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Vector Control Methods Adopted By a Village in Andaman & Nicobar Islands: A Cross-Sectional Study

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ABSTRACT

Background and Objectives: In Andaman & Nicobar Islands vector borne diseases are a common public health problem. This study was conducted to assess the vector control methods adopted by households in Wandoor village of South Andaman and to assess the coverage of IRS and ITN.

Methods: The cross-sectional study was conducted in Wandoor, between January to March 2017. Using systematic sampling, every third house was identified for inclusion in the study. Data was collected using a semi structured questionnaire, administered to one respondent per household.

Results: Of the 87 households, vector borne diseases were reported by five households (5.75%; 95% CI: 1.89 to 12.9, p<0.0001). Almost 97% (95% CI: 90.25 to 99.28, p value<0.0001) of the families used one or other method of vector control measures.The total coverage by IRS of all households was 20.7% (95% CI: 12.7 to 30.7, p<0.001) and ITN use was 3.4% (95% CI: 0.72 to 9.7, p<0.001).Refusal rate to IRS was 66% (95% CI: 51.73 to 78.48, p=0.027).

Interpretation: Coverage with IRS and ITN was poor. Personal protection methods were widely used. Most of the cases of VBD in the study occurred in households which use vector control methods other than ITN and IRS.

Keyword Mosquito control, malaria, dengue

INTRODUCTION

Andaman and Nicobar (A& N) Islands historically was called "kala-pani" because of high death rates in the island, predominantly due to malaria [1,2]. In due course the incidence of malaria declined [3], and other vector borne diseases classically unknown in the islands like Dengue and Chikungunya began to rise [4,5]. Humidity, long rainy season, rich vegetation, presence of marsh and swampy land coupled with increase in migration of people contribute to the favorable environment for mosquito survival and disease transmission in the islands. Post Tsunami 2004, rice fields and fallow lands with freshwater also became important breeding sites because of saline water intrusion. [6,7]

In 2017 according to the National vector borne diseases control programme, the Annual Parasite Incidence (API) of Malaria in A & N Islands was 1.06 and as per belonged to category three state as per the National Framework for Malaria Elimination in India[8]. The prevalence of Chikungunya, and dengue were 3.47 and 0.44 per 10,000 population respectively [9].Although filariasis is prevalent in the islands, it is localized to the Nicobar group of islands where prevention efforts in the form of Di-Ethyl-Carbamazine fortified salt is implemented[10]. The other Vector Borne Diseases (VBD) Leishmaniasis and Japanese Encephalitis have not been reported from the islands [9].

Anopheles epiroticus (sundaicus) is the predominant vector for Malaria in the islands while Aedes

aegypti and Aedes albopictus are the chief vectors for Dengue and Chikungunya [5,11] . Vector control is especially challenging in the islands because of the breeding habits of An.epiroticus and Ae.albopictus at brackish water and natural sites like tree holes, leaf axils, ground pools and coconut shells respectively [12,13]. Studies indicate that in the islands, An. epiroticus remains sensitive to insecticides like DDT while the Aedes mosquitos have developed resistance to several commonly used insecticides including DDT [5,14].

Indoor Residual Spraying (IRS) and use of Insecticide Treated Nets (ITN's) or Long Lasting Insecticidal Nets (LLIN's) are the two cost effective interventions used globally for reducing the burden of VBD's [15]. In A&N Islands bi- annual spraying with DDT is the chief vector control strategy adopted by the health system, in the view of erratic availability and supply of ITN's or LLIN's [11].

Several studies have been conducted in the islands and information is available regarding the common vectors, entomological determinants and vector susceptibility to insecticides. However, the coverage with mosquito control measures, which is the most important factor in the fight to eliminate vector borne diseases is not known. Hence this study was conducted to assess the vector control methods adopted by the households in Wandoor village of South Andaman and to assess the coverage of IRS and ITN in the community.

MATERIALS AND METHODS

The cross-sectional study was conducted in Wandoor village of Andaman & Nicobar Islands. The village is located about 30 kms from Port-blair with an area of 708 hectare and is served by the Primary Health Centre at Manglutan. According to census 2011, the village consisted of 364 households with 1,437 population. The village was selected purposively because of the reported high susceptibility to vector breeding and transmission of VBD [16].

The sample size was calculated based on the prevalence of regular use of ITN of 80% [17]. With 10% relative precision, the sample size was calculated to be 100 households. Using systematic sampling, every third house was identified for inclusion in the study.

Data was collected using a semi structured questionnaire which was designed to obtain socio demographic information about the respondent, details of individuals who suffered from fever in households two weeks preceding the survey, sites of vector breeding around household and information about vector control methods adopted. One

Table1: Socio -Demographic profile of respondents

Variable	Frequency (%)
Age*	
<40 years	49(56.32)
41-60 years	26 (29.89)
>60 years	12 (13.79)
Sex	
Male	28 (32.2)
Female	59 (67.8)
Education (n=85)	
Illiterate	7 (8.24)
Primary School	15 (17.65)
Middle School	25 (29.41)
High School	23 (27.06)
Intermediate/Graduate	15 (17.64)
Occupation	
Housewife	51 (58.62)
Fishing	7 (8.05)
Private	7 (8.05)
Retired	5 (5.75)
Govt	4 (4.6)
DRM	4 (4.6)
Others	9 (10.34)

*Mean age: 41.94, median: 38, SD: 15.86, Range: 20-87

Table 2: Distribution of households with fever among family members intwo weeks preceding the survey, associated treatment seeking behaviour and domiciliary visits by health care personnel

Variable	Frequency (%)
History of fever among family members in last 2 weeks	
Yes	38 (43.7)
No	49 (56.3)
History of vector borne disease among family members in last 2 weeks	
Yes	5 (5.75)
No	82 (94.25)
Preferred health facility for treatment of fever (n=39)	
Government	31 (79.49)
Private	2 (5.13)
Others	6 (15.39)
Health personnel visit to families in last 2 weeks	
Yes	8 (9.2)
No	73 (83.9)
Dont know	6 (6.9)
Enquiry about fever episodes by health personnel in last 2 weeks (n=8)	
Yes	5 (62.5)
No	1 (12.5)
Dont know	2 (25)
Blood collection for fever in last 2 weeks by health personnel (n=8)	
Yes	1 (12.5)
No	6 (75)
Dont know	1 (12.5)

respondent from each household selected was interviewed. Households which were found locked were visited on one more occasion, before being excluded from the study. The data was collected between January to March 2017.

Ethical approval was obtained from institute ethics committee and informed consent was obtained from the respondent. The participants were provided health information and referral if needed. The data was entered in MS excel and analyzed using R version 3.4.1 [18]. Coverage with IRS and ITN were calculated. P value for single proportion was calculated against the null hypothesis assuming the prevalence of 0.5, and for prevalence of malaria and other VBD, significance against a prevalence of 0.001 was tested. Bivariate analysis was performed using Fisher exact test. P value less than 0.05 was considered significant.

RESULTS

A total of 87 households were considered in the analysis, after excluding the five households which refused participation and seven households which were found locked even after two attempts. The non response rate was therefore 14.9%.

As given in table:1, majority of the respondents were less than 40 years (56.3%), females (67.8%), have studied up-to middle or high school (56.5%) and were housewives (58.6%). The mean age of the respondents was 41.94 years with a standard deviation of 15.86. In the two week preceding the survey, fever was reported by any family members in 43.7% of the households, out of which vector borne diseases were reported by five households (5.75%; 95% CI: 1.89 to 12.9, p<0.0001).

Government health facility was reported as the preferred place for treatment of fever by 80% of the study population. In the two weeks preceding the survey, home visits were carried on by ASHA or Health workers in 9.2% of the families out of which 62.5% reported that the health personnel had asked about history of fever and 12.5% reported collection of blood sample for testing. (Table:2)

In the 38 households which reported fever in the two weeks preceding the survey, there were a total of 72 cases of fever. Majority of the fever cases were in the age group of 21-60 years (57%) and were males (52.8%). Of the thirty-eight cases with a reported diagnosis, 33% were due to common cold and viral fever. There were three cases of dengue (4.2%), two cases of malaria (2.8%) and one case of filariasis (1.4%) in five households. This gives the prevalence of VBD to be 4.18 per 1000 population (95% CI: 1.53 to 9.07, p=0.03) (Table:3)

Table 3: Details of individuals with fever, associated symptoms and treatment seeking behavior

Variable	Frequency (%)
Age (n=72)	
<10 years	14 (19.44)
11-20 years	12 (16.67)
21-60 years	41 (56.94)
>61 years	5 (6.94)
Sex (n=72)	
Male	38 (52.8)
Female	34 (47.2)
Diagnosis if any (n=72)	
Common cold	12 (16.67)
Viral fever	12 (16.67)
Dengue	3 (4.17)
Filariasis	1 (1.39)
Malaria	2 (2.78)
Others	8 (11.11)
Associated symptoms (n=72)	
Cough	49 (68.06)
Breathlesness	6 (8.33)
Retroorbital pain	4 (5.56)
Bodyache	21 (29.17)
Chills	11 (15.28)
Joint pain	10 (13.89)
Diarrhoea	1 (1.39)
Nausea/Vomiting	6 (8.33)
Headache	12 (16.67)
Rash	1 (1.39)
Hospital where treatment was obtained (n=43)	
Tertiary hospital	9 (20.93)
Any Govt health facility	16 (37.21)
PHC	4 (9.3)
Private hospital	6 (13.95)
Sub-centre	8 (18.6)
Testing for malaria in hospitals (n=43)	
Yes	26 (60.47)
No	17 (39.53)

Seventy-six households (87.4%) reported that mosquito bite is a common problem in and around the house. Almost 80% of the households also perceived that there are breeding sites around the house. Bushes around the house (70.1%), open drains (54%) and uncovered wells (36.8%) are the most common site of vector breeding reported. Almost 97% (95% CI: 90.25 to 99.28, p value<0.0001) of the families used one or other method of vector control measures. The most commonly used are coils/mats (70%), bed-nets (58.6%) and liquid repellants (18.4%). (Table:4)

Insecticide treated bed-nets were provided by the health system to 13.8% (95% CI: 7.34 to 22.85, p<0.001) of the households and used by 3.4% (95% CI: 0.72 to 9.7, p<0.001) of the households. Sixty-one percent of the households were approached for spraying activities in the six months before the survey. However, of the 53 households only 18 (34%) allowed indoor residual spraying. Refusal rate was therefore 66% (95% CI: 51.73 to 78.48, p=0.027).

Table 4: Distribution of households by perceived problem of mosquito breeding, sites of breeding around house, and vector control methods used

Variable	Frequency(%)
Perceived problem of mosquito bite	
Yes	76 (87.36)
No	10 (11.49)
Dont know	1 (1.15)
Awareness about biting habits of dengue mosquito	
Day biter	25 (28.74)
Night biter	29 (33.33)
Both	6 (6.9)
None	27 (31.03)
Perceived breeding sites for vectors around house	
Yes	69 (79.3)
No	18 (20.7)
Sites of vector breeding around house	
Open drains	47 (54.02)
Open overhead tanks	12 (13.8)
Uncovered wells	32 (36.78)
Collection of water in coconut shells, small vessels	17 (19.5)
Collection of water in discarded tyres	2 (2.3)
Bushes around house	61 (70.1)
Use of vector control methods	
Yes	84 (96.55)
No	3 (3.45)
Vector control method adopted by households	
Creams	7 (8.05)
Liquid repellants	16 (18.4)
Coils/mats	61 (70.1)
Bednets - non medicated	51 (58.6)
Insecticide treated bed nets	3 (3.45)
Window or door screening	6 (6.9)
Others	4 (4.6)

Table 5: ITN and IRS Activities in the households

Variable	Frequency(%)
Households provided with ITN	
Yes	12 (13.79)
No	75 (86.21)
Households approached for spraying in last 6 months	
Yes	53 (60.92)
No	31 (35.63)
Dont know	2 (3.45)
Households where spraying was done in last 6 months (n=53)	
Yes	18 (34)
No	35 (66)
Reason for refusal of IRS (n=35)	
Didn't think was needed	5 (14.29)
Thought it was toxic	16 (45.71)
Was inconvenient	14 (40)
Last spraying activity done in household	
In last six months	18 (20.69)
In last one year	20 (23)
Been more than a year	20 (23)
Never done	25 (28.7)
Dont know	4 (4.6)

The total coverage by IRS of all households was 20.7% (95% CI: 12.7 to 30.7, p<0.001). Misconception about IRS and inconvenience were cited as the important reasons for refusal. Also, IRS has never been done in 28.7% of the households. (Table : 5)

As reflected in table: 6, all the cases of vector borne disease occurred in households who reported use of vector control measures other than ITN's and none occurred in households which reported use of ITN. Also 80% of the cases were reported from households where IRS was not done in the last one year.

DISCUSSION

The proportion of families using any method of vector control was high in the study area and was comparable to other studies done in India[19,20, 21,22]. However, the IRS coverage was poor in the study area. This was because of a combination of factors like refusal to spraying by the families and inadequate coverage of all families by spraying teams. Hence spraying activities should be preceded by health education campaigns[23] to address the misconceptions and also it should be held at a time feasible to the residents, ensuring complete coverage of all the households in the area.

The use of ITN was also low and comparable to studies done in other sites of India[19,24,25,] mainly because of poor supply. Insecticide treated bed nets provide better personal protection and is also useful for reduction of transmission of vector borne diseases[13,26]. Since almost half of the families favoured using bed nets, substituting non-medicated bed nets with ITN's would be a feasible intervention in the study area[17].

Surprisingly, most of the cases of VBD in the study occurred in households which use vector control methods other than ITN and IRS. This might be due to various reasons. Firstly, this might be due to vector resistance to the chemicals used in creams, coils, mats and liquid repellants. Secondly,the inefficacy of bed-nets (non- medicated) may be due to improper use or individual non-use of bed-net or day biting habits of mosquitoes, since bed-nets are more likely to be used indoors and only at nights[13]. Hence, the use of personal protection methods should not be considered a substitute for IRS [22,27,28,29].

Active fortnightly surveillance for vector borne diseases by health personnel was reported only by 9% of the study households. In the absence of effective surveillance, the reported incidence of different vector borne diseases of the sub-centre is likely to be an underestimate. Though not statistically significant, the prevalence of malaria in the

Table 6: Vector borne disease and its association with vector control methods

Variable	VBD		OR	P
	Yes	No	(95% CI)	value
Perceived problem of VBD				
Yes	3	73	0.17	0.153
No	2	8	(0.02-2.32)	
Use of PPM other than ITN				
Yes	5	76	-	-
No	0	6		
Bed net (non-medicated) use				
Yes	4	47	2.98	0.399
No	1	35	(0.32-27.83)	
ITN use				
Yes	0	3	-	-
No	5	79		
Spray done in last 1 year				
Yes	1	37	0.3	0.272
No	4	45	(0.03-2.84)	
Duration since last spraying				
In last six months	0	18	-	-
In last one year	1	19		
Been more than a year	2	18		
Never done	1	24		
Dont know	1	3		

two weeks preceding the survey was 1.4 per 1000 population (95% CI: 0.17 to 5.02, p= 0.6584). In the era of malaria elimination, active surveillance of vector borne diseases holds an important role [15].

In the study area, IRS with insecticide other than DDT should be the preferred vector control method, since Ades aegypti is resistant to DDT and An.epiroticus is predominantly an indoor biting vector [30]. In-addition, IRS should be supplemented with personal protection and Larval Source Management to protect against malarial vectors. Sustained community involvement is crucial for successful elimination of mosquito borne diseases in the community. Considerable improvement can be achieved by efforts by the community, since most of the breeding sites identified in the study are amenable to environmental modification like clearing of bushes around the households, covering of open drains, tanks and wells and prevention of artificial collections of water[23]. The scope for expansion of use of larvicides, larvivorus fishes, screening of doors and windows should also be explored.

The study is one of the kind conducted in the islands which takes into account all methods of vector control and also gives an estimate of vector borne diseases prevalent in the study population. The non-response rate however was high (14.9%) and self reported diagnoses of fever were enquired, whose accuracy was not verified. Despite the limitations, the study provides a direction for further action to curb the dengue and chikungunya epidemic and elimination of malaria in the Islands.

CONCLUSION

Although the proportion of households using any method of vector control is high, coverage with IRS and ITN was low. The prevalence of VBD was 4.18 per 1000 population in the two weeks preceding the survey. Several breeding sites were reported by the households and active surveillance for VBD's was poor. Hence, in-addition to emphasizing Larval Source Management and personal protection, coverage with IRS has to be improved in the village. Such activities should be supplemented with awareness programs for enhancing correct knowledge regarding IRS and other vector control measures.

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