Original Article

VECTOR CONTROL AND PERSONAL PROTECTION MEASURES PRACTICED AT HOUSEHOLD LEVEL BY TRIBAL AND NON-TRIBAL COMMUNITIES IN A RURAL AREA OF KAMRUP DISTRICT, ASSAM

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ABSTRACT

Background: Vector Control and Personal Protection measures practices play major role in control of malaria.

Objective: The study objective was to find out the practices of mosquito control and personal protection measures observed at household level and the acceptance of vector control measures under malaria control programme.

Methods: A Community based cross-sectional study was undertaken from June 2009 to May 2010 and 150 tribal and 150 non-tribal head of the households interviewed. Data was collected on socio-demographic characteristics, factors related to mosquito breeding and its prevention practice, personal protection measures, DDT spray status of their houses. Data was analyzed by Epi Info Version7.

Results: The overall coverage of DDT was low (25.3%). Coverage was slightly better among tribal households (31.3%) compared to non-tribal population (19.4%). The acceptance of DDT spray was found to be significantly associated with knowledge about mode of transmission of malaria and type of house. Room-wise coverage was not as per norms. Refusal of DDT was seen more among non-tribal communities. Commercial personal protection practices like mosquito repellants, mats and coils were lesser among the tribal counter parts and it was associated with level of income. Majority of tribal and non-tribal respondents were not having knowledge of the new insecticide treated bed nets (ITNs) and LLINs.

Conclusion: Coverage with IRS in rural areas is far less (25.3%) than the recommended coverage of 80% required for its effectiveness. With majority using mosquito nets in their houses, use of ITNs should be encouraged and IEC activities for creating greater awareness on methods to control vector population suggested for success of the malaria programme.

Keywords: DDT; Malaria; Tribal; ITNs; LLINs; Vector control; personal protection

INTRODUCTION

Northeast India is a high risk area for malaria transmission as several ecological paradigms exists like tribal malaria, forest malaria and project malaria. The main vector control measures recommended for these ecotypes are

IRS, ITNs and LLINs with limited role for larval control. [1] Current strategy for DDT spraying under NMCP is based on API ≥ 2 but there is also the evidence of false calculation of API due to lack of surveillance resulting in potentially endemic zones being left out of spraying activity as per the report of Malaria Epidemic investigation, MRC, 1999-2001. Therefore community awareness regarding measures for vector control measure is required. Use of personal protection measures like mosquito nets, repellants and ITNs also are important.

Under National Vector Borne Disease Control Programme (NVBDCP) of 2003 integrated vector management (IVM) was introduced. In IVM, Environment Management plays a crucial role in malaria control but because of lack of scientific evidence of effectiveness of environmental management, especially in Asia, about feasibility of implementation, it still remains neglected. [2,3] There are very few studies are available done recently on the malaria control practices at community level and very little is known about the recently introduced malaria control strategies like ITNs and LLINs. [2] This study was undertaken to find out the current vector control practices prevalent among the rural communities and factors related to mosquito breeding and its prevention practices, personal protection measures, the awareness and acceptance of DDT spraying under malaria control programme.

MATERIALS & METHODS

A community based cross-sectional study was undertaken from June 2009 to May 2010 in Rani Community Development Block of Kamrup District, Assam. Kamrup district has an ABER of 6.5% which is well below the target of target of 10%, SPR=2.44% which is below 5% to declare it as a high risk zone, but has *P.f* % of 88% which makes it a high risk zone and an API ≥ 2 which is a sensitive malariometric indicator for residual spray intervention. The study area shares interstate border with Meghalaya which is also a very high endemic state contributing 5% of malaria deaths and 10% of the cases and 14% *P.f* cases of the total malaria burden of Assam.[4] Prior to conducting the study baseline data on malaria prevalence was gathered from local Block PHC but the value was very less and unreliable due to complete absence of surveillance in the area for more than 5 years prior to this study. So a prevalence of 50% was taken considering the high endemic status of area. [1] The study area has a population of approximately 86500 as per 2001 Census. By Epi Info Software Version7 the required sample size was estimated to be 300 (95% confidence level and 5.65% confidence limits).

As it is a single handed and time bound study along with financial constraints, there are other aspects that were considered to make it feasible to get a representative study population. The study area has mixed population of tribal and nontribal communities. A list of villages with total number of households and total population was collected from Rani Community Development Block Office and the villages were divided based on type of community predominant with the help of Statistician of Block Office which formed the sampling frame. A two stage stratified random sampling technique was done and 8 villages from tribal areas and 8 villages from non tribal areas and considering the proximity to PHC (>5kms and <5kms) were selected. Proportionate Probability Sampling technique was then applied to the all the 16 selected villages to find out the number of houses to be visited in each village to get the total 150 tribal and 150 non-tribal households. This was done as per the recommendation of WHO for malaria situation analysis mentioned in "Protocols and Methods for malaria situation analysis" [5] and NVBDCP household survey methodology. [6] The consenting head of the households from 150 tribal households and 150 non-tribal households visited were interviewed regarding socio-demographic characteristics, factors related to mosquito breeding and its prevention practices, personal protection measures and the spraying of DDT in their houses in the last 12 months recall period. Data was collected in a pre-designed and pre-tested schedule and data was analyzed for proportions and chi squared test wherever applicable using Epi Info Version7.

A few operational definitions were maintained while collecting data about specific attributes which are as follows:

Type of House: As per the Pareek and Trivedi Classification (1964)[7]

Pucca house: Floor and walls are constructed of concrete (stone or brick built) and roof either made of tin, asbestos or concrete.

Kutcha house: Floor and walls constructed with mud and roof with thatch.

Mixed type (Semi-pucca/Semi-kutcha) house: Floor constructed with mud and walls constructed of stone or brick and roof of tin. Or floor constructed of concrete with walls of mud, stone or bricks with thatch roof

Cattle shed close to dwelling: if located within 25ft of the dwelling place [8]

DDT spray done: if atleast one round covered within last 12 months recall period considering recall bias for specific rounds.

Proper drainage: considered present if there is no stagnation or water logging of household waste water or rainwater in the vicinity of the residing place.

RESULTS

The socio-demographic profile of the study population is summarized in Table 1. Results shows, 24% tribal and 12.6% non-tribal were BPL families (income less than Rs 228.9 per capita per month at 1993-94 prices). Literacy rate of the tribal and non-tribal head of the households was 82.7% and 92.6% respectively. By occupation majority of tribal were cultivators (51.2%) and daily wage earners (41.3%) whereas majority of the non-tribal were businessmen (40.7%) and cultivators (31.3%). Among those having cattle rearing and silkworm rearing practices as shown in Table 1, majority of the households had cattle sheds close to their dwelling site among the tribal (85.6%) and non-tribal (73.3%) respondents.

Study also shows that harmful practices like outdoor sleeping habits have significantly decreased in both the tribal (2.6%) and nontribal (1.4%) communities. It was practiced mainly during the summer time among the adult male members but women and children are not allowed to sleep outside at night. Tube wells are more commonly used as a source of water among both tribal (74.7%) and non-tribal (80%) households. Many of the tribal (28.6%) and non-tribal (63%) said that they reside in flood prone areas and it was found to be statistically more in non-tribals than in the tribals ($X^2 = 5.83$, $p = 0.01$). The construction of proper drainage system in the tribal households was 8% whereas among non-tribal households it was 29.3%. This was found to be statistically highly significant ($X^2 = 22.48$, $p < 0.0001$).

Table 1: Socio-demographic profile of respondents (N=300)

Variables	Tribal (n=150) (%)	Non-tribal (n=150) (%)
Age group (in years)		
19-28	15 (10)	9 (6)
29-38	44 (29.2)	49 (32.7)
39-48	52 (34.8)	52 (34.8)
49-58	28 (18.8)	26 (17.3)
59+	11 (7.2)	14 (9.2)
Sex		
Male	92 (61.4	108 (72)
Female	58 (38.6	42 (28)
Religion		
Hindu	118 (78.7)	129 (86)
Christian	32 (21.3)	-
Islam	-	21 (14)
Type of family		
Nuclear	78 (52)	108 (72)
Joint	72 (48)	42 (28)
Per capita monthly income (in rupees		
<228	36 (24)	19 (12.6)
228-500	74 (49.4)	30 (20)
501-750	23 (15.4)	42 (28)
751-1000	6 (4)	21 (14)
>1000	11 (7.2)	38 (25.4)
Literacy Status		
Illiterate	26 (17.3)	11 (7.4)
Primary	56 (37.3)	35 (23.3)
High School	44 (29.3)	57 (38)
HSLC passes	16 (10.7)	21 (14)
HS passes & above	8 (5.4)	26 (17.3)
Occupation		
Cultivator	77 (51.2)	47 (31.3)
Daily wage earner [$]	62 (41.3)	19 (12.7)
Skilled labour	5 (3.3)	2 (1.3)
Service	26 (17.3)	37 (24.7)
Business	10 (6.6)	61 (40.7)
Others*	17 (11.3)	8 (5.3)
Type of House		
Pucca	21 (14)	58 (38.7)
Kutcha	81 (54)	22 (14.7)
Mixed	48 (32)	70 (46.6)
Cattle rearing practices	104 (69.3)	90 (60)
Source of water supply		
Ringwell	32 (21.3)	15 (10)
Tubewell	112 (74.7)	120 (80)
Municipality tap water	18 (12)	42 (28)
Others [#]	10 (6.6)	6 (4)

[$] Work in quarries, logging of woods, forest clearing projects and construction work.

*Fisherman, Silkworm rearing, selling household produce like betel nuts and vegetables etc,
agricultural labour, income from house renting and from pension.

[#] Water sources like ponds and stream.

Majority of the tribals (56.7%) believed that malaria is a problem in their areas compared to only 9.4% of non-tribals and it was statistically significant (X^2=*76, df=1, p< 0.001*)

Table 2: Showing some attributes related to malaria control and mosquito breeding in the 300 households studied

Attributes	Tribal (n=150)		Non-tribal (n=150)		Chi-squared (p value)
	No.	%	No.	%	
Cattle shed <25ft from dwelling place	21	14	25	16.7	
Silkworm rearing practices	15	10	12	8	
Outdoor sleeping habit	4	2.6	2	1.4	
Absence of proper drainage facility	138	92	106	70.7	22.48 (<0.0001)
People living in flood prone areas	43	28.7	63	42	5.83 (0.01)
Use of personal protection measure ¥					
use of mosquito nets	146	97.3	149	99.4	
commercial mosquito repellants	45	30	89	59.3	
commercial insecticide sprays	29	19.3	22	14.6	
smoke by burning of organic waste	102	68	112	74.6	
nothing done	12	8	8	5.3	
Mosquito breeding prevention practices¥					
prevention water stagnation	91	60.6	87	58	
burning of rubbish and garbage	30	20	34	22.7	
maintain household cleanliness	22	14.6	8	5.4	
apply bleaching powder to stagnant water	6	4	32	21.4	
apply phenol	8	5.4	7	4.7	
others #	3	2	6	4	
nothing done	59	39.4	63	42	
Knowledge about ITNs/LLINs	12	8	32	21.3	10.65 (0.001)
Positive attitude about DDT spraying	42	28	6	4	
Willing for community participation	32	21.3	25	16.7	

¥ Multiple response

Agricultural pesticides and repellant use like Endrin, Ditenium-45 and Citronella used in water collections

Majority of the tribal (97.3%) and non-tribal (99.4%) households are using mosquito nets. Those not using mosquito nets among both tribal and non-tribal's mentioned reasons like damaged nets and unable to afford a new one. Regarding insecticide treated nets (ITNs), non-tribal (21.3%) had higher knowledge than tribal (8%) respondents (X^2=*10.65, p=0.001*) but none are using it yet. Use of commercial mosquito repellants and insecticides was seen among 30% tribal and 59.3% non-tribal households. This was found more in the higher income groups and this was found to be highly significant (X^2= 12.11, df=3, p=0.0005). Majority of the tribal (68%) and non-tribal (74.6%) households used smoke by burning of organic waste like dried leaves, coconut fibers, dung and hay as traditional fumigants. But this was traditionally uniformly practiced among majority of the tribal and nontribal households and is not related to knowledge about malaria or income. Use of commercial insecticides like Baygon spray, Finit and kerosene was mentioned by 19.3% tribal and 14.6% non-tribal respondents.

Prevention of mosquito breeding sources was practiced by 60.6% of tribal and 58% nontribal households. Use of chemicals disinfectants like bleaching powder and phenyl were found in few and also use of pesticides and insecticides as shown in Table 2. Pesticides and insecticides are used among the among the cultivation dependent families which they use for agricultural purpose.

Regarding DDT spraying of the household atleast once in the 12 months recall period, it was found that only 47 (31.3%) tribal and 29 (19.4%) households had been sprayed. However among those who accepted spraying the coverage of all the rooms within a household was not done in majority and a number of reasons were mentioned for refusal of DDT in the study population as shown in Table 3. It was observed that acceptance of DDT spray was less among the non-tribal compared to the tribal

households and this was found statistically significant (X^2=*5.71, p=0.01*). It was also found that acceptance of DDT spray was found to be significantly associated with the type of house they reside in (X^2=*6.6, p=0.009*). People residing in the pucca houses accepted less than those residing in kutcha and semi-pucca houses. The acceptance of DDT spray was also found to be associated with knowledge of mode of transmission of malaria among both tribal and nontribal. *(X^2=19.18, p=0.00001*)

Table 3: DDT coverage in the studied households (n=300)

DDT spraying	Tribal (%)	Non-tribal (%)
DDT Spraying status(Tribal=150, Nontribal=150)$		
Done	47 (31.3)	29 (19.4)
Not done *	89 (59.3)	103 (68.6)
Refused	14 (9.4)	18 (12)
Rooms Sprayed (Tribal =47, Nontribal =29)		
Entire house including kitchen	2 (4.2)	
Living room only	12 (25.5)	4 (13.7)
Living room plus bedroom	4 (8.5)	1 (13.4)
Outside walls only	24 (51.1)	23 (79.3)
Cattle shed only	5 (10.7)	1 (3.4)
Reasons of refusal (Multiple response) (Tribal = 14, Nontribal =18)		
Spoils wall colour	12 (85.7)	18 (100)
Discomfort due to lack of advanced information	10 (71.4)	14 (77.8)
Increased bed bug nuisance	7 (50)	11 (61.1)
Unpleasant smell	8 (57.1)	10 (55.6)
Others #	2 (14.2)	4 (22.2)

*Spraying could not be carried out due to certain reasons other than refusal (locked house, sprayman didn't turn up)
Include fear of cattle poisoning, presence of toddler in the family
$ P value = 0.01

DISCUSSION

The study results showed that the literacy rate of the study population was better among both tribal (82.7%) and non-tribal (92.6%) communities than the results published in NFHS-3 and Baseline Survey of Kamrup District conducted by OKDIS CD [9, 10] where the literacy status of Kamrup District was reported to be around 76%. Here housing characteristics of the study population has somewhat changed with 14% tribal and 38.7% non-tribal living in pucca houses. NFHS-3 reported that only 20% of the households live in pucca houses in Assam. The baseline survey of OKDIS CD [10] showed that 71% reside in Kutcha houses and 10.6% in Pucca houses. The relation of housing type and DDT spraying was found which is mentioned elsewhere in this paper. [11,12]

Majority of the tribal (51.2%) households were dependent on cultivation as compared to non-tribal (31.3%) households. The 41.3% tribal and 12.7% non-tribal daily wage workers found here are mainly engaged in quarries, logging of woods, forest clearing for project work and construction work. Occupations related to agriculture, forest-related workers and migrant workers are identified problems of high risk and the awareness about malaria and personal protection among these workers is necessary. [13, 14]

Source of water for 74.7% tribal and 80% nontribal households is either tube well or bore well and only 12% tribal and 28% nontribal have tap water as source of drinking water. Similar data published in NFHS-3 survey report.[9] Open sources like ponds and streams are used by 6.6% of tribal and 4% of non-tribal respondents. Association was found with water management and malaria outbreaks in few studies. [15] Environment Management plays a crucial role in malaria control and more research to identify specific environmental management measures for reduction of vector or vector-people contact is suggested. [2]

Also in this study higher number of non-tribal (42%) respondents mentioned of flood problems in their areas compared to the tribals (28.7%). This might be due to the fact that many of the tribal areas are located in hilly areas whereas most of the non-tribal areas were located in the

plains. Hence the construction of proper water drainage facilities around the non-tribal households was seen more than their tribal counterpart probably due to the fact that they reside in plain areas and facing more water stagnation problem. Monsoon floods are common in the area with heavy rainfall inundating the agricultural fields, ditches, roads and sometimes houses. Flash floods are common in low lying areas. Relation of proper water management has been found to be associated with malaria occurrence. [2-3,16-17] Also these studies have shown that bio-environmental vector control was 18% cheaper than IRS and considerably more environmentally – friendly. It recommends developing environmental control strategies as long term strategy to reduce malaria transmission intensity which in turn will place less reliance on the heavy use of antimalarials and insecticides and then to assess reduction in clinical malaria. Interventions that are most likely to be initiated are: improved drainage systems, filling and leveling sites with standing water, improved water management systems, improved housing and better access to health facilities.

The outdoor sleeping practice was found to be a major obstacle in breaking the transmission cycle in many studies done earlier.[15] Outdoor sleeping only by adults during summer was found in other studies [18]. Also practices like cattle rearing and silkworm rearing has reduced in the rural and was not a significant cause of refusal of DDT spraying. Use of commercial methods of personal protections measures like mats, coils and repellants was lesser among tribals compared to the non-tribals and was significantly found to be associated with level of income. Income level of family is not only related to purchasing power of medicines but in itself related to malaria in the sense that the preventive measures of malaria like bednets, mosquito coils, construction of proper housing, seeking treatment from proper place is affected when there is sickness. [19]

Higher number of kutcha and semi-pucca type of households were accepting DDT spray compared to pucca house owners in both the tribal and non-tribal communities and was found to be statistically significant. This might be due to the increased mosquito nuisance faced by those residing in kutcha and semipucca house and also low acceptance due to fear of spoiling wall colour among pucca house owners. Few frequently mentioned complaints among DDT acceptors were of over diluted DDT that is was devoid of the typical smell and hence failed to decrease the mosquito problem. This might be due to the fact that reduced strength of DDT (50% WDP) is carried out @1gm/m2 in current programme.[20] Also even the room wise coverage among the DDT acceptors was not correct. Proper supervision of spray activity seems to be lacking. [2] As DDT spray of the households were not done as recommended by the national and WHO guidelines as shown in Table 3. More than 80% coverage of homes and barns is necessary for effectiveness of IRS and low coverage can jeopardize the programme.[21]

Majority of the tribals (56.7%) believed that malaria is a problem in their areas compared to non-tribals (9.4%) and this might be due to greater exposure of the tribals to malaria morbidity and mortality compared to their non-tribal counterpart .The coverage of DDT was very low in both tribal (31.3%) and non tribal (19.4%) communities. The Joint Monitoring Mission report of 2007, [21] also stated that DDT spray coverage is low in all areas and only 9% of targeted houses had uniform and complete DDT spray.

The newer personal protection methods like ITNs and LLINs needs to be promoted in the rural community as most are not aware of its benefits and none are currently using it (Table 2). In view of the low IRS coverage in the study population implementation of ITNs will be beneficial in the study area. Similar views were expressed by the Joint Monitoring Mission report of 2007. [20] Provision for free or subsidized ITNs available under malaria control programme should be made immediately available to those in need and the targeted beneficiaries. Infact the new policy of NVBDCP advocates the same with atleast 80% coverage by ITNs/LLINs among economically disadvantaged people in areas with high API.

Here it was found that knowledge about mode of transmission of malaria influenced the vector breeding prevention practices at household level. Levels of education may also affect malaria treatment seeking and prevention behaviours. However it was found in the JMM report that Malaria awareness campaigns have not created the desired impact in creating BCC.[20]

CONCLUSION

With increasing urbanization and changes in the lifestyle and traditional housing patterns in rural

areas where more and more kutcha houses are replaced by modern pucca houses the increased possibility of lesser acceptance of DDT spray was observed. The programme effectiveness is also reduced by low coverage of DDT of (25.3%) in the study area compared to

80% IRS coverage recommended. Among poor tribal communities lesser use of commercial mosquito control measures observed due to constraints of affordability. Usage of ITNs and LLINs is to be encouraged and IEC activities to be scaled up for creating greater awareness on methods to control vector population for success of the malaria programme.

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REFERENCES

1. Scaling up malaria control interventions with a focus on high burden areas. Strategic Action Plan for Malaria Control in India, 2007-2012. Pg 1-84 Directorate of NVBDCP, DGHS, MoHFW, Govt. of India, 22-Shamnath Marg, Delhi- 110 054
2. Steve Lindsay, Matthew Kirby, Enis Baris and Robert Bos. Environmental Management for Malaria Control in the East Asia and Pacific (EAP) Region. April 2004; 1-64. Health, Nutrition and Population (HNP) Discussion Paper. (available at : http://siteresources.worldbank.org/HEALTHNUTRITIONANDPOPULATION/Resources/281627-1095698140167/Lindsay-EnvironmentalManagement_whole.pdf)
3. Wim van der Hock. Human health in Water Resource development. Water and Health- Vol –II. UNESCO © Encyclopedia of Life Support Systems (ELOSS) Sample Chapter. Available at: www.eolss .net/Sample-Chapters/C03/E2-20AA-05.pdf
4. Dev V, Dash A P and Khound K. High risk areas of malaria and prioritizing interventions in Assam. Current Sciences. 10 January 2006; 90(1): 32-36.
5. Protocols and methods of malaria situation analysis. WHO HIV/AIDS, Tuberculosis, Malaria. Roll Back Malaria. July 2003. Trial Edition. Pg. 19 (WHO/HTM/RBM/2003.47)
6. Report of Household Survey and Health Facility Survey for In-Depth Review of NVBDCP (Malaria), 2007. National Institute of Malaria Research (ICMR) 22, Sham Nath Marg, Delhi . 110 054. p16-17.
7. Udai Pareek and G. Trivedi. Socio- economic Status Scale (Rural). Form and manual. Delhi: Manasayan. 1964; p 32
8. Park K. Textbook of Social and Preventive Medicine, 13th Edition. Jabalpur; Banarsidas Bhanot 2002; p 389
9. H. Lhungdim, Sunita Kishor and B. Amenla Nuken. International Institute for Population Sciences (IIPS) and Macro International. 2008. National Family Health Survey (NFHS-3), India, 2005-06: Assam. Mumbai: IIPS. p1-129 (available from:www.nfhsindia.org)
10. Baseline Survey of Minority Concentrated Districts. District Report. KAMRUP. Study Commissioned by Ministry of Minority Affairs, Government of India. Study Conducted by Omeo Kumar Das Institute of Social Change and Development: Guwahati, VIP Road, Upper Hengerabari, Guwahati 781036.
11. Chand G and Tiwary R S. Parasitological observations on prevalence seasonality and transmission of malaria among tribals of Surguja District. *Indian J Com. Med*. 2001; 26(4):183
12. Savigny de D, Mayombama C, Masanja E M H, Minhaj A Yahya Mkilindi, Conrad Mbuya, Harun Kasale, Graham Reid. Care-seeking patterns for fatal malaria in Tanzania. *Malaria Journal. 28 July, 2004; 3(1):27. doi:10.1186/1475-2875-3-27*
13. Clifford M Mutero, Matthew Mc Cartney, Eline Boelee. Understanding the links between agriculture and health, Agriculture, Malaria and water associated Diseases. For food, agriculture and the environment. Vision 2020. May 2006. *International Food Policy Research Institute.*
14. Booth Christopher M and Maclean J Dick. Knowledge, Treatment seeking and socioeconomic impact of malaria on the Essequibo Coast of Guyana. *McGill Journal of Medicine*. 2001; 6(1):17-25.
15. S.P. Yadav, R.K. Kalundha & R.C. Sharma Sociocultural factors and malaria in the desert part of Rajasthan, *India. J Vect Borne Dis* September 2007; 44: 205–212.
16. Martin S Fritsch. Chapter 7 – Health issues related to drainage water management. FAO Corporate Document Repository. By: Natural Resources Management and Environment Department. (Available at: www.fao.org/docrep/W7224E/w7224e0b.htm)
17. Lauren L Pinault and Fiona F Hunter. Malaria knowledge, concerns, land management and protection practices among land owners and/or managers in lowland versus highland Ecuador. *Malaria Research and Treatment*, 2011 (2011). Article ID 765125, 12 pages. Doi:10.4061/2011/756125. (Available at: www.hindawi.com/journals/mrt/2011/765125)
18. Claudia Frey, Corneille Traoré, Manuela De Allegri, Bocar Kouyaté and Olaf Müller. Compliance of young children with ITN protection in rural Burkina Faso. *Malaria Journal* 2006, 5:70. doi: 10.1186/1475-2875-5-70.
19. Anil Prakash, D.R. Bhattacharyya, P.K. Mohapatra, B.K. Goswami & J. Mahanta. Community practices of using bed nets & acceptance & prospects of scaling up insecticide treated nets in north-east India, *Indian J Med Res*, Nov.2008, 128: 623-629.
20. V P Sharma. General Article; DDT. *Current Sciences*, 10 Dec. 2003; 85 (11):1506-1642.
21. NVBDCP: Joint Monitoring Mission (JMM) Report. Directorate of NVBDCP, Government of India. Feb 2007; p 1-70.