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## MALARIA

### MALARIA IN MAURITIUS

There were no declared cases of malaria in Mauritius during the period of French colonization 1715-1810 despite important ship movements with Madagascar, Africa and the Indies. During the English colonization, although Indian and African labourers from malaria endemic countries were working, no cases were reported until 1864 when the first cases were detected. A violent epidemic broke out in 1867 and there were 43,000 deaths during 1866 – 68 out of a population of 330,000. This was the worst calamity that Mauritius has known and it had serious economic impact on the island. Many people moved from the capital Port Louis (a coastal town at that time) to the high plateau (Curepipe) in order to escape the disease. During the next 100 years malaria became endemic and caused recurrent epidemic with high mortality – malaria was the principal cause of death in the post world war II period.

Ronald Ross linked the high mortality rate in Mauritius to malaria infection as far back as 1908 and made recommendation to the government for malaria control. Extensive environmental sanitation work was carried out to eliminate all mosquito breeding grounds and a Malaria Unit was created to coordinate all malaria related works. Malaria remained the principal cause of death until 1949, when the Malaria Eradication Programme started. In the 1930's and 1940's malaria accounted for 26% of the total mortality, in 1947 it was 71%, 52% in 1949 and 44% in 1950. As from 1956 no case of death due to malaria has been reported.

In 1949 the government began a spraying campaign of all houses with DDT. The spraying led to the eradication of *Anopheles Funestus* (the major malaria vector) by 1959, thus reducing malaria prevalence to a very low level. The number of malaria cases

dropped from 48,000 in 1948 to 6000 in 1950. During the same period, total mortality and infant mortality fell dramatically. There remains the *Anopheles gambiae* malaria vector that proved to be more difficult to eradicate because they normally stay outside the houses for resting and are thus not affected by house spraying. But as there was, then, neither a detection system nor a surveillance system in place that could ensure full coverage of the island, many malaria cases went undetected, leading to believe that malaria had been totally eradicated. In fact transmission continued at a very low level. As from 1952, spraying which was less rigorous, became less and less frequent and were eventually interrupted in 1955. As from that date only a small number of targeted DDT spraying were maintained. The prevention of Malaria Act which was revised in 1981 became in force in 1946.

In 1958 in an effort to eradicate the remaining malaria cases a detection system based on malaria surveys (of infants and school children) was set up. A small team of workers was responsible for the surveys, treatment and statistics covering the whole island. In addition, blood samples were sent to the laboratory by doctors and dispensaries for examination. During the same period, it was shown that screening of malaria cases based on microscopic examination of blood slides from all persons suffering from fever (an active detection) was more fruitful ( to detect positive cases) than malaria surveys.

Thus, in 1960, with WHO support, the Malaria Control Programme (which started in 1949) was transformed into an eradication programmed based on an improved active detection system. Through this active detection system, more than 1000 cases were detected in 1960 which led to believe that there was an epidemic, when in fact it was due to more effective detection. Thus the central high plateau of the island which was considered as malaria free was placed under maintenance phase and the malaria prone coastal region under attack phase. DDT spraying of all houses (which was stopped in 1955) was restarted. As and when transmission ceased in a given region, it was placed under consolidation phase. In the following years, the number of indigenous cases of malaria decreased considerably (from 1179 in 1960 to 14 cases in 1965). Spraying was stopped in December 1965. Thus the elimination of *Plasmodium falciparum* (which has

been the predominant parasite since early 19<sup>th</sup> century in Mauritius) was observed following that of Plasmodium vivax. In 1966 only targeted DDT spraying remained in place but the malaria surveillance continued. Since then all malaria prone regions were placed under the consolidation phase. The last indigenous case of malaria was found in 1968 and the rest were mostly imported cases. Consequently in 1973, Mauritius was officially declared free from malaria by the WHO. However, the malaria mosquito (Anopheles gambiae) was not eradicated. In 1975-76 after the passage cyclone Gervaise there was a resurgence of the disease caused by the re-introduction of malaria parasite (Plasmodium vivax) by workers from malaria infected countries, who came to rehabilitate the island infrastructure destroyed by the cyclone. The malaria situation deteriorated to reach epidemic proportion in 1980. The situation gradually worsened to reach a peak of 668 cases in 1982 of which 92% were indigenous. Technically expertise from the WHO was sought. Dr. Onori from the WHO (Geneva) and Mr. Colussa from WHO (Mali) visited the island in 1981 for an evaluation of the epidemiological situation. A plan of action was developed in 1982.

The plan of action was as follows:-

1. Surveillance
2. Intra-domiciliary spraying with DDT over a period of three years in all active foci.
3. Fogging operations in specific regions.
4. Larviciding.
5. Environmental management.
6. Strengthening of laboratory and entomology services.
7. Health Education.
8. Provision of logistic support.

Funds were used for the following:-

1. Purchase of:
  - (i) spraying equipment with spare parts,
  - (ii) fogging equipment with spare parts,

- (iii) insecticide
  - DDT
  - Abate
  - Malathion
- (iv) Anti-malaria drugs,
- (v) equipment for malaria laboratory including purchase of equipment and supplies for immuno-fluorescence microscopes,
- (vi) equipment for entomology laboratory,
- (vii) office equipment for Malaria Unit and Entomology Laboratory,
- (viii) vehicles.

## 2. Training of staff both locally and overseas

At the start of the project in 1984 there were 143 cases of malaria of which 102 were indigenous cases. A WHO inter country team composed of Dr. Giri, Malariologist, Mr. S. Roche and Mr. F. Benthein both technical officer and Mr. V. Ariaratnam, Entomologist visited the island from December 1984 to March 1985. The team concluded that the anti malarial campaign launched since 1982-83 has had the desired effect on the reduction of malaria cases. By 1985 only 54 cases were reported, 16 of which were indigenous. The situation improved over the years and was under control within 5 years. The government post cyclone Gervaise strategy was implemented by the Malaria Unit, now Communicable Diseases Control Unit. Surveillance workers were trained to take blood slides, provide anti malarial treatment according to set protocol and conduct epidemiological surveys.

In the period 1990 – 2001, Mauritius has been free from indigenous malaria except for two small localised outbreaks of Plasmodium vivax malaria in 1992 and 1996 when 13 and 17 cases were reported respectively. Aggressive control measures taken prevented the spread to adjoining areas and no indigenous cases were reported in these localities in the year following these outbreaks.

Mauritius is in an unstable malaria zone and the malaria vector is present in the island. The risk of re-introduction of the diseases from imported malaria cases

exists if proper preventive measures are not taken. Most of the preventive measures are carried out by Government Services. The population is encouraged to eliminate mosquito breeding grounds in their immediate surroundings, to seek medical attention in cases of fever and to take prophylaxis if traveling to a malarious country. The following measures are being carried out by the Ministry of Health and Quality of Life with regard to malaria control:-

## **1. Surveillance**

### **(i) At Port and Airport**

All aircrafts coming from or transiting through malarious countries are controlled by Health Inspectors of the Port and Airport Unit to ensure that proper disinsection has been carried out in conformity with International Health Regulations

### **(ii) All passengers originating or having transited through malarious countries are registered by staff of Port and Airport Unit and their names and addresses are referred to the respective regional offices for visits by Health Surveillance Officers.**

### **(iii) Nurses and Doctors in the private sector are encouraged to take blood smears from suspected malaria cases.**

## **2. Malaria Diagnosis**

There is a special government laboratory for malaria diagnosis. All blood slides collected for malaria are examined at the laboratory. Slides from the private sector are also examined. All cases diagnosed in private laboratories are cross checked at the government laboratory to ensure that the correct diagnosis has been made. Laboratory services for the diagnosis of malaria operate on a 24 hr basis.

## **3. In vivo monitoring for resistance of malaria parasites to drugs**

This is carried out in all cases of malaria.

## **4. Entomological Surveillance**

Entomological surveys are carried out by staff of the Medical Entomology Division of the Ministry of Health and Quality of Life to assess mosquito behaviour and density. Tests of resistance of mosquitoes to insecticide are also carried out.

#### **5. Residual Spraying**

Spraying operations are carried out only when indigenous or introduced cases (secondary to imported cases) are detected. Routine spraying of Port and Airport areas are carried out at 6 monthly intervals to destroy mosquitoes that may enter the country in aircrafts and ships.

#### **6. Larviciding**

Potential mosquito breeding grounds are treated with insecticide at regular intervals.

#### **7. Malaria Prophylaxis**

Drugs for malaria prophylaxis are dispensed **free of charge** to travelers proceeding to malarious countries.

#### **8. Treatment**

All malaria cases, both in the public and the private sector, are treated **free of charge.**

#### **9. Follow-up**

All malaria cases are followed up for a period ranging from 3 months to one year depending on the species of malaria parasite.

#### **10. Health Education**

Health Education is routinely carried out.

However, our malaria free situation is constantly threatened as a result of the island's geography and tourism industry. Mauritius is surrounded by endemic countries with high prevalence of malaria situation and having a dense sea and air link with these countries and thus is at risk of imported cases by visitors. In fact some imported cases of malaria continue to be found every year but are closely monitored by the public health services.

**MALARIA CASES, 1981 to 2007**

<b>Year</b>	<b>Introduced</b>	<b>Imported</b>	<b>Indigenous</b>	<b>Total</b>
<b>1981</b>	<b>0</b>	<b>44</b>	<b>563</b>	<b>607</b>
<b>1982</b>	<b>0</b>	<b>48</b>	<b>620</b>	<b>668</b>
<b>1983</b>	<b>0</b>	<b>30</b>	<b>266</b>	<b>296</b>
<b>1984</b>	<b>0</b>	<b>41</b>	<b>102</b>	<b>143</b>
<b>1985</b>	<b>0</b>	<b>38</b>	<b>16</b>	<b>54</b>
<b>1986</b>	<b>0</b>	<b>9</b>	<b>24</b>	<b>33</b>
<b>1987</b>	<b>0</b>	<b>96</b>	<b>24</b>	<b>120</b>
<b>1988</b>	<b>15</b>	<b>136</b>	<b>17</b>	<b>168</b>
<b>1989</b>	<b>2</b>	<b>73</b>	<b>3</b>	<b>78</b>
<b>1990</b>	<b>1</b>	<b>53</b>	<b>0</b>	<b>54</b>
<b>1991</b>	<b>4</b>	<b>44</b>	<b>0</b>	<b>48</b>
<b>1992</b>	<b>2</b>	<b>51</b>	<b>13</b>	<b>66</b>
<b>1993</b>	<b>5</b>	<b>49</b>	<b>0</b>	<b>54</b>
<b>1994</b>	<b>7</b>	<b>59</b>	<b>0</b>	<b>66</b>
<b>1995</b>	<b>0</b>	<b>46</b>	<b>0</b>	<b>46</b>
<b>1996</b>	<b>2</b>	<b>63</b>	<b>17</b>	<b>82</b>

<b>1997</b>	<b>0</b>	<b>64</b>	<b>1</b>	<b>65</b>
<b>1998</b>	<b>4</b>	<b>53</b>	<b>0</b>	<b>57</b>
<b>1999</b>	<b>0</b>	<b>73</b>	<b>0</b>	<b>73</b>
<b>2000</b>	<b>0</b>	<b>62</b>	<b>0</b>	<b>62</b>
<b>2001</b>	<b>3</b>	<b>63</b>	<b>0</b>	<b>66</b>
<b>2002</b>	<b>1</b>	<b>38</b>	<b>0</b>	<b>39</b>
<b>2003</b>	<b>0</b>	<b>40</b>	<b>0</b>	<b>40</b>
<b>2004</b>	<b>3</b>	<b>44</b>	<b>1</b>	<b>48</b>
<b>2005</b>	<b>1</b>	<b>35</b>	<b>0</b>	<b>36</b>
<b>2006</b>	<b>0</b>	<b>38</b>	<b>0</b>	<b>38</b>
<b>2007</b>	<b>0</b>	<b>42</b>	<b>0</b>	<b>42</b>
<b>2008</b>	<b>0</b>	<b>27</b>	<b>0</b>	<b>27</b>

A maintenance strategy is now in place. The main components are: -

1. Surveillance of incoming passengers – this consists of the screening of all passengers arriving from malarious countries at the port and airport and their follow up for taking blood slide to be tested for malaria.
2. Early diagnosis treatment and follow up of cases – this consists of free of charge blood examination in government laboratory for specimen collected by Health Surveillance Officers, public and private sector. A 24-hour laboratory service for malaria diagnosis. Free treatment for patients in both public and private sectors. All cases of falciparum malaria are monitored for drug resistance. Drug policy and guideline for treatment of cases. Follow up at regular intervals of all malaria cases.
3. Entomological surveillance and vector control – this consists of: survey of all mosquito breeding places. Night catches for adult mosquitoes. Susceptibility test for insecticide. Vector control consists of regular measures against mosquito larvae



using insecticide Temephos. Encouraging community participation in elimination of mosquito breeding grounds in the immediate surroundings. Spraying of Port and Airport compounds every six months.

4. Malaria prophylaxis – consisting of free drug prophylaxis provided to residents leaving for malarious countries.
5. Health education and training
6. Monitoring and evaluation

Now that the malaria is under control, the malaria unit has been transformed into Communicable Diseases Control Unit and its scope expanded to cover other diseases, but malaria control remain its key focus. The unit under the Ministry of Health, coordinate with the five regional regions and other sectors for implementation of policies regarding the surveillance, prevention, and control of communicable disease that cause serious threat to the health of the population and economy of the country. The success of malaria program is due to the firm government commitment to deal with the problem, the existence of a technical sound and feasible policy and its implementation in a systematic way, back by the allocation of adequate resources. The institutional capacity to implement the program under the direction of the Malaria Unit was an important aspect of the programme success, as well as the full participation of the population endeavor

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*(Source: CDCU & UNICEF)*