

# Knowledge and Use of Personal Protective Measures Against Mosquito Borne Diseases in a Resettlement Colony of Delhi

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## Abstract

**Background:** Mosquito borne diseases (MBDs) are major public health problem in India. State of Delhi is endemic for dengue and other MBDs. The increasing incidence of MBDs in Delhi in recent years warrants a pro-active approach for their prevention. Knowledge and use of personal protective measures (PPMs) presents an effective strategy for prevention and control of MBDs. **Aim:** The present study was conducted to assess the knowledge and use of PPMs against MBDs in an urban resettlement colony of Delhi. **Subjects and Methods:** It was a cross-sectional study carried out in a resettlement colony of Delhi. A total of 100 families were selected by systematic random sampling. Data was collected using semi-structured questionnaire and supplemented by spot survey by the investigator in the community. The results were analyzed in SPSS version 16.0 (Chicago Illinois, USA). **Results:** Out of the 100 respondents, 65% (65/100), 58%(58/100) and 13% (13/100) had heard about dengue, malaria and chikungunya, respectively. Nearly, one-fifth (20/100; 20%) of the participants reported incorrect breeding sites for mosquitoes. The knowledge regarding PPMs was very high (93/100; 93%) and about (90/100; 90%) families were actually using at least one of the PPMs. However, very few families were using them correctly (1/90; 1.1%) and adequately (5/90; 5.6%). The most common PPM being used by the study population was liquid vaporizers (54/90; 60%). Nearly one-third (29/90; 32.2%) of the participants reported side-effects due to PPMs with irritation to smell being the most common reported side-effect. On house visit, adult mosquitoes were seen in 67% (67/100) of the houses, while potential mosquito breeding sites were found in and around 56% (56/100) houses. **Conclusions:** There were crucial gaps in knowledge and practices of participants with regard to prevention and control of MBDs. Thus, there is a need to intensify efforts toward creating public knowledge and mobilizing community about correct use of preventive measures against MBDs.

**Keywords:** Chikungunya, Delhi, Dengue, Malaria, Mosquito borne diseases, Personal protective measures

## Introduction

In recent years, mosquito borne diseases (MBDs) have emerged as a serious public health concern in India. Many of these, particularly dengue fever, Japanese encephalitis and malaria

now occur in epidemic proportions almost on an annual basis causing considerable morbidity and mortality.<sup>[1]</sup> Though, the confirmed cases of malaria have decreased from 75 million in 1950's to 1.49 million in year 2010,<sup>[2]</sup> approximately 65% of the population at risk of becoming infected with malaria in South-East Asia is still residing in India.<sup>[3]</sup> Recently, it has been suggested that malaria incidence is between 9 times and 50 times greater than reported with approximately 13 fold under estimation of malaria related mortality.<sup>[4]</sup> On the other hand, changing epidemiology of dengue fevers in terms of strains, severity and geographic distribution is a growing concern in Indian subcontinent. Over the last 10-15 years recurrent outbreaks of dengue fever have occurred in different

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parts of the country. Delhi, the capital city of India, has experienced nine major outbreaks of dengue fever from 1967 to 2010. Thus, it is evident that malaria and dengue have already established their endemicity in Delhi.<sup>[5]</sup> The failure to cap the resurgence of malaria and the continuing increased incidence of other MBDs is warranting a more pro-active approach for their prevention.

Vector is an important link in transmission of MBDs and thus, protection from vector serves as one of the best strategies for prevention in population. Personal protective measures (PPMs) serve as critical action in this regard. A variety of PPMs are available including-repellent creams, mosquito nets (plain or insecticide treated), mosquito coils, liquid repellents, electric rackets, mats, smokeless coils, Incense sticks and naphthalene balls. Under national vector borne disease control program, government has introduced insecticide treated nets for the malaria endemic communities.<sup>[6]</sup> Considering the increasing problem of MBDs, it is important that people should be aware about various measures available and how to use them correctly. Success of these measures largely depends on the access, acceptability and proper usage by the target population.<sup>[7]</sup> Further, role of community participation in vector control is imminent. Community participation in turn depends on people's awareness and knowledge towards the disease and its prevention.<sup>[8]</sup> Therefore, for designing evidence based effective prevention strategies, it is pertinent to study the existing knowledge of the population regarding the disease.

Thus, the present endeavor was undertaken with the objective to study the knowledge about the MBDs in the community, assess the various measures taken by the families to prevent them and to explore reasons for choice of various PPMs used against MBDs by them.

## Subjects and Methods

### Study settings and sampling

It was a cross-sectional study conducted in a resettlement colony of central Delhi from June 2011 to July 2011. Sample size was calculated as 94 using the level of knowledge regarding MBDs as 62% as reported in previous study,<sup>[9]</sup> with 10% precision at 95% confidence interval. There were 400 houses/families in that colony. A total of 100 families were selected by systematic random sampling method and informed consent was obtained before their inclusion into the study. This was carried out to ensure equal representation from whole of the study area. Sampling interval (SI) was calculated as four. A random number was chosen using random number table ( $n = 1$ , i.e., the first house) and by adding the SI to it, the next house was chosen ( $n + SI = 5$  in this case). In case where the family refused to participate or those who could not be contacted or whose houses were found locked during the study period, the next house was included without disturbing the overall sampling procedure.

### Study tool

A pre-tested, pre-designed, semi-structured questionnaire was used for data collection regarding socio-demographic profile Knowledge about MBDs, breeding sites of mosquitoes, PPMs and usage or non-usage of PPMs. The adequacy and correctness of use of PPMs were also assessed. Socio-economic status of the families was calculated using modified Kuppuswamy Scale.<sup>[10]</sup>

### Key definitions

Adequacy and correctness of PPMs have been defined as follows:

1. Bed nets:
  - Adequacy: Preferably every member of the house should sleep under the bed net
  - Correctness: To be used every night, all year round, even if mosquitoes are not seen or heard. The net should be erected and supported in such a way so as to prevent contact of the net with the sleeping person. It should be installed before the dusk when mosquitoes become active.<sup>[11]</sup> Nets to be re-treated after washing 3 times or at least once a year.<sup>[12]</sup> (As it was a cross-sectional study, so the investigator only enquired about the date of last treatment of nets and number of washes they normally do in a year, for assessment of correctness).
2. Liquid vaporizers, mats and coils:
  - Adequacy: Mats (containing allethrin and parathrin) and coils (pyrethroids) to be changed every-day. Liquid vaporizers most commonly used in India (synthetic pyrethroids like transfluthrin 0.88%) come in 30, 60 and 90 day pack and have to be used daily preferably throughout the day
  - Correctness: The heating machine/vaporizer is plugged into the ordinary household electric socket and heats up to an optimum temperature depending upon the mat and the heater.<sup>[13]</sup> The free end of the spiral of a coil should be lit and room should be closed and left, to return after 1-2 h.<sup>[14]</sup> The coil usually lasts for 6-8 h.
3. Sprays (with knockdown insecticide like pyrethrum and its related compounds):
  - Adequacy: Multiple applications are particularly necessary for *Aedes aegypti* at intervals shorter than the extrinsic incubation period, but not < 8-10 days<sup>[15]</sup>
  - Correctness: The application must occur at times relevant to target mosquito activities.<sup>[16]</sup> During and after the process of spraying, doors and windows be closed for at least 30 min and food and water should be covered.<sup>[16]</sup>
4. Creams (N, N diethyl benzamide, DEET-N, N-diethyl-meta-toluamide, N, N-diethyl-3 methyl benzamide):
  - Adequacy: Re-application duration will vary with the amount of active ingredient, air temperature, amount of physical activity and perspiration, water exposure and other factors. Re-apply repellent creams according to label instructions
  - Correctness: It must be applied on exposed skin of arms, forearms, legs, feet etc., and preferably before wearing

anything so as to have protection against mosquito bites even through clothes. Should be applied in daytime also for protection against day biting mosquitoes.

(Adequacy of use of repellent creams was checked by asking the respondents about re-application duration and the answers were matched with the duration for re-application mentioned on the label of the cream).

### Study methods

From the selected family, an adult person who was available at the time of survey and was willing to participate was contacted. In case, there were more than one adult present at the time of survey, simple random sampling was performed for selection. After explaining the purpose of this study, the requisite information was obtained through the questionnaire by interviewing the consenting participants. Data collection was further supplemented by spot survey by the investigator using an observation check-list at the study site regarding the presence of mosquitoes, presence of screened windows and mosquito breeding site in and around the selected house. After the interview, the study subjects were given health education about prevention of MBDs.

### Statistical analysis

Data collected was entered in MS office excel and analyzed using Epi-info 2005 software of world health organization and SPSS version 16.0 (SPSS Inc., 233 South Wacker Drive, 11<sup>th</sup> Floor, Chicago, IL 60606-6412) The results were presented in proportions and any difference between two proportions in relation to particular factor was assessed by Chi-square (or fisher exact test if expected frequency in any of the cell was < 5) and was considered significant if probability of error was < 5%.

### Ethical considerations

Informed written consent was taken from all the participants and privacy and confidentiality of information so provided by them was assured. The study was approved by the Institutional Ethics Committee, Maulana Azad Medical College.

## Results

### Sociodemographic profile of the participants

Out of the 100 families surveyed, large proportion of the participants belonged to nuclear families (55%). The mean age of the participants was 39.1 (11.2) years (19-66 years). Out of the total participants, 58% were males. Most of the respondents belonged to upper middle class families (68%) according to modified Kuppusswamy Scale.<sup>[10]</sup> No gender wise significant difference was noted in the demographic profile of the participants except for religion and type of family [Table 1].

### Knowledge regarding MBDs and their prevention

Majority of the participants had heard about MBDs such as dengue (65%) and malaria (58%) while only 13% had known

**Table 1: Socio-demographic profile of the participants (n=100)**

Socio-demographic variables	Total (n=100)
Age (in years)	
Mean (SD)	39.1 (11.2)
18-25	6
26-30	19
31-35	22
36-40	13
41-45	14
46-50	8
51 and above	18
Religion	
Hindu	54
Muslim	46
Type of family	
Nuclear	55
Joint	45
Education status	
Professional or honors	-
Graduate or post-graduate	23
Intermediate or post-high school diploma	28
High school certificate	20
Middle school certificate	14
Primary school certificate	4
Illiterate	11
Occupation status	
Professional	1
Semi-professional	13
Clerical, shop owner, farmer	48
Skilled worker	14
Semi-skilled worker	7
Unskilled worker	16
Unemployed	1
Socio-economic status <sup>s</sup>	
Upper class	1
Upper middle class	68
Lower middle class	18
Upper lower class	13
Lower class	-

<sup>s</sup>According to modified kuppusswamy scale 2007. SD: Standard deviation

about chikungunya. There were only 7% of the participants who had no knowledge about the MBDs. "Dengue" was named by 52% of the participants as MBD, which is highly prevalent in Delhi, followed by "malaria." Enquiry into the knowledge about the mosquito breeding sites revealed that 68% respondents knew that mosquitoes breed in stagnant clean water whereas nearly one-third (29%) believed that breeding occurs in polluted stagnant water. There were only 6% of the participants who named desert coolers as the breeding site for mosquitoes. Nearly, 20% of the participants named incorrect breeding sites such as toilets, air, garbage etc. Majority of the participants (70%) also believed that MBDs are the highest during and after monsoons largely because of collection of water [Table 2].

The knowledge regarding PPMs (93%) was very high followed by source reduction (47%). Knowledge regarding other preventive measures such as cleaning of coolers and cleaning the surroundings was poor. The recommendation about draining water and cleaning of coolers at least once in week,<sup>[17]</sup> was answered correctly by only 20% of the respondents. Only 26% of the participants knew about any knowledge activity against MBDs in the city with nearly 77% (20/26) of them citing advertisements as source of such activities. There was negligible knowledge regarding the anti-malarial month (2%). Though 84% of the respondents said that anti-mosquito activities were being undertaken by Municipal Corporation of Delhi, only 14% (12/84) found them adequate [Table 2]. Majority of the participants cited corruption, late reactive approach and lack of accountability and ownership in the system for such inadequacy in their work.

### Practices and pattern of usage of PPMs

Most of the participants (90%) were using PPMs. The most common PPM being used by the study population was Liquid vaporizers (54/90; 60%) followed by insecticidal spray (29/90; 32.2%). However, they were just handful of the participants

who were using the methods correctly (1/90; 1.1%) and adequately (5/90; 5.6%). Majority of the households were using PPMs only at night (65/90; 72.2%). Nearly one-third of the participants stated convenience, effectiveness and cost as the main reasons for choosing a particular PPM. Only 32.2% (29/90) of the users said that they experienced side-effects on using the PPMs [Table 3]. The most common side-effect reported by the participants was irritation to smell of PPMs (15/29; 51.7%) followed by headache (13/29; 44.8%).

### Observations by the investigator

On house visit, adult mosquitoes were seen in 67% of the houses of the respondents. As visit was made during the day, it was observed that only 3% were using PPM at that time. Screening of windows with mesh was seen in only 63% of the houses. Majority of the houses (56%) had potential mosquito breeding sites in and around the house while actual mosquito larvae were seen in 36% houses.

On bivariate analysis, upper socio-economic status of the family ( $P = 0.03$ ) and presence of appropriate screening of windows

**Table 2: Knowledge regarding MBDs and its prevention among the participants (n=100)**

Knowledge regarding MBDs and their prevention	Total (n=100)
Name the MBDs you know of	
Dengue	65
Malaria	58
Chikungunya	13
Don't know/incorrect	7
Name MBDs high in Delhi	
Malaria	47
Dengue	52
Don't know	15
Where do the mosquitoes breed?	
Stagnant polluted water	29
Stagnant clean water	68
Desert coolers	6
Others	20
In which season MBDs are highest?	
During and after rains (correct)	70
How can you prevent MBDs?	
PPMs	93
Source reduction	47
What is the recommendation about draining water and cleaning of the coolers?	
Correct (every week)	20
From where did you get the knowledge about MBDs and their prevention?	
Family and friends	62
Television	49
Newspapers	29
Doctor/health professional	5
Schools/college/workplace	12

Responses are multiple not mutually exclusive and only correct responses have been included in the table. MBDs: Mosquito borne diseases, PPMs: Personal protective methods

**Table 3: Practices and pattern of usage of PPMs against mosquitoes**

Practices	Total (n=90) (%)
PPMs being used by the families <sup>§</sup>	
Liquid vaporizers	54 (60)
Insecticidal sprays	29 (32.2)
Coils	22 (24.4)
Mats	16 (17.8)
Repellant creams	9 (10)
Bed nets	2 (2.2)
Correctness of method used	1 (1.1)
Adequacy of method used	5 (5.6)
Frequency of using PPMs	
Only at night	65 (72.2)
Only during day	4 (4.4)
Throughout 24 h	2 (2.2)
Few days a week	9 (10)
Others	10 (11.1)
Reasons for using particular PPMs <sup>§</sup>	
Effective	29 (32.2)
Cheap/low cost	28 (31.1)
Convenient to use	27 (30)
Popular	19 (21.1)
Easy availability	3 (3.3)
Safe	4 (4.4)
Side-effects with PPMs	
Yes	29 (32.2)
No	61 (67.8)
Reasons for not using particular PPMs <sup>§</sup>	
No/limited knowledge	43 (47.8)
High cost	22 (24.4)
Safety concerns	4 (4.4)
Side-effects	2 (2.2)

<sup>§</sup>Multiple responses not mutually exclusive. PPMs: Personal protective methods

and doors ( $P < 0.001$ ) were found to be significantly protective against presence of adult mosquito in the house [Table 4].

## Discussion

The present community based observational study assessed the knowledge and practices regarding MBDs and their prevention in an urban resettlement colony in Delhi. The study revealed that knowledge regarding MBDs like dengue (65%) and malaria (58%) was fair in the study participants. However, chikungunya was named by only 13%. The findings are similar to that found in a study by Boratne *et al.*<sup>[7]</sup> in 2010 in peri-urban areas of Puducherry where nearly 57% of the study population was aware about malaria while the knowledge about dengue was just 19%. A study in Rajkot in 2011 also revealed similar knowledge about MBDs with only 62% being aware of malaria.<sup>[9]</sup> These findings show low perception about risk of mosquitoes as a cause of morbidity and mortality, by the study participants. Thus, the study emphasizes the need for intensification of health education regarding MBDs as the prevention of MBDs through better knowledge and knowledge is the appropriate way to keep the disease away.<sup>[18]</sup>

Majority of the participants (68%) knew about the breeding site of anopheles and dengue mosquito and nearly 70% also believed that the mosquito breeding peaks during and after rainy seasons due to collection of water. These findings are similar to those reported in studies done on similar peri-urban populations in Gujarat,<sup>[9]</sup> in 2011 (69.6%) and Puducherry,<sup>[7]</sup> in 2010 (61%). A study performed by Rasania *et al.*<sup>[19]</sup> in 2002 in patients attending malaria clinic in Delhi also showed prevalence of knowledge regarding breeding places of mosquito to be 62.9%. The “use of PPMs” followed by environmental measures were cited as the most common methods for controlling the mosquitoes. The findings are consistent with above finding that mosquito breeding takes place in collection of water and hence source reduction is emphasized in control of MBDs.

The knowledge regarding the correct recommendation of cleaning of coolers was quite low. Participants were also unaware about any knowledge generation activity regarding MBDs being undertaken by municipality. This finding

points towards strengthening and promoting of effective Information Education Communication (IEC) campaigns. The most common source of information about MBDs and their prevention were family and friends followed by television. This finding is in contrast to the results found in other study where television was reported as the most common source.<sup>[7]</sup> Finding of the study highlights the role of social integration in health promotion efforts. Health-care professionals as source of information were reported by few only which points towards the low participation by doctors and paramedical staff in spreading Knowledge regarding MBDs. Though majority (84%) of respondents felt that anti-malarial activities were being undertaken by municipality, but at the same time found them grossly inadequate. Thus, there is a need for strengthening of efforts for control of MBDs at community level.

Practice of using PPMs against mosquitoes was quite high among study subjects. Similar observations were noted in study performed in 300 households of Vadodra District in Gujarat where 97% of the participants were using at least some kind of the PPMs.<sup>[6]</sup> A study performed in rural, semi-rural and bordering areas of East Delhi showed the use of PPMs to be nearly 100%.<sup>[20]</sup> Thus, there is evidently varying practices against mosquito bites from place-to-place. Liquid vaporizers followed by insecticidal sprays, mosquito coils and mats were the most common PPMs used in the current study. Studies done in South India,<sup>[7,21]</sup> found a similar pattern of use of PPMs. However, almost all the study participants were reported to be using PPMs inadequately and incorrectly. Further, PPMs were being used by them only at night time. These findings were consistent with another study in a resettlement colony in South Delhi in 2005.<sup>[22]</sup> As the *A. aegypti* mosquito bites during daytime,<sup>[23]</sup> it is imperative to use these methods during the daytime also. Convenience, effectiveness and cost of a particular PPM were cited as the common reasons for usage of a particular PPM. These factors could be taken into consideration while development and marketing of PPMs under the national program to ensure its wider acceptability by the people.

On observation, 56% houses had potential breeding sites while actual mosquito larvae were seen in and around 36% houses. This finding is much higher than stagnant water collections that were observed around 44% houses in areas in South Delhi.<sup>[22]</sup> It could be attributed to close proximity of the houses and poor drainage system in the community under current study. Presence of adult mosquito was found to be significantly associated with lower socio-economic status in the present study and has been reported by others also.<sup>[20,22]</sup>

## Strengths and limitations of the study

One of the strength of this study is that it is first study of its kind, which had objective parameters for assessment of correctness and adequacy of PPMs taken by the study population. However, the study being a cross-sectional in design could not reflect the varying pattern of usage of various

**Table 4: Bivariate analysis of the association between presence of adult mosquito in the house and socio-demographic and other independent factors**

Variables	Chi-square	P value
Socio-economic status (upper)	-	0.03* <sup>#</sup>
Education status of participant	-	0.09 <sup>#</sup>
Religion (Hindu)	0.86	0.35
Use PPM	-	0.29 <sup>#</sup>
Screening of windows and doors (present)	10.09	<0.001*
Potential breeding sites found	-	0.11 <sup>#</sup>

\* $P < 0.05$ , <sup>#</sup>Fischer exact test applied. PPMs: Personal protective methods

personal protective methods. Hence, a follow-up study is required to find out the variations of usage of PPMs with different seasons and mosquito density.

To conclude, there are crucial gaps in knowledge about MBDs and practices of participants with regard to prevention and control of MBDs. As the efforts of government health authorities are not always adequate, it therefore, becomes responsibility of the individuals themselves to use protection against MBDs. Role of mass media particularly television and radio needs to be further emphasized in reaching out to the general public. Role of social environment in spread of Knowledge regarding MBDs can be explored. Further, health education and IEC campaigns need to be intensified in the community by local civil authorities and municipalities.

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## References

- SEARO, WHO. Vector-Borne Diseases in India: Report of Brainstorming Session, 2006, 2012. Available from: [http://www.searo.who.int/LinkFiles/CDS\\_vector-borne\\_diseases\\_in\\_India.pdf](http://www.searo.who.int/LinkFiles/CDS_vector-borne_diseases_in_India.pdf). [Accessed on 2012 Sep 6].
- National Programme for Prevention and Control of Vector Borne Diseases: Malaria-Magnitude of Problem, 2012. Available from: <http://nvbdcp.gov.in/malaria3.htm>. [Accessed on 2012 Dec 25].
- World Health Organization, 2007. Available from: [http://www.whoindia.org/LinkFiles/Malaria\\_Country\\_Profile-Malaria.pdf](http://www.whoindia.org/LinkFiles/Malaria_Country_Profile-Malaria.pdf). [Accessed on 2012 Dec 25].
- Das A, Anvikar AR, Cator LJ, Dhiman RC, Eapen A, Mishra N, *et al.* Malaria in India: The center for the study of complex malaria in India. *Acta Trop* 2012;121:267-73.
- National Programme for Prevention and Control of Vector Borne Diseases, 2012. Available from: [http://mohfw.nic.in/NRHM/PIP\\_09\\_10/Delhi/NVBDCP\\_text.pdf](http://mohfw.nic.in/NRHM/PIP_09_10/Delhi/NVBDCP_text.pdf). [Accessed on 2012 Sep 7].
- Pandit N, Patel Y, Bhavsar B. Knowledge and practice about preventive method against mosquito bite in Gujarat. *Health Line* 2010;1:16-20.
- Boratne AV, Datta SS, Singh Z, Purty A, Jayanthi V, Senthilvel V. Attitude and practices regarding mosquito borne diseases and socio-demographic determinants for use of personal protection methods among adults in coastal Pondicherry. *IJMS*2010;1:91-6.
- Sharma AK, Bhasin S, Chaturvedi S. Predictors of knowledge about malaria in India. *J Vector Borne Dis* 2007;44:189-97.
- Patel AB, Rathod H, Shah P, Patel V, Garsondiya J, Sharma R. Perception regarding mosquito borne diseases in an urban area of Rajkot city. *Natl J Med Res* 2011;1:45-7.
- Kumar N, Shekhar C, Kumar P, Kundu AS. Kuppuswamy's socioeconomic status scale-updating for 2007. *Indian J Pediatr* 2007;74:1131-2.
- Armed Forces Pest Management Board. Personal Protective Measures Against Insects and Other Arthropods of Military Significance, 2012. Available from: <http://www.afpmb.org/sites/default/files/pubs/techguides/tg36.pdf>. [Updated on 2009 Oct; Accessed on 2012 Oct 24].
- WHO. Insecticide Treated Bed Nets: A WHO position Statement, 2012. Available from: <http://www.who.int/malaria/publications/atoz/itnspopaperfinal.pdf>. [Accessed on 2012 Oct 24].
- Smoke from mosquito coils may be as harmful as fumes from a vehicle exhaust, 2012. Available from: [http://www.caiindia.org/PDFs/mosquito%20coil\\_eng.pdf](http://www.caiindia.org/PDFs/mosquito%20coil_eng.pdf). [Accessed on 2012 Oct 25].
- Cupp EW. Protection against mosquitoes. In: Dupont HL, Steffen R, editors. *Textbook of Travel Medicine and Health*. 2<sup>nd</sup> ed. Hamilton, Ontario: BC Decker; 2001. p. 189-92.
- Bonds JA. Ultra-low-volume space sprays in mosquito control: A critical review. *Med Vet Entomol* 2012;26:121-30.
- Salifou S, Gouissi FM, Etorh AP, Gbetoh MH, Gouissi SG, Okereke E, *et al.* Impact of propoxur use in indoor residual spraying (IRS) on malaria transmission in the commune of aguegues in Benin. *Int J Biomol Biomed* 2012;2:13-20.
- Vector Management and Control, 2012. Available from: [http://www.searo.who.int/LinkFiles/Dengue\\_DHF\\_pgc\\_ch9.pdf](http://www.searo.who.int/LinkFiles/Dengue_DHF_pgc_ch9.pdf). [Accessed on 2012 Oct 14].
- Klein RE, Weller SC, Zeissig R, Richards FO, Ruebush TK 2<sup>nd</sup>. Knowledge, beliefs, and practices in relation to malaria transmission and vector control in Guatemala. *Am J Trop Med Hyg* 1995;52:383-8.
- Rasania SK, Bhanot A, Sachdev TR. Awareness and practices regarding malaria of catchment population of a primary health centre in Delhi. *J Commun Dis* 2002;34:78-84.
- Tyagi P, Roy A, Malhotra MS. Knowledge, awareness and practices towards malaria in communities of rural, semi-rural and bordering areas of east Delhi (India). *J Vector Borne Dis* 2005;42:30-5.
- Snehalatha KS, Ramaiah KD, Vijay Kumar KN, Das PK. The mosquito problem and type and costs of personal protection measures used in rural and urban communities in Pondicherry region, South India. *Acta Trop* 2003;88:3-9.
- Acharya A, Goswami K, Srinath S, Goswami A. Awareness about dengue syndrome and related preventive practices amongst residents of an urban resettlement colony of south Delhi. *J Vector Borne Dis* 2005;42:122-7.
- NVBDCP, MoHFW. Guidelines for Integrated Vector Management for Control of Dengue/Dengue Hemorrhagic Fever. [Internet] 2006 [Accessed on 2012 Dec 6]. Available from: [http://nvbdcp.gov.in/Doc/dengue\\_1\\_%20Director\\_Desk%20DGH%20meeting%20OCT%2006.pdf](http://nvbdcp.gov.in/Doc/dengue_1_%20Director_Desk%20DGH%20meeting%20OCT%2006.pdf).

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