ORIGINAL ARTICLE

PATTERN, COSTS AND SOCIO-DEMOGRAPHIC DETERMINANTS OF PERSONAL PROTECTION MEASURES AGAINST MOSQUITOES IN RURAL AND URBAN COMMUNITIES OF TRIVANDRUM DISTRICT OF KERALA

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ABSTRACT

Background: Vector borne diseases are a major health problem in India. Personal protection measures (PPM) have become important tool against vector borne diseases.

Objectives: The use and pattern of personal protection measures against mosquitoes and the socio- demographic factors influencing its usage were studied. The average monthly expenditure per household on them was assessed.

Materials and Method: A cross sectional Study was done during November-December 2010 among rural and urban communities in Trivandrum district of Kerala.

Results: 98% of the people in the study community perceived mosquitoes as a problem. Most (80%) of the rural and all of the urban households reported using at least one personal protection measure against mosquitoes. Fumes (60%) were the popular method in the rural whereas liquid vaporizer (62%) was commonly used in the urban. Place of residence was an important predictor of use of PPM. Rural and urban household on an average spent Rs 16.85 and Rs 74.64 per month respectively. Average expenditure on PPM in rural area is 0.31% and that of urban is 0.15% of the family income.

Conclusion: The study found that the uses of personal protection measures were high in urban area as compared to rural area. Urban households also spend more on PPM as compared to rural counterparts.

Keywords: Mosquitoes, Personal protection measures, Cost

INTRODUCTION

Vector borne diseases are major public health concern and impede socio economic development especially in developing countries including India[1]. Globally mosquitoes kill more than one million people a year just through transmission of Malaria[2]. Added to it are the numbers of those sickened and killed by other mosquito borne diseases like Dengue fever, Yellow fever, West Nile fever and Japanese Encephalitis.

In India more than 1.5 million people are infected with Malaria every year[3]. Many of the vector borne diseases particularly Dengue fever, Japanese Encephalitis and Malaria now occur in epidemic form causing considerable morbidity and mortality[3]. One third of global Filarial cases live in India[3]. Chikungunya has re-emerged in India after a gap of more than three decades[4].

In Kerala, Urban Malaria spread through *Anopheles Stephensi*[5] and Filariasis spread through *Wuchereria Bancrofti* are prevalent in urban areas. Indigenous cases of Malaria are also being reported recently as part of large scale constructional activities being carried out in the state which has lead to an influx of migrant labour from states endemic to Malaria. Dengue fever appeared in 1997 and reached epidemic proportions in 2003 and is more or less endemic in the state now[6]. There have been frequent outbreaks of Chikungunya in various parts of the state since 2006[7].

Even after implementing various control activities, mosquitoes still continue to be the most important vectors of diseases and it has become imperative for people to protect themselves against them. It is in this context Personal Protection Measures (PPM) have gained in importance[8]. The human attitude and adoption of various methods of personal protection measures vary in rural and urban areas[9].

The pattern and use of personal protection measures against mosquitoes in Trivandrum and their costs were not studied yet. Present study was done to understand the use of personal protection measures against mosquitoes, socio-demographic determinants for its use and the economic burden imposed by them on households in a rural and urban area of Trivandrum.

METHODOLOGY

A cross sectional study was done in a rural and urban ward of Trivandrum district of Kerala during November-December 2010. In Kerala the smallest administrative unit of a panchayat (village) or Municipal Corporation (town) is a ward. One ward each in urban and rural area was chosen purposively. The rural ward (Anappara, population1644, houses 560) and the urban ward (Kulathoor, population 3129, 987 houses) were selected for the study. Sample size of was calculated as 72 households; taking a prevalence rate of PPM usage 58% (p)[7], taking relative precision of 20% and using the formula $N= [Z^2_{(1-\alpha/2)} p (1-p)]/d^2$. Therefore 100 houses were selected for this study from each ward (rural-100, urban-100) by systematic random sampling technique. House to house survey was done using a semi structured pretested questionnaire.

The first author had personally done the interviews as it was part of the research project done for completion of PGDPHM course. The questionnaire was in Malayalam the local language. Piloting was done in the neighboring wards in 10 households each in rural and urban areas. The investigator was trained in the interview technique by the faculty members of the department (Second and Third authors).

All the members of the surveyed households were included in the study. Consent for participation in the study was taken from the head of the households. Details on socio-demographic parameters, on perceptions about mosquitoes, awareness on mosquito borne diseases, mosquito control measures at the community level and personal protection measures were enquired into.

Data was analysed using SPSS 16.

Ethical clearance was obtained from the Institute Ethics committee, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry.

RESULTS

In the 200 households studied there were a total of 829 individuals. Out of which 410 were rural and 419 urban. The socio-demographic details are given in table 1. Most of the households studied (97% of the rural and 99% of the urban) perceived mosquitoes as a public health problem.

Table 1: Baseline characteristics of study population

Parameters	Rural	Urban	Total
Households surveyed	100	100	200
Individuals studied	410	419	829
Age group (in yrs)			
0-4	19(4.4)	25(5.9)	44(5.3)
5-15	64(15)	69(16.5)	133(16)
16-45	204(47.8)	199(47.5)	403(48.6)
45-60	79(18.5)	74(17.6)	153(18.4)
>60	44(10.3)	52(12.4)	96(11.6)
Gender distribution			
Male	208(50.7)	192(45.8)	400(48.3)
Female	202(49.2)	227(53.9)	429(51.7)
Family type			
Nuclear	67	60	127
Joint	33	40	73
House type			
Kutcha	26	0	26
Semipucca	43	6	49
Pucca	31	94	125
Income (Rs.)*	1357	6101	3729
Mean family size	4.09	4.17	4.13

Figure in parentheses indicate percentages
* Average income per capita

Table 2 Pattern of personal protection measures in study area, 2010

Types of Personal Protection Measures	Rural	Urban
Fumes (mainly obtained by burning of natural substances)	60	21
Coil (produces fumes aiming at deterring the insects from entering the rooms)	15	16
Fan (electric appliance generating air)	12	12
Vaporizer (consist of pyrethroids which are synthetic derivatives of Pyrethrins, a group of naturally occurring chemicals extracted from the flowers of the Pyrethrum)	6	62
Net (Untreated bed nets form a protective barrier around persons)	5	12
Mat (put on electric plates to produce fumes aiming at deterring the insects from entering rooms)	4	4
Electric bat (Electric Bats used to char the mosquitoes when they come in contact)	3	21
Insecticidal spray (chemicals used by a spray to kill mosquitoes / insects)	0	2
Total	**100**	**100**

The PPM practiced by the study households are given in the chart 1. Almost all the studied households (80% of the rural and 100% of the urban) reported use of at least one measure against mosquitoes which was found to be statistically significant (Fisher Exact test value= 22.1, $p<0.05$). Out of these 26% of the rural and 76% of the urban population were using modern methods of PPM based on chemical repellants or insecticides and electric bat. Around 61% of the rural and the 21% of the urban were using traditional methods of PPM which includes fumes produced by burning coconut husks with or without *Kundrikkam* (Frankincense) (Table 2).

Fumes (60%) were the popular method in the rural area and liquid vaporizers (62%) were the commonest method in the urban. Mosquito nets were used only by 5% of the rural and 12% of the urban households. Reasons for not using the net was that it was either uncomfortable due to hot climate (9% of rural and 39% of urban) or unaffordable (2% of rural).

Table 3 Use of personal protection measures in study area

Characteristics	Rural (n=100)	Urban (n=100)	X^2, P Value
Modern method used	26	80	58.5, <0.001
Traditional methods used	60	21	31.5, <0.001

In the rural 26% used PPM daily, 30% only during rainy season and 24% used occasionally. In the urban 50% used PPM daily, 33% used during rainy season and 17% occasionally. Regarding satisfaction on use of PPM's 74% of the rural and 94% of the people of urban households were satisfied on the PPM's used by them which was found to be statistically significant ($X^2 = 14.1$, $p<0.05$). Health problems like allergy, cough and headache were reported, and are rare (3% of rural and 8% of urban). Place of residence was a predictor in usage of modern or traditional PPMs ($p<0.001$) as given in Table 3.

Table 4: Association of family type, type of houses and social classes with use of traditional methods of PPM in the rural ward (n=100)

Characteristics	Traditional PPM (n=60)	Not used (n=40)	X^2, P Value
House type			
Kutcha	20	6	4.325,
Semipucca	24	19	0.115
Pucca	16	15	
Family type			
Nuclear	45	22	4.342,
Joint	15	18	0.037
Social class			
I	3	1	3.34,
II	7	10	0.342
III	24	15	
IV	26	14	

The study did not find any statistical difference in the use of modern and traditional personal protection measures as per the family type (nuclear & Joint), type of household (semi-pucca, pucca) and social class in urban wards respectively ($p>0.05$). Similar observation was made in the rural ward except the relationship between use of traditional PPMs and the type of family which was found to be statistically significant (members residing in nuclear family were using traditional methods more than those in joint family; $X^2=4.34$, $p=0.037$). The education or the occupation of the head of the family had no relation with the modern methods in the rural and urban areas respectively. The occupation of the head of the family was associated with use of traditional methods of PPMs in the rural ward ($X^2=11.9$, $p=0.03$), however, similar association was not found in urban ward (table 4 & 5).

Table 5: Association of family type, type of houses and social classes with use of traditional methods of PPM in the urban ward (n=100)

Characteristics	Traditional PPM (n=21)	Not used (n=79)	X^2, P Value
House type			
Semipucca	1	5	0.072,
Pucca	20	74	0.788
Family type			
Nuclear	14	46	0.492,
Joint	7	33	0.483
Social class			
I	0	5	2.925,
II	4	7	0.403
III	11	43	
IV	6	24	

The expenditure incurred on personal protection measures varied between rural and urban areas. The expenditure on PPM for one month varied from zero to a maximum of Rs 180. The average expenditure on PPM in rural ward was Rs 16.85 and that in urban ward was Rs 74.64. Average expenditure on PPM in rural area is 0.31% and that of urban is 0.15% of the family income. Fumes and vaporizers were cheaper whereas insecticidal spray and coils were costlier individual PPM when the net costs of individual items per month were considered.

DISCUSSION

In the present study 100% of the participants could name at least one mosquito borne disease and knew that mosquitoes spread diseases. Study done in Delhi (2005) by Tyagi P[10] reported that 100% of study participants knew that mosquito bites transmit malaria. Surendren SN[11] had reported from northern Sri-lanka that 71% of study participants were able to name at least one disease transmitted by mosquitoes.

Present study found that 80% of the rural and 100% of the urban households were using at least one method of PPM against mosquitoes. Similar observations were reported by Babu et al[9] from Orissa where 84% of the rural and 99% of the urban households were using at least one measure of PPM. Snehalatha et al[8] from Pondicherry reported that 73% and 99% of the rural and urban respondents were found to use some form of personal protection measure against mosquito bites. But a study from Kerala[10] only 58% of the studied households used at least one method of PPM.

Present study brought out marked differences in usage of different types of personal protection measures in rural and urban areas. 60% of the rural and 21% of the urban were practising traditional methods-mainly of fumes. 26% of the rural and 80% of the urban were using modern PPM's. A study done in Orissa 9 showed that 92% of the urban and 64% of the rural used a 'modern' chemical method like coils, vaporizing mats, liquid vaporizers or sprays. Also the wide publicity mainly in the form of well produced and catchy advertisements shown in electronic/ print media may have a role to play in the usage of modern PPM. Regarding individual methods, fumes were the commonest method in the rural community. Smoke/ fumes were the preferred method by rural areas in many studies12. In the present study, fumes made by burning of coconut husks or with Kunthirikkam were mainly used. The coconut husks being cheaper and easily available could be one of the reasons for using them. According to a study done by Vernede et al13 in Papua New Guinea during 1994, it was reported that smoke produced by burning various kinds of woods and coconut husks were found to repel mosquitoes significantly. Anopheles farauti, Anopheles hinesorum, Anophele skoliensis and Anopheles punctulatus were the vectors reported in this study; however this can be a further area of research in our setting to identify other species causing diseases.

In the urban area of this study, liquid vaporizer was the most popular method which is comparable with the Boratne et al[14] study in 2010 where liquid vaporizer was used by 43.85% respondents. In the present study bed nets were used only by 5% of rural and 21% of urban households. Nets were not used by a vast majority which was also reported by a study done in Karnataka[15]. When enquired for the reason of not using bed nets most people reported that it was uncomfortable and few said that they could not afford them. Same explanations were reported by other studies also[8, 12]. In Kerala most people do not use mosquito nets which are possibly due to heat and humidity. Currently Insecticide treated bed nets are being provided under the Malaria control initiative by the Ministry of Health and family welfare (MOHFW). This fact needs to be considered and Information education and communication activities (IEC) need to be carried out to improve the usage rate.

3% of the rural and 8% of the urban populace perceived health problems after using modern chemical based PPMs. It was attributed mostly to mosquito coils because they produced smoke and unpleasant odour and people complained of allergy, breathing difficulty, cough and headache etc. Some of these facts may be justified as some studies have showed that prolonged exposure to smoke from coils may damage lungs[17, 18].

Present study revealed that the area of residence was a predictor of use of PPM, similar finding was found in the Babu et al[9] study done in Orissa. This can be attributed to various cultural factors prevailing in the area. In the rural population the pattern of use of different types of PPM was influenced by the education and occupation of the head of the household as well as income of the family which shows that socioeconomic status is a predictor of selecting various personal protection measures which was found in many studies[19, 20].

In the present study the average daily expenditure on PPM in rural and urban ward were Rs16.85 and Rs 74.64 respectively. This is comparable to the study done by Snehalatha et al[8] in Pondicherry in 2003 where it was Rs 62.17 in urban areas and Rs 8.03 in rural areas.

The Average expenditure on PPM in rural area is 0.31% of the average family income and that of urban is 0.15% of the family income which is similar to study done by Babu et al in Orissa in 2006. This implies that the lowest income groups spent substantial amounts of money from their monthly income for personal protection measures which is a burden to their daily life. The study is limited to a single urban and rural ward hence cannot be generalized to the whole of Trivandrum district. Another limitation of the study is purposive sampling technique, which limits the external validity of the study.

In conclusion, mosquitoes being a significant cause of nuisance to the community, it has become imperative on the part of individuals to use personal protection measures. The study found that the use of personal protection measures were high in urban area as compared to rural area. The average daily expenditure on PPM in rural and urban ward was found to be Rs16.85 and Rs 74.64 respectively.

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