*J Vector Borne Dis* 47, December 2010, pp. 249–256

**Short Research Communications**

# Predictors of knowledge of selected mosquito-borne diseases among adults of selected peri-urban areas of Puducherry

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**Key words** Coastal area; India; knowledge, attitudes and practices; mosquito-borne diseases

The mosquito borne diseases of public health importance are complex and their occurrence depends on the interaction of various biological, ecological, social and economic factors. Though several measures for their prevention and control are followed, yet the problem density is too high with 300–500 million cases and 1.1–2.7 million deaths due to malaria alone globally per year[1]. Puducherry (earstwhile Pondicherry) has 64 species of mosquitoes causing severe mosquito nuisance[2]. The burden of vector-borne diseases (malaria, dengue, chikungunya and filaria) is low while Japanese encephalitis and kala-azar have not been reported from Puducherry[3]. The mosquito-borne diseases result in avoidable ill-health and death which also has been emphasized in National Health Policy[4] and Millennium Development Goals (MDGs)[5]. National Vector Borne Disease Control Programme (NVBDCP)[6] under the aegis of National Rural Health Mission (NRHM)[7] is one of the most comprehensive and multifaceted public health activity in India including prevention and control of mosquito-borne diseases.

Inspite of mass communication and educational approaches, community participation is far below expectation. Community participation in turn depends on peoples' awareness, knowledge and attitude towards the disease[8]. Several socioeconomic studies in different countries indicate variations in knowledge and practice-related to mosquito-borne diseases[9–11]. However, taking socially acceptable measures by the local government, in collaboration with other relevant sectors and social mobilization for full involvement of the community is crucial. Thus, a need was felt to know the existing knowledge of the study population regarding mosquito-borne diseases usually reported from Puducherry and its predictors which may be helpful in designing evidence-based effective prevention and control strategies as well as sustainable community participation.

The present community-based cross-sectional study was undertaken during February 2010 in selected peri-urban areas (Solai Nagar and Samipillaithottam) in Puducherry which falls in the geographical jurisdiction of field practice area of Department of Community Medicine, Pondicherry Institute of Medical Sciences, Puducherry. Geographically it is located at 162 km south of Chennai, the capital of south Indian state, Tamil Nadu and is surrounded by the Bay of Bengal on the east, and on the other sides by the Cuddalore and Villipuram districts of Tamil Nadu. Puducherry experiences hot and humid climate and the temperature normally varies between 26 and 38°C[12]. Average annual rainfall is 1254 mm and relative humidity varies from 70 to 80%[13]. The study area has the population of 11,600 with the facilities like two schools, one Primary Health Centre, one Urban Health Centre run by our Institute and private practitioners providing medical care. The study population primarily consists of housewives, fishermen and daily wage workers.

The pre-designed and pre-tested structured questionnaire was used for data collection. Faculty and resident medical officer from the department visited the study area along with volunteers from self-help groups and prior information was given to the study population regarding purpose of the study. The ward representatives were contacted for better community participation. The questionnaire was discussed with final year medical students, ANMs, social workers and Interns. They were properly trained for data collection. The data were collected under the supervision of faculty, medical entomologists and postgraduates from the Department of Community Medicine.

Water obtained from pipe water supply, hand pumps and bore wells was considered as safe. Insecticide spraying, fogging and mosquito repellents were taken as chemical methods, larvivorous fishes as biological control methods while filling ditches, removal of collected water, and construction and cleaning of drainage system were taken as environmental measures for control of mosquitoes. ANM/MPWs or doctors were considered as health care providers. Modified Prasad classification (1997) was used for socioeconomic classification of respondents.

The trained interviewers were instructed to cover all households in these two peri-urban areas by house-to-house visits and to collect information from available respondents on socio-demographic characteristics, awareness and knowledge regarding selected mosquito-borne diseases including causative agents of the selected diseases, modes of disease transmission, breeding places of mosquitoes and their control measures. The respondents were also asked about the source of information regarding mosquito-borne diseases and whether they were aware of the seriousness of the diseases in the study area as well as measures taken by the government for prevention and control of these diseases. The final results are based on 1674 available adults who were interested to participate in the study and gave informed verbal consent.

The data were entered in Microsoft excel and analyzed using SPSS software version 16.0 and Epi 6.04. The results were projected as proportions and percentages. To get the predictors of knowledge regarding selected mosquito-borne diseases odds ratio was calculated for different variables. To compare data sets chi-square test was used and $p < 0.05$ was considered statistically significant.

Out of 1674 adults studied, about 71.03% were females and 28.97% were males. Majority of respondents 388 (80%) males and 789 (66.36%) females were >30 yr of age. Majority of females (76.28%) and males (86.19%) were literate, and 499 (29.81%) respondents were poor (class IV and V as per Modified Prasad classification). In all, 80% of male and 72% of female respondents were from nuclear family and 66.67% of the study population was living in *pucca* houses. Majority of respondents (97.07%) were getting safe water supply. Majority of males (65.77%) and females (62.07%) reported practice of throwing waste disposal indiscriminately. About 1040 (62.13%) of the respondents had good drainage system (Table 1).

Interviewers also enquired about awareness and knowledge regarding mosquito-borne diseases among all respondents. A total of 384 (79.17%) males and 887 (74.60%) females were aware about these mosquito-borne diseases through television followed by health care providers (16.43%) and through newspapers (12.84%). About 242 (49.90%) males and 677 (56.94%) females described various mosquito-borne diseases as serious public health problem in the study area. On the other hand, 21.09% were aware about existing various government measures for prevention and control of mosquito-borne diseases (Table 2).

When asked regarding mosquito breeding places, 290 (59.79%) male and 726 (61.06%) female respondents knew that stagnant water was the breeding place for vectors followed by ditches and ponds in the vicinity. The breeding sources like plastic containers, water tanks and tins were included in 'others' category. In spite of availability of abundant coconuts in the study

**Table 1. Socio-demographic characteristics of respondents**

| Characteristics | Male n =485 | Female n =1189 | Total n =1674 |
|---|---|---|---|
| Age (yr) | | | |
| 18-30 | 97 (20) | 400 (33.64) | 497 (29.69) |
| >30 | 388 (80) | 789 (66.36) | 1177 (70.31) |
| *Educational status* | | | |
| Literate | 418 (86.19) | 907 (76.28) | 1325 (79.15) |
| Illiterate | 67 (13.81) | 282 (23.72) | 349 (20.85) |
| *Occupation* | | | |
| Working | 394 (81.24) | 365 (30.70) | 759 (45.34) |
| Non-working | 91 (18.76) | 824 (69.30) | 915 (54.66) |
| *Economic status* | | | |
| Class I–III | 346 (71.34) | 829 (69.72) | 1175 (70.19) |
| Class IV–V | 139 (28.66) | 360 (30.28) | 499 (29.81) |
| *Family type* | | | |
| Nuclear | 388 (80) | 857 (72.08) | 1245 (74.37) |
| Joint | 97 (20) | 332 (27.92) | 429 (25.63) |
| *Type of house* | | | |
| Pucca | 329 (67.84) | 787 (66.19) | 1116 (66.67) |
| Semi-*pucca/Kutcha* | 156 (32.16) | 402 (33.81) | 558 (33.33) |
| *Water supply* | | | |
| Safe | 471 (97.11) | 1154 (96.72) | 1625 (97.07) |
| Unsafe | 14 (2.89) | 35 (3.28) | 49 (2.93) |
| *Waste disposal* | | | |
| Compost pits | 56 (11.55) | 185 (15.56) | 241 (14.40) |
| Covered pits | 110 (22.68) | 266 (22.37) | 376 (22.46) |
| Throwing discriminately | 319 (65.77) | 738 (62.07) | 1057 (63.14) |
| *Drainage* | | | |
| Open | 180 (37.11) | 454 (38.18) | 634 (37.87) |
| Underground | 294 (60.62) | 702 (59.04) | 996 (59.5) |
| Soakage pits | 11 (2.27) | 33 (2.78) | 44 (2.63) |

Figures in parentheses indicate percentages.

area being a costal area, only about 4% of the respondents enumerated coconut shells as one of the breeding places for vectors while about 2% respondents knew about old tyres as breeding places of mosquitoes. On enquiring about causative agents for diseases under interest, 422 (87.01%) males and 967 (81.33%) females had knowledge that mosquito bite causes these diseases while 56 (11.55%) males and 117 (9.84%) females held dirty drinking water responsible for these diseases. About 308 (63.51%) males and 652 (54.84%) females clearly stated mosquitoes as vector for malaria followed by chikungunya and filaria but only 19.12% listed dengue as a mosquito-borne disease. A total of 1023 (61.11%) respondents knew about chemical measures and 348 (20.79%) about environmental measures as the methods for prevention and control of mosquito-borne diseases while 103 (21.24%) male and 241 (20.27%) female respondents did not know about any prevention and control measures (Table 2).

The respondents living in semi-*pucca* or *kutcha*

**Table 2. Awareness and knowledge regarding selected mosquito-borne diseases**

| Characteristics | Male (n=485) | Female (n=1189) | Total (n=1674) |
|---|---|---|---|
| | **Awareness** | | |
| *Source of information** | | | |
| TV | 384 (79.18) | 887 (74.60) | 1271 (75.93) |
| Radio | 35 (7.22) | 102 (8.58) | 137 (8.18) |
| Newspaper | 68 (14.02) | 147 (12.36) | 215 (12.84) |
| Health care providers | 65 (13.40) | 210 (17.66) | 275 (16.43) |
| Others | 31 (6.39) | 134 (11.27) | 165 (9.86) |
| *Serious problem in area* | | | |
| Yes | 242 (49.90) | 677 (56.94) | 919 (54.90) |
| No | 243 (50.10) | 512 (43.06) | 755 (45.10) |
| *Awareness about various Govt. measures* | | | |
| Yes | 107 (22.06) | 246 (20.69) | 353 (21.09) |
| No | 378 (77.94) | 943 (79.31) | 1321 (78.91) |
| | **Knowledge** | | |
| *Breeding places** | | | |
| Ditches | 145 (29.90) | 440 (37.01) | 585 (34.95) |
| Ponds | 125 (25.77) | 277 (23.30) | 402 (24.01) |
| Vehicle tyres | 12 (2.47) | 31 (2.61) | 43 (2.57) |
| Stagnant water | 290 (59.79) | 726 (61.06) | 1016 (60.69) |
| Coconut shells | 21 (4.33) | 50 (4.21) | 71 (4.24) |
| Others | 95 (19.59) | 306 (25.74) | 401 (23.95) |
| *Causative agents** | | | |
| Mosquito bite | 422 (87.01) | 967 (81.33) | 1389 (82.97) |
| Drinking dirty water | 56 (11.55) | 117 (9.84) | 173 (10.33) |
| Overwork/sun exposure | 1 (0.21) | 5 (0.42) | 6 (0.35) |
| Food | 2 (0.41) | 10 (0.84) | 12 (0.72) |
| Others | 0 | 25 (2.10) | 25 (1.49) |
| Don't know | 37 (7.63) | 143 (12.03) | 180 (10.75) |
| *Disease transmitted by mosquitoes** | | | |
| Malaria | 308 (63.51) | 652 (54.84) | 960 (57.35) |
| Dengue | 108 (22.27) | 212 (17.83) | 320 (19.12) |
| Chikungunya | 230 (47.42) | 658 (55.34) | 888 (53.05) |
| Filaria | 179 (36.91) | 385 (32.38) | 564 (33.69) |
| Others | 19 (3.92) | 36 (3.03) | 55 (3.29) |
| Don't know | 59 (12.16) | 153 (12.87) | 212 (12.66) |
| *Control measures** | | | |
| Environmental | 82 (16.91) | 266 (22.37) | 348 (20.79) |
| Chemical | 296 (61.03) | 727 (61.14) | 1023 (61.11) |
| Biological | 14 (2.89) | 34 (2.86) | 48 (2.87) |
| Integrated | 2 (0.41) | 8 (0.67) | 10 (0.60) |
| Don't know | 103 (21.24) | 241 (20.27) | 344 (20.55) |

*Multiple responses possible; Figures in parentheses indicate percentages.

houses (OR: 0.70; 95% CI: 0.57–0.86; $p$ <0.001), female respondents (OR: 0.70; 95% CI: 0.56–0.87; $p$ = 0.001), respondents belonging to socioeconomic class IV and V (OR: 0.74; 95% CI: 0.59–0.92; $p$=0.004), respondents aged >30 yr (OR: 0.77; 95% CI: 0.62–0.96; $p$=0.017) and illiterate respondents

(OR: 0.76; 95% CI: 0.59–0.96; $p$=0.019) were less likely to have knowledge regarding malaria as mosquito-borne diseases than their other counterparts and for all these categories the difference was statistically significant. However, association of occupation and type of family of respondents was statistically not significant as predictors of knowledge of malaria (Table 3).

The illiterate respondents (OR: 0.48; 95% CI: 0.33–0.70; $p$<0.001), respondents aged >30 yr (OR: 0.63; 95% CI: 0.49–0.82; $p$=0.004), respondents belonging to socioeconomic class IV and V (OR: 0.67; 95% CI: 0.5–0.9, $p$=0.005), and females (OR: 0.76; 95% CI: 0.58–0.99; $p$=0.036) were found to be less knowledgeable for dengue as a mosquito-borne disease than literates, young (18–30 yr) respondents belonging to class I, II and III, and male respondents respectively and the differences were statistically significant whereas association of occupation, type of house and family type of respondents was statistically not significant (Table 3).

The illiterate respondents (OR: 0.65; 95% CI: 0.51–0.82; $p$ <0.001), respondents with age >30 yr (OR: 0.67; 95% CI: 0.54–0.83; $p$<0.001) had less knowledge on chikungunya as a mosquito-borne disease than literate and young (18–30 yr) respondents respectively while females had more knowledge of chikungunya as a mosquito-borne disease than male respondents (OR: 1.37; 95% CI: 1.11–1.71; $p$=0.003) and for all these instances the differences were statistically significant. However, occupation, socioeconomic status, housing condition and family type of respondents were not significantly associated statistically with the knowledge regarding chikungunya (Table 3).

The illiterate respondents (OR: 0.58; 95% CI: 0.44-0.76; $p$<0.001) and class IV and V respondents (OR: 0.74; 95% CI: 0.59–0.93; $p$=0.008) were less likely to have knowledge of filaria as a mosquito-borne disease than literate and class I, II and III respondents and whereas respondents living in joint families had more knowledge of filaria as mosquito-borne disease (OR: 1.31; 95% CI: 1.03–1.65, $p$=0.021) as compared to respondents from nuclear families. However, association of age, sex, occupation and housing condition of the respondents were statistically not significant predictors of knowledge of filaria as mosquito-borne disease (Table 3).

The current study shows, about three-forth (75.93%) of the study population were aware about mosquito-borne diseases through television followed by health care providers (16.43%) and newspapers (12.84%) and only 8.18% through radio. Study from Nepal[14] showed that respondents labeled radio (58.1%) and television (25.4%) as the major media sources for information regarding malaria. The higher awareness through TV as compared to radio in our study may be possibly due to availability of TV among a larger population in peri-urban areas.

Majority of respondents (54.90%) perceived mosquito-borne diseases as a serious problem in the study area whereas a study from Tanzania[15] revealed that almost three-forth of the study population labeled malaria as public health problem. This is possibly because of high morbidity due to malaria in Tanzania. More than three-forth respondents reported that they were unaware about existing prevention and control measures against mosquito-borne diseases being taken by the local administrative/health authorities in their locality. Thus, there is a need to intensify health measures by these authorities for prevention and control of mosquitoes along with IEC activities through all available means.

Regarding knowledge about breeding places of concerned vector, more than half respondents (60.69%) stated stagnant water as commonest breeding place followed by ditches and ponds. Similar results have been reported from Nepal[14]. In spite of availability of abundant coconuts in study area being a coastal area, only few (4.24%) respondents knew coconut shells as a breeding place for these vectors, which need to be highlighted in health awareness campaigns. Majority (82.97%) of the study population knew that mosquito bites cause vector-borne diseases (VBDs)

**Table 3. Predictors of knowledge of selected mosquito borne diseases**

| Predictors | Malaria | | | | Dengue | | | | Chikungunya | | | | Filaria | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Yes | No | OR | P-value | Yes | No | OR | P-value | Yes | No | OR | P-value | Yes | No | OR | P-value |
| *Sex* | | | | | | | | | | | | | | | | |
| Male | 308 | 177 | 1 | 0.001 | 108 | 377 | 1 | 0.036 | 230 | 255 | 1 | 0.003 | 179 | 306 | 1 | 0.075 |
| Female | 652 | 537 | 0.70 (0.56–0.87) | | 212 | 977 | 0.76 (0.58–0.99) | | 658 | 531 | 1.37 (1.11–1.71) | | 385 | 804 | 0.82 (0.65–1.03) | |
| *Age* (yr) | | | | | | | | | | | | | | | | |
| 18–30 | 307 | 190 | 1 | | 121 | 376 | 1 | | 298 | 199 | 1 | | 159 | 338 | 1 | |
| >30 | 653 | 524 | 0.77 (0.62–0.96) | 0.017 | 199 | 978 | 0.63 (0.49–0.82) | 0.004 | 590 | 587 | 0.67 (0.54–0.83) | <0.001 | 405 | 772 | 1.12 (0.89–1.40) | 0.339 |
| *Education* | | | | | | | | | | | | | | | | |
| Literate | 779 | 546 | 1 | | 280 | 1045 | 1 | | 773 | 592 | 1 | | 478 | 847 | 1 | |
| Illiterate | 181 | 168 | 0.76 (0.59–0.96) | 0.019 | 40 | 309 | 0.48 (0.33–0.70) | <0.001 | 155 | 194 | 0.65 (0.51–0.82) | <0.001 | 86 | 263 | 0.58 (0.44–0.76) | <0.001 |
| *Occupation* | | | | | | | | | | | | | | | | |
| Working | 451 | 308 | 1 | | 151 | 608 | 1 | | 386 | 373 | 1 | | 259 | 500 | 1 | |
| Non-working | 509 | 406 | 0.86 (0.70–1.05) | 0.118 | 169 | 746 | 0.91 (0.71–1.17) | 0.460 | 502 | 413 | 1.17 (0.96–1.43) | 0.101 | 305 | 610 | 0.97 (0.78–1.19) | 0.733 |
| *Economic status* | | | | | | | | | | | | | | | | |
| Class I–III | 700 | 475 | 1 | | 245 | 930 | 1 | | 634 | 541 | 1 | | 419 | 756 | 1 | |
| Class IV–V | 260 | 239 | 0.74 (0.59–0.92) | 0.004 | 75 | 424 | 0.67 (0.50–0.90) | 0.005 | 254 | 245 | 0.88 (0.71–1.10) | 0.251 | 145 | 354 | 0.74 (0.59–0.93) | 0.008 |
| *Type of house* | | | | | | | | | | | | | | | | |
| Pucca | 673 | 443 | 1 | | 214 | 902 | 1 | | 601 | 515 | 271 | | 385 | 731 | 1 | |
| Semi-pucca/ Kutcha | 287 | 271 | 0.70 (0.57–0.86) | <0.001 | 106 | 452 | 0.99 (0.76–1.29) | 0.929 | 287 | 271 | 0.91 (0.74–1.12) | 0.349 | 179 | 379 | 0.90 (0.72–1.12) | 0.323 |
| *Family type* | | | | | | | | | | | | | | | | |
| Nuclear | 703 | 542 | 1 | | 251 | 994 | 1 | | 671 | 574 | 1 | | 400 | 845 | 1 | |
| Joint | 257 | 172 | 1.15 (0.92–1.45) | 0.213 | 69 | 360 | 0.76 (0.56–1.03) | 0.064 | 217 | 212 | 0.88 (0.70–1.10) | 0.235 | 164 | 265 | 1.31 (1.03–1.65) | 0.021 |

P-values are based on chi-square analysis of numbers in each category.

under interest. Similar results have been reported by Joshi and Banjara[14] from neighbouring country of Nepal. About 10% of the respondents also reported drinking dirty water as a cause for these diseases and almost similar proportion of respondents knew nothing about causation of these diseases.

These myths, misconceptions and ignorance about causation of mosquito-borne diseases need to be overcome by effective IEC campaigns. On enquiry about the names of mosquito-borne diseases, more than half of respondents listed malaria and chikungunya followed by filaria while < 20% of the respondents listed dengue. About three-fifth (61.11%) of respondents knew about chemical method as a measure for prevention and control of mosquito-borne diseases followed by the environmental control measures. A study by Joshi and Banjara[14] in Nepal also revealed almost similar results where 66.7 and 48.1% of the respondents respectively reported removal of the collected water from ditches and spraying insecticides can control mosquito-borne diseases.

The present study reveals that knowledge regarding mosquito-borne diseases is less among females than males which is similar to findings of Sharma *et al*[8] from Delhi and Joshi and Banjara[14] from Nepal. This might be due to their less exposure to multiple channels of communication. Illiterate study subjects had statistically significant less knowledge regarding all mosquito-borne diseases under interest compared to literate ones. Similar results have been reported by Rasania *et al*[16] from Delhi while contrast finding has been given by Kaona *et al*[17] from Zambia.

Respondents belonging to low socioeconomic status were found to be less knowledgeable compared to respondents from higher economic status in the current study which is similar to the findings of Yadav *et al*[9] from Rajasthan. This may be attributed to the more access to knowledge imparting tools by well-to-do members in the society. The study subjects who were living in semi-*pucca* or *kutcha* houses had less knowledge regarding these mosquito-borne diseases than those who were living in *pucca* houses. This may be due to their poor socioeconomic conditions having lesser access to the means of communication.

Thus, the current study revealed that overall awareness and knowledge about selected mosquito-borne diseases was low among females, illiterates and economically backward respondents. Therefore, it is recommended that the reach of IEC activities must improve particularly among these subgroups of population. Basic information related to prevention and control of mosquitoes can be taught from school age and at the same time strong IEC activities can be initiated to address the adults in the community. Active participation of stakeholders, community volunteers and self-help group members should maximize community awareness and improve the performance of National Vector Borne Disease Control Programme.

## Acknowledgement

The authors acknowledge the study participants, final year medical students, interns and volunteers for their active participation. The authors are also thankful to the Director-Principal of Pondicherry Institute of Medical Sciences, Puducherry for his constant support, guidance, logistics and permission for publishing this study.

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*Received:* 19 May 2010 *Accepted in revised form:* 4 August 2010