemia, (decrease <25%), or an increase in parasitemia after 48 hours [8–10].

8. CONCLUSION

In Malaysia, the concept of eradication had changed to one of the control in the early 1980s but the anti-malarial activity had remained the

same. But, additional supplementary-activities such as the use of the impregnated bed-net, and the Primary Health Care approach, became introduced in the malarious and malaria-prone area. Malaysia should be expected to eliminate human-malaria by 2020, in case this nation is found here to stay on in the present direction.

COMPETING INTERESTS

The Author has declared that no competing interests exist.

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