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Effects of Socio-economic and socio-cultural risk factors on low malaria transmission in Mannar and Trincomalee Districts of Sri Lanka

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Abstract

Background:Socio-economic and socio-cultural practices of people differ between communities and play an important role in malaria control operations. The present study was conducted to assess the influence of household socio-economic and socio-cultural status on reduction of malaria transmission in the Districts of Mannar and Trincomalee.

Methods: A total of 32 malaria endemic localities based on past malaria incidence was selected from Mannar (n= 12) and Trincomalee (n= 20) Districts. Two hundred houses were identified at each locality. Among them 45 houses were randomly selected to participate in the present study. A cross-sectional household survey was carried out.

Results: A total of 1,440 household heads were interviewed. The majority of the families in this community was of the middle economic strata and lived under "moderate" housing condition.Out of 13 main occupation categories identified, only 23.54% (127/540) from Mannar and 40.33% (363/900) from Trincomalee represented "Farmer", which is significantly less when compared to the studies conducted previously. The individual monthly income of the

population surveyed in both districts was denoted Rs. 5,001-10,000 as predominant.Majority (78.8%, n= 426) of the household heads in the Mannar District were known about malaria vector and their role of transmission while, in the District of Trincomalee had only 32.4 % (n= 292). The most common preventive measure against mosquito biting was the use of bed nets in both Mannar (74.4%) and Trincomalee (59.3%) Districts. Only 0.28% (7/2,445) and 0.10% (4/3,859) of the total population in the Districts of Mannar and Trincomalee respectively had experienced a single attack of malaria during their lifetime.

Conclusion:These observations indicate significant relationship of low malaria morbidity with current socio-economic and socio-cultural practices. The findings would be helpful in better planning and implementation of malaria control strategies in the study areas.

Keywords: Socio-economic, Socio-cultural, Malaria, Household, Transmission.

Introduction

Malaria was a major public health problem in Sri Lanka until the recent past. It is well known that the intensity of malaria transmission depends on the interplay of epidemiological risk factors that govern its distribution in rural agricultural communities. Currently, Sri Lanka has achieved a significant reduction in malaria incidence since 2000 and embarked on a malaria elimination phase in 2009 of a substantial progress toward elimination of malaria in the last decade.

Several factors have impacted on malaria transmission during the last two decades (Amarasinghe, 2001: 421-429).Among the unfavorable factors include the conflict situation in the Northern

and Eastern Provinces, the emergence of malathion-resistance in the vector population, the spread of chloroquine resistant to *P. falciparum* malaria and the increase in intra-country population migration. The favorable factors include, increased reliance on self protection methods, early detection and treatment of patients by mobile malaria clinics and actions taken to forecast and prevent malaria outbreaks. Awareness and changes in the socio economic, socio cultural and living standards in the community may have a positive impact on reducing cases at present.

Malaria is a former endemic problem in the Districts of Mannar and Trincomalee. However, there is a significant reduction in malaria cases at present. As a result of resettlement and development activities there have been many changes in their living standards. Therefore, Districts of Mannar and Trincomalee were selected for this study in order to understand how the household socio-economic/ socio-cultural status, knowledge, attitude and vector controlling measures have affected in reducing malaria in these areas.

Methodology

Selection of sentinel sites and localities

A total of eight sentinel sites, three in the District of Mannar (Figure 1) and five in the District of Trincomalee (Figure 2) were selected. Each malaria sensitive sentinel site having a radius of 30 km was further subdivided into four localities (within 5-20 km) to ensure full coverage of the sentinel site during the surveillance. Hence, a total of 32 localities in eight sentinel sites were identified and each locality was given a name code. Selection of the localities was based on past malaria history, environmental conditions, availability of breeding sites, an established

agricultural community and feasibility of field operations to collect relevant data were considered in selecting study area.

Study design

This analytical cross-sectional survey was carried out from June – August 2010. Two hundred houses were identified at each locality. Of them 45 houses from each locality were selected randomly to participate in the present study. The head of the household was defined as the person who perceived by household members to be the primary decision maker in the family and the household was defined as individuals living together and taking meals from a common cooking facility (Talisuna et al, 2009: 1224-1226). In the absence of a household head, a responsible adult above 18 years who appointed by the family was interviewed.

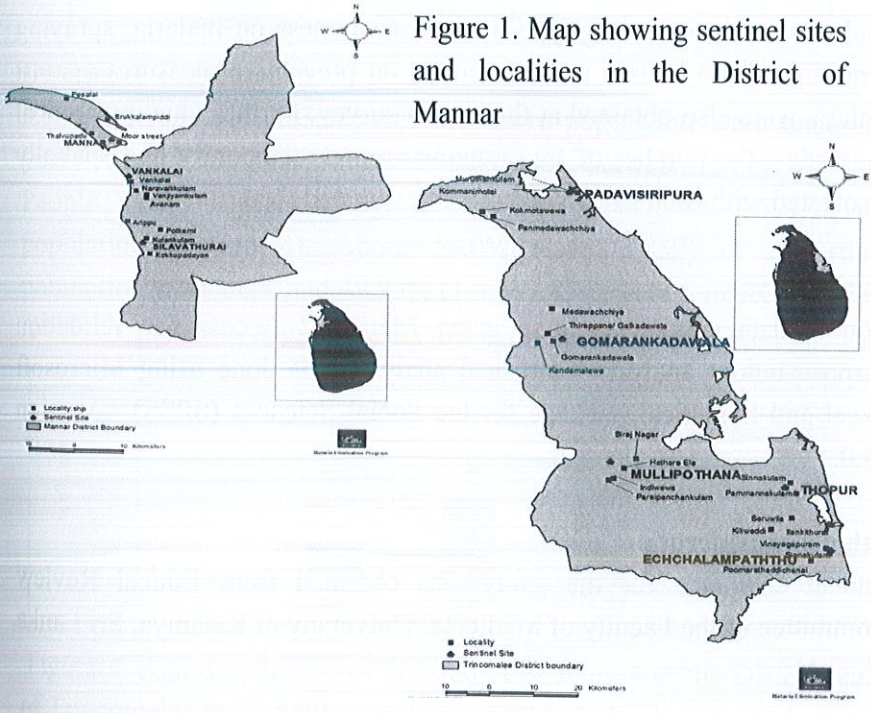


Figure 1. Map showing sentinel sites and localities in the District of Mannar

Figure 2. Map showing sentinel sites and localities in the District of Trincomalee

Data collection

Data were collected using a structured questionnaire from randomly selected household heads. The collection of information included the composition of the household, demographic and socio-economic data at the household level. Information with respect to each individual of the house such as name, age, sex, relationship to head of the household, occupation, income, religion, past malaria history and their status whether permanent or temporary residents were recorded.

Further, information consisting to household with respect to the material used for the construction of the house, the presence of domestic animals, land ownership including type of land, awareness on malaria, spraying condition of the houses and particulars on preventive measures against malaria were also obtained at the census survey. Further, due to practical constrains, the number of free ranging animals temporary and spatially associated with each study site was not estimated.

Data analysis

Double data entry was done using Microsoft Access for validation purpose before analysis. Statistical analysis was done using Microsoft Excel and Statistical Package for the Social Sciences (SPSS) – version 15.0.

Ethical consideration

Ethical clearance for the study was obtained from Ethical Review Committee of the Faculty of Medicine, University of Kelaniya, Sri Lanka.

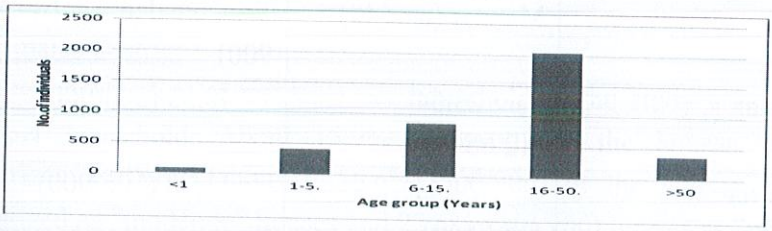
Results

Age and sex distribution

District of Mannar

About 35.19% (864/2,455) of the entire population were under 16 years of age, while 52.34% (1,285/2,455) were between 16 and 50 years. People over 50 years of age comprised 12.46% (306/2,455) of the population (Figure 3). Male and female were 51.53% (1,260/2,455) and 48.26% (1,185/2,455) respectively.

Figure 3. Age distribution of the study population in the District of Mannar (n= 2,455)



District of Trincomalee

About 35.73% (1,379/3,859) of the entire population were under 16 years of age while 54.28% (2,095/3,859) were between 16 and 50 years. People over 50 years of age comprised 9.97% (385/3,859) of the population (Figure 4). About 50.0% (1,932/3,859) of the study population were male and 49.93% (1,927/3,859) were female. The male to female ratio was approximately 1:1 in all the age groups.

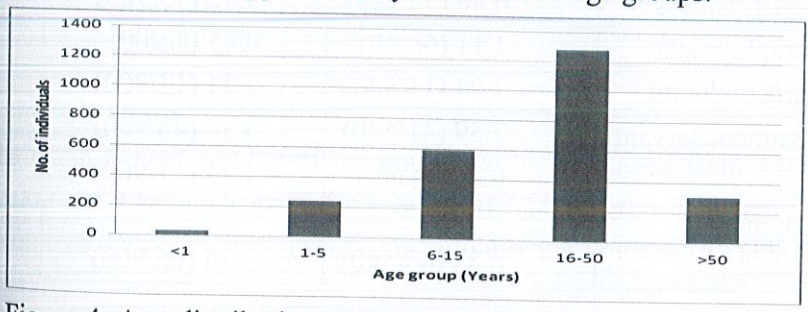


Figure 4. Age distribution of the study distribution in the District of Trincomalee (n= 3,859)

Occupation

In Mannar District, farmer comprised 23.5%, while labourers and fishermen comprised (24.4%) and 22.2%, respectively (Table 4.1). In Trincomalee District, 40% of chief occupants interviewed were farmers (Table 1).

Table 1. Occupation of chief occupants in households

Occupation	Percentage (%)	
	Mannar (n= 540)	Trincomalee (n= 900)
Farmer	23.54 (127/540)	40.33 (363/900)
Laborer	24.44 (132/540)	11.78 (106/900)
Mechanic	2.22 (12/540)	2.45 (22/900)
Fisherman	22.22 (120/540)	8.67 (78/900)
Mason	0.56 (3/540)	1.78 (16/900)
Carpenter	1.11 (6/540)	0.78 (7/900)
Army/Forces	0.19 (1/540)	14.12 (127/900)
Traders/Business	6.48 (35/540)	4.45 (40/900)
Self employment	1.11 (6/540)	0.45 (4/900)
Driver/Conductor	2.04 (11/540)	1.34 (12/900)
Government servant	7.59 (41/540)	5.34 (48/900)
Foreign employment	0.19 (1/540)	1.23 (11/900)
Other	8.33 (45/540)	7.34 (66/900)

Housing condition

Mannar District

The average number of residents per household in the study area was 4.16. About 20.74% (112/540) of the houses, which had cement plastered walls and tiled or asbestos roofs, were considered as "good" houses. About 42.22% (228/540) of houses, which had un-plastered brick walls and tiled or asbestos roofs, were considered as "moderate" houses. All other types, 37.03% (200/540) were considered as "poor" type houses (Table 2).

Trincomalee District

The average number of residents per household in the study area was 4.29 per household. About 15.9% (143/900) of the houses were categorized as "good" houses, 56.6% (509/900) of the houses were categorized as "moderate" houses and 27.6% (248/900) houses as "poor" houses (Table 2).

Table 2. Distribution of house types

House type	Mannar (n=540)	Trincomalee (n=900)
Good*	20.74% (112/540)	15.88% (143/900)
Moderate**	42.22% (228/540)	56.56% (509/900)
Poor***	37.04% (200/540)	27.56% (248/900)

Economic status

The mean annual earning of the household heads ranged from 5,001 to 10,000 Sri Lankan Rupees (459.26 to 918.34 USD). The individual income of the population surveyed in both districts is given in Table 3.

Table 3. Distribution of monthly family income

Monthly income	Mannar (n=540)	Trincomalee

(Rs.)		(n=900)
<5,000	37.41% (202/540)	29.56% (266/900)
5,001-10,000	42.96% (232/540)	41.33% (372/900)
10,001- 20,000	13.33% (72/540)	23.00% (207/900)
20,001-30,000	3.33% (18/540)	4.11% (37/900)
>30,000	2.96% (16/540)	2.00% (18/900)

Educational level

Of all the total population surveyed in households in the District of Mannar, 51.8% (1,231/2,374) had secondary school education (Grade 6-11), 427 (17.98%) with primary school education (Grade 1-5), 321 (13.52%) of them had tertiary school education (Grade 12-13), 24 (1%) of with degree level education, 4 (0.16%) with diploma level, 131 (5.5%) of the total population were illiterate as they have not received any level of school education and remaining 9.94% (236/2,374) were not in an age to acquire school education.In The District of Trincomalee, educational level was varied as follow; 50.84% (1,962/3,859) of Grade 1-5, 20.98% (810/3,859) of Grade 6-11, 6.14% (237/3,859) of Grade 12-13, 0.25% (10/3,859) with degree level education and 0.07% (3/3,859) had diploma level education. Remaining 8.86% (342/3859) of the total population had not attended school and 12.82 % (495/3,899) were below the school age.

Use of preventive measures against mosquitoes

Between both districts, the most common preventive measure used against mosquito bites was bed nets. Among all families, the average number of bed nets per family was 2.04. About 10.7% (58/540) and 15.9% (143/900) of families in the Districts of

Mannar and Trincomalee respectively, used to more than one preventive measure against mosquito bites. Most of the measures used were in combination with bed nets and mosquito coils. In addition, 2.03% (11/540) of the total population in the District of Mannar were not using any specific measure against mosquitoes; in the Trincomalee District, 3.3% (30/900) of households did not use any protective measure against mosquitoes (Table 4).

Table 4. Use of protective measures against mosquitoes by households

Mosquito protective method	Mannar (n=540)	Trincomalee (n=900)
Residual spraying	6.66% (36/540)	0.89% (8/900)
Bed nets	74.44 %(402/540)	59.33% (534/900)
Covering eaves and windows	2.96%(16/540)	4.33% (39/900)
Mosquito coils	2.96% (16/540)	13.67% (123/900)
More than one method	10.74% (58/540)	15.88% (143/900)
Others	0.18% (1/540)	2.56% (23/900)
No protective measures	2.03% (11/540)	3.33% (30/900)

Exposure to malaria

Only 0.3% (7/2,445) and 0.1% (4/3,859) of the total population in the Districts of Mannar and Trincomalee respectively, had experienced at least a single attack of malaria during their lifetime (Table 5).

Table 5. Exposed to malaria during the life span

District	No. of persons infected malaria	% of infected persons with reference to the total population surveyed
Mannar	7	0.3 (7/2,445)

Trincomalee	4	0.1 (4/3,859)

Discussion

This study was carried out in the Districts of Mannar and Trincomalee, Sri Lanka, which was considered as high-risk areas for malaria infections, in order to determine the socio economic and socio cultural changes that resulted negatively on malaria transmission. Only two persons out of the infected persons (one each of the Districts of Mannar and Trincomalee) had an experience of two malarial infections during their lifetime. This indicates that certain individuals are subjected to more than one attack of malaria.

The majority of the families in this community was of the middle economic strata and lived under "moderate" housing condition. A strong association between malaria incidence and house construction type, independent of location, has been documented in Southern Sri Lanka in previous studies (Mendis et al, 1990: 298-308; Mendis, 1991: 25-39). A previous study conducted in Sri Lanka showed that over 70% of the malarial episodes were reported in "poor" houses (Mendis et al, 1990: 298-308). It is further explained that the "poor" house type with mud, cadjan or brick un-plastered walls with thatched or asbestos roofs was the most predominant house type in that study. However, in the present study, "good" and "moderate" house types were higher than of "poor" house type, which does not support malaria vector mosquitoes to rest inside houses. Ultimately, it reduces the possibility of being bitten by a vector mosquito. Therefore, changing living style in these areas may have a negative impact on malaria transmission.

Socio-economic status and human settlement patterns also affect human vulnerability to vector-borne diseases. For example, if preventive

measures such as screens, insect repellants or other practices are available and affordable to risk populations of mosquito-borne diseases, infection can be drastically lowered (Mendis et al, 1990: 298-308). The household heads had skills and were aware of techniques used to reduce vector-human contact. Majority of the households were known that malaria is a mosquito borne disease, the areas where malaria vector larvae are found and the time when larvae productivity was high. In fact, the household heads were aware that if their houses were close to the mosquito breeding habitats it increased the risk of exposure to mosquito bites and subsequently malaria transmission.

The present case study identified residual spraying, use of bed nets (LLIN, ITN or normal nets), covering eaves/ windows and use of mosquito coils as the main preventive measures against mosquito biting. About 10.74% and 15.89% in the Districts of Mannar and Trincomalee showed integrated vector control methods, which contained at least two preventive measures. In addition, only 0.18 % and 2.46 % of the total families surveyed in the Districts of Mannar and Trincomalee indicated the use of traditional methods such as creating a smoke with "Maduruthala" (*Ocimum sanctum*) leaves or coconut shells, applying citronella oil on the skin, which categorized as other preventive measures against mosquito biting.

Increasing the use of preventive measures against vector biting has caused negative impact on malaria transmission. However, the awareness of community on malaria was very poor. Some people even did not known malaria as a vector-born disease. Severity of the disease was also not known by 75% of the total population surveyed. This may be due to the very low cases at the moment in the country. This may facilitate to re-emerge the disease as a result of poor awareness about the disease by the community, since the lack of adequate knowledge among the general

public about the disease and its prevention is an important contributory factor for the persistence of the disease (Pinikahana, 1993: 48-53).
Sri Lanka is essentially an agricultural country in which the majority of the country's population engages in agricultural related activities and lives in traditional malarious areas. Malaria has been recognized as a disease of major public health importance in the country that places a considerable burden on household economy (Konradsen et al, 1997: 656-600).

The peak of malaria transmission in the county coincided between important agricultural activities during past years. The present study surveyed the distribution of occupation of chief occupants in the families. Out of 13 main occupation categories identified, only 23.54% from Mannar and 40.33% from Trincomalee represented "Farmer", which is significantly less when compared to the previous studies conducted in Sri Lanka (Mendis et al, 1990: 298-308; Premasiri, 2006: 160-200). It seems that majority of the people living in the Districts of Mannar and Trincomalee do not engage with direct agricultural activities. The agricultural activity practices by farmers is paddy cultivation, which were dominated by land preparation followed by planting of crops, application of fertilizer, application of agro-chemicals for the control of pest/weeds and harvesting the crops. In early days, people were used to follow traditional, time consuming practices for land preparation and cultivation.

As a result of expanding commercial agriculture and use of mechanical equipment have reduced the time consume for the agricultural activities. Therefore, the number of days stayed outside for ploughing and harvesting or time stays out-door till late evening, when mosquitoes become more active in their biting habits have been reduced significantly. Hence, the people get less chance for being exposed to mosquito bites, which would make them less susceptible to malaria.

In most of the household heads kept domestic animals in their household. The majority of them kept cattle, goats, dogs, cats and poultry. Since malaria vectors are zoophilic in nature, there is possibility of attracting vectors to animals. Therefore, the reason for the absence of malaria incidence in these demarcated study areas and the presence of vector could be due to the phenomenon of zooprophylaxis.

In the present study, an attempt was made to comprehensively link factors associated with malaria transmission in rural communities. Some established risk factors in this study were not associated with malaria. Use of personal protection methods such as mosquito nets including those treated insecticides, repellent such as smoking of local plan materials could reduce the human vector contact. Finally, the use of bed nets, use of traditional smokes, improvement in living standard and commercial agriculture were associated with reduction of malaria.

Acknowledgement

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