

## **Malaria Epidemiology and Anti-Malarial Activities through Primary Health Centres in Rameswaram Island, Ramanathapuram District**

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### **Abstract:**

Rameswaram Island is one of the important malaria endemic areas in Ramanathapuram district of Tamil Nadu. The control of malaria remains one of the major global health challenges. It threatens 2.4 billion people, or about 40% of the world's population living in the world's developing and under developing countries and more than one million deaths are attributable to the disease annually (WHO, 2000). The aim of this study is to determine the situation of the disease and analyse the anti-malarial measure which is provided by the State Government in the study area. The anti-malarial activities are taken up through the Primary Health Centres (PHCs) by the State Health Society, Tamil Nadu. This paper concludes with a discussion of strategies that can be used to overcome of the malaria endemic problems.

**Keywords:** Malaria, Anti-malarial activities, Epidemic disease.

### **Introduction**

Malaria is one of the major public health problems of the country. Around 1.5 million confirmed cases are reported annually by the National Vector Borne Disease Control Programme (NVBDCP), of which 40–50% is due to *Plasmodium falciparum*. Malaria is curable if effective treatment is started early. Delay in treatment may lead to serious consequences, including death. Prompt and effective treatment is also important for controlling the transmission of malaria (Guidelines for Malaria- GOI, 2009). Malaria is an environmental disease, with the large-scale limits of its distribution are being mostly determined by the climatic factors like rainfall, humidity and temperature (Craig et al., 1999). The large-scale variables are inter-annual climate factors and the movement of population, drug and insecticide resistance etc. are small-scale variables. Both large and small-scale variables effect on the active malaria situation that needs continuing research and managing efforts to control it (Sharp et al., 2001).

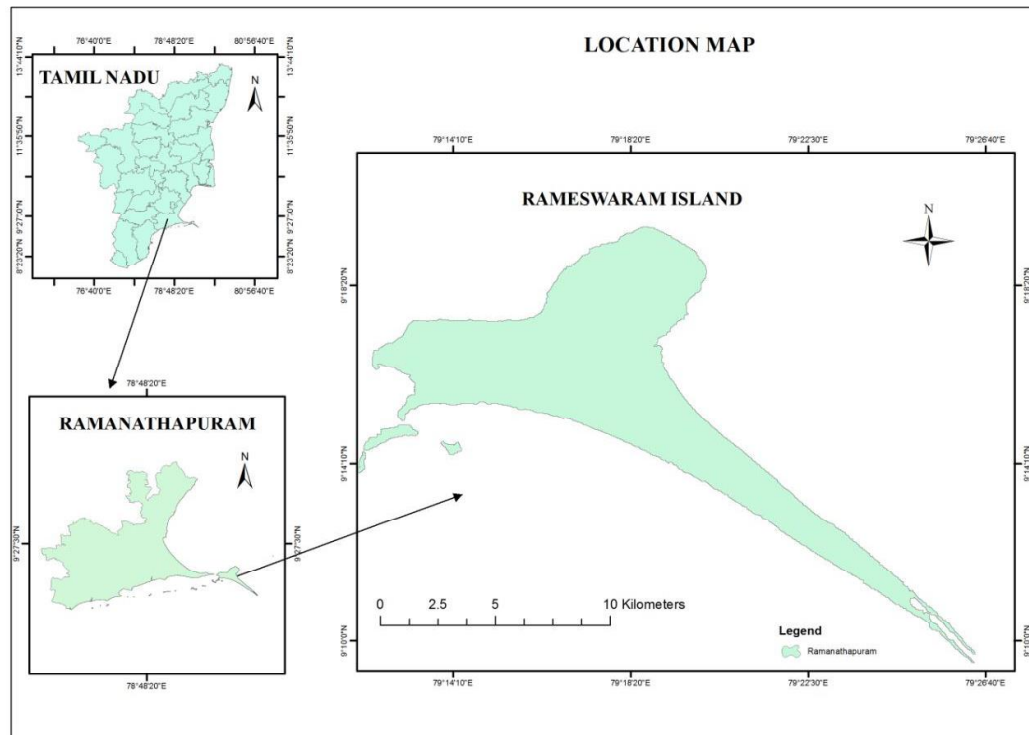
### **Aim and Objective**

The aim of this study is to identify the high incidence areas of malaria in Rameswaram Island and analyse the anti-malarial activities which are taken up by the PHCs.

1. To evaluate the epidemiological parameters of malaria in Rameswaram Island.
2. To examine the anti-malarial activities those are provided by the Government of Tamil Nadu over the PHCs in Rameswaram Island.

### **Study Area**

Rameswaram Island is known as Pamban Island and famous for its pilgrimage and one of the most endemic districts for malaria for decades in Tamil Nadu. It is situated in the Rameswaram taluk of the Ramanathapuram district. It is located in the Eastern tip of Ramanathapuram District, overturned shoe shaped island connected to the mainland by Railway Bridge and road. It is lied between 9°11'N and 9°19'N latitude and 79°12' E to 79°23' E longitudes. The total area of the island is 67 square km. The Island is encircled in the north by Palk Bay, south by the Gulf of Manner and East by Bay of Bengal. The terrain is entirely costal with sand dunes.

**Figure 1: Study Area – Location Map**

The Rameswaram taluk has four administrative divisions: Okarisakulam, Mahindi, Pamban and Rameswaram. Rameswaram is the headquarters of this taluk. Pamban and Rameswaram are the two main towns in this taluk. It has a population of 77,724 including two PHCs and 13 HSCs with 146 villages (SHS-PIP 2012). Rameswaram is a national pilgrim center, the fluctuating population from various parts of India and overseas may exceed one lakh per month. It is located at the centre of the island, nearby 11 kilometres from Pamban and 18 kilometres from Dhanushkodi. Pamban is situated at the western edge of the island and the main point of entry for the pilgrim center of Rameswaram. It is located around 11 kilometres from Rameswaram and 7 kilometres from Mandapam. Thangachi Madam is placed between Pamban and Rameswaram is a smaller settlement. Dhanuskodi is at the eastern tip of the island, but it was destroyed by a cyclone in 1964. After that, it could not ever be rebuilt ([www.wikipedia.com](http://www.wikipedia.com)). The main occupation of the people is fishing in addition to coconut farming ([www.ramanathapuram.nic.in](http://www.ramanathapuram.nic.in)).

### Need for the Study

Malaria remains to be an economic burden and a great risk in worldwide and practically impossible to eradicate for the past six decades. It is a mosquito-borne disease causing 1.5 to 2.7 million people to die annually (Breman and Alilio, 2004). Malaria has become more resistant to insecticides and the parasites which cause the disease are becoming strong to Chloroquine (antimalarial drug) and other anti-malarial drugs, making prevention and treatment gradually more difficult and costly. Around 40% of the world's population live in regions where malaria transmission is prevalent, mostly within the tropical and sub-tropical regions. (Aultman, 2002). Malaria has become a major threat in India and adversely affected the economy of the nation. In general, the Health Workers who are representing the government's health services are unable to identify high or risk areas of malaria endemic. The main reason for that is lacking of the health workers in the island. This study will be examined the health human resources and their availability in Rameswaram Island.

### Methodology

The malaria data are collected from Rameswaram Island through the Primary Health Centres (PHCs) in Pamban and Thangachimadam from the year of 2002 to 2011. To analyse the minimum requirement of the environmental and climatological parameters for the malaria incidence will be determined. Based on the malaria endemic data, the Annual Blood smear Examination Rate, Slide Positive Rate (SPR), Slide falciparum Rate (SfR) and Annual Parasite Index (API) will be calculated and compared along the decade. The malaria epidemiological factors will be compared using statistical methods. The data has been collected from various sources namely the Health and Family Welfare Department, Tamil Nadu, State Health Society, Tamil Nadu and website of National Vector Borne Disease Control Programme. To delineate the state government's participation in eradicating and controlling the disease patterns in most endemic areas. This will be helped to researchers, health planners and policy makers for planning and research.

### **Malaria Epidemiology in Rameswaram Island**

Malaria is an environmental related disease affected by a variety of factors. Fever is the serious symptom of malaria. It can be irregular with or without periodic or continuous. The fever has frequently gone wild by headache, myalgia, arthralgia, anorexia, sickness and vomiting (Guidelines for Malaria, GOI. 2009). The malaria prevalence in Pamban and Thangachimadam PHCs are shown in Table 1 and Table 2.

### **Epidemiological Factors**

#### **Host Factors**

1. Movement from one place to another is the main factor for malaria endemic. The majority of the population in the Rameswaram Island are fishermen and they are moving around the eastern coastal areas from Nagapattinam to Kanyakumari.
2. The Full course of Radical Treatment in *P. vivax* malaria case is now for 14 days. The non-availability and insufficiency of health human resources affect the tablets are handed over to the patients for consumption could not be completed.
3. In Rameswaram Island, the large scale of malaria cases all over India are being transmitted because of the pilgrimage, even from the states where the resistant stress of malaria parasites is reported.

#### **Parasite Factors:**

In India, three species of malaria prevalence occur and they are *Plasmodium vivax*, *Plasmodium falciparum* and *Plasmodium malariae* (Behera P, 2013). In Rameswaram Island, both *P. vivax* and *P. falciparum* are being stated all over the year. Due to the pilgrimage, the *P. falciparum* has been declared as resistant to Chloroquine. After that, the Artesunate Combination Therapy (ACT) is being started in the island since 2007 (SHS-PIP, 2012).

#### **Environmental Factors:**

The malaria parasite development and the duration of the malaria incidence are directly influenced by climatic conditions (Martens W.J., et al., 1995). Parameters like rainfall, humidity and temperature are most important on malaria outbreaks. The average rainfall of Rameswaram Island is 970 mm and maximum rainfall is during north east monsoon. The amount of optimized humidity for malaria incidence is 60 – 65 percent (Sumana B, et al., 2006). The humidity of the island is always high i.e. 60 – 80 percent, this has a direct impact on the survival of the mosquitoes. Temperature is very vital because it manages the mosquito's development into adults and the growth time of parasites in the mosquito (Muirhead, Thomson R.C., 1951). Warmer ambient temperatures shorten the duration of the extrinsic cycle, thus increasing the chances of transmission (Jackson, 2010). In this island, the average temperature is between 36°C - 42°C throughout the year. This is very suitable climatic conditions for malaria incidence in Rameswaram Island.

### **Epidemiological Indicators for Malaria**

#### **Annual Blood Smear Examination Rate (ABER):**

ABER reflects the efficiency and adequacy of case detection. It should be equal to the fever rate in the locality.

$$\text{ABER} = \frac{\text{Number of blood smears examined in a year}}{\text{Total Population}} \times 100$$

**Slide Positivity Rate (SPR):**

$$\text{SPR} = \frac{\text{Total No. of blood smears found positive for malaria parasite}}{\text{Total Population}} \times 100$$

**Slide falciparum Rate (SfR):**

$$\text{SfR} = \frac{\text{Number of blood smears examined in a year}}{\text{Total Population}} \times 100$$

**Annual Parasite Incidence (API):**

$$\text{API} = \frac{\text{Confirmed cases during one year}}{\text{Population under Surveillance}} \times 1000$$

(WHO, 1963)

**Table 1:** Year wise ABER, SPR,SfR and API from 2002 to 2011

**PHC:** Thangachimadam

Year	Blood Smear Collection/Exam.	Pv*	Pf**	Total	ABER	SPR	SfR	API
2002	19823	329	22	351	41.15	1.77	0.11	7.29
2003	39301	2984	355	3339	81.59	8.50	0.90	69.32
2004	31854	2253	214	2467	66.13	7.74	0.67	51.21
2005	26741	2865	645	3510	55.51	13.13	2.41	72.87
2006	10184	585	48	633	21.14	6.22	0.47	13.14
2007	21594	751	147	898	44.83	4.16	0.68	18.64
2008	16600	494	62	556	34.46	3.35	0.37	11.54
2009	9894	493	66	559	20.36	5.70	0.70	11.60
2010	15253	774	65	839	31.70	5.50	0.40	17.40
2011	22752	861	216	1077	47.29	4.75	0.95	22.38

\*Pv = Plasmodium vivax, \*\*Pf = Plasmodium falciparum Source: PIP, SHS-TN, 2012-13.

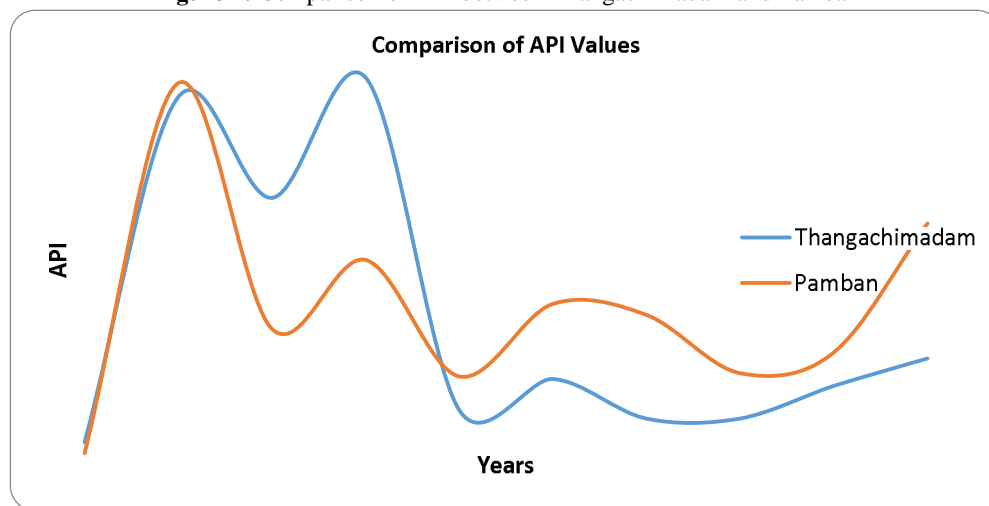
**Table 2:** Year wise ABER, SPR,SfR and API from 2002 to 2011

PHC: Pamban

Year	Blood Smear Collection/Exam.	Pv*	Pf**	Total	ABER	SPR	SfR	API
2002	18,313	149	4	153	64.69	0.84	0.02	5.40
2003	31,901	1,738	296	2,034	112.68	6.38	0.93	71.85
2004	15,138	703	81	784	53.47	5.18	0.54	27.69
2005	14,494	994	140	1,134	51.20	7.82	0.97	40.06
2006	7,176	481	61	542	25.35	7.55	0.85	19.15
2007	19,765	742	169	911	69.82	4.61	0.86	32.18
2008	12,562	760	94	854	44.37	6.80	0.75	30.17
2009	8,367	527	58	585	28.26	7.00	0.69	19.78
2010	8,739	915	86	1,001	31.70	7.40	0.60	23.40
2011	17,547	1,232	195	1,427	57.34	8.13	1.11	46.63

\*Pv = Plasmodium vivax, \*\*Pf = Plasmodium falciparum Source: PIP, SHS-TN, 2012-13.

Figure 2: Comparison of API between Thangachimadam and Pamban



The Annual Parasite Incidence (API) in Pamban and Thangachimadam is >10 and then the government initiate an innovative approach that is Tent-type Mosquito Nets are to be supplied to the HSCs where the SPR and SfR is high.

There are 13 Health Sub Centres (HSCs) in Rameswaram Island and has been found 7 HSCs are high risk SPR areas. The following list shown the high risk HSCs having SPR is always above 5.0 for consecutive three years.

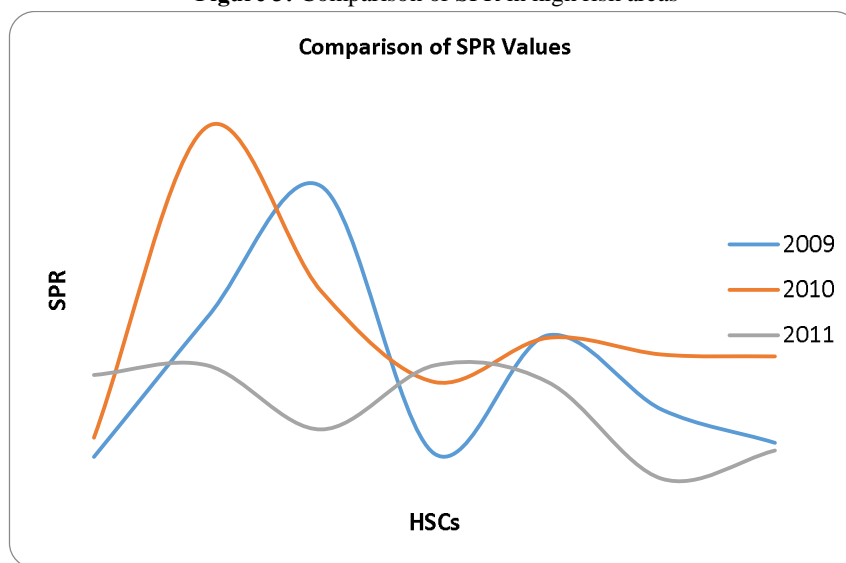
**Table 3:** List of high risk areas in Malaria

S.No	Name of the HSC	SPR			SfR		
		2009	2010	2011	2009	2010	2011
1	Pamban	4.16	5.12	8.26	0.44	0.61	0.54
2	S.S.Pattinam	11.12	20.65	8.72	1.15	1.31	1.55
3	Ariankundu	17.68	12.45	5.53	0.85	0.66	0.78
4	Tharavaithoppu	4.34	7.92	8.73	0.65	0.95	1.51
5	Thangachimadam	10.23	10.12	7.91	1.30	0.65	2.16
6	S.M.Koil	6.55	9.28	3.10	1.42	0.75	0.27
7	Natarajapuram	4.88	9.17	4.48	0.62	1.18	0.48

Source: PIP, SHS-TN, 2012-

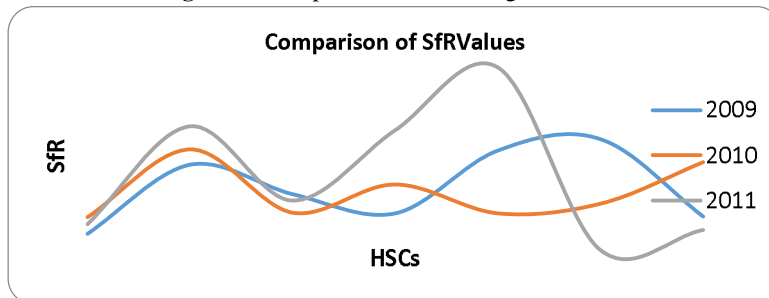
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**Figure 3:** Comparison of SPR in high risk areas



In 2010, the SPR is very high comparing with the year 2011. Relating with S.S.Pattinam to others places the SPR is great. So the government has been taking all remedial measures including IRS, Anti-Larval work, Biological and Thermal Fogging.

**Figure 4:** Comparison of SfR in high risk areas



In the above figure is shown the comparison of SfR values in high risk areas of the Rameswaram Island. In 2011, it is high in Thangachimadam HSC area with compared to any other places.

**Present Malaria Control in Rameswaram Island**

### Anti-Larval Activities

Anti-Larval plans are carried out in Whole Island. All wells are treated with larvicides. Temephos and other breeding sources are treated with Biolarvicide. Bacillus thuringiensis. Temephos is used once in a week and Biolarvicide once in a fortnight. Field workers are being tied up in this work. The work load of Anti-larval work in Rameswaram Island is as follows:

S.No	Name of PHC	No. of Wells	No. of OHT*	No. of Pits	Others
1	Thangachimadam	7570	1609	1986	0
2	Pamban	3581	259	1767	326
	<b>Total</b>	11151	1868	3753	326

\*OHT- Over Head Tank

Source: PIP, SHS-TN, 2012-13

### Anti-Adult Measures

Indoor Residual Spray (IRS) with artificial pyrethroid was started during 1991-92. Two rounds of IRS is being done in a year, i.e., 1st round in June and 2nd round in September. The insecticides like Deltamethrin, Lambda cyhalothrin and Cyfluthrin are used on rotation, once in 3 years.

### Status of Health Human Resources availability for Anti larval work

In Rameswaram Island, the landscape is undulating plain and sand dunes. So the Anti-larval work in the Island is difficult in nature. In the coconut farms which are situated in remote places in the island have burrow pits, but it could not easily be accessed by field workers.

**Table 3: Staff Position - Field Worker**

S.No	Name of the PHC	Field Worker in Position
1	Thangachimadam	11
2	Pamban	5

Source: NVBDCP, 2010.

There are only 16 field workers available for the island which is very minimum in terms of work load.

### Conclusion:

A Global Malaria Action Plan seeks to eliminate using integrated approaches including vaccines, insecticide-treated mosquito nets (ITNs), indoor insecticide residual spray (IRS) and improved drug treatments (WHO, Rollback Malaria, 2000). The measurement of malaria in a community helps in finding the prevalent of the disease and the prevalent factor is very vital in the study of the spatial distribution of the disease (Dutta S, 2006). The supervision of anti-larval work is very essential to make sure the correct dosage of larvicide, proper visit of the field workers for anti-larval work, completeness of the area and the mortality of the larva after the treatment. So, 9 Surveillance Inspectors (SI) to Thangachimadam PHC and 4 Surveillance Inspectors to Pamban PHC are required. But now only one Health Inspector for Thangachimadam PHC and nil Health Inspector for Pamban PHC is available. So, 13 Surveillance Inspectors are needed for Rameswaram Island for surveillance and Radical Treatment of malaria endemic. In high risk areas, the unavailability of manpower for carries out Residual spray and anti-larval work to control malaria transmission also a major problem in the Island. To create public awareness, the government will conduct special camps; organize of meeting with village leaders and impressing about the prevention of malaria at village level is very helpful to eradicate malaria.

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