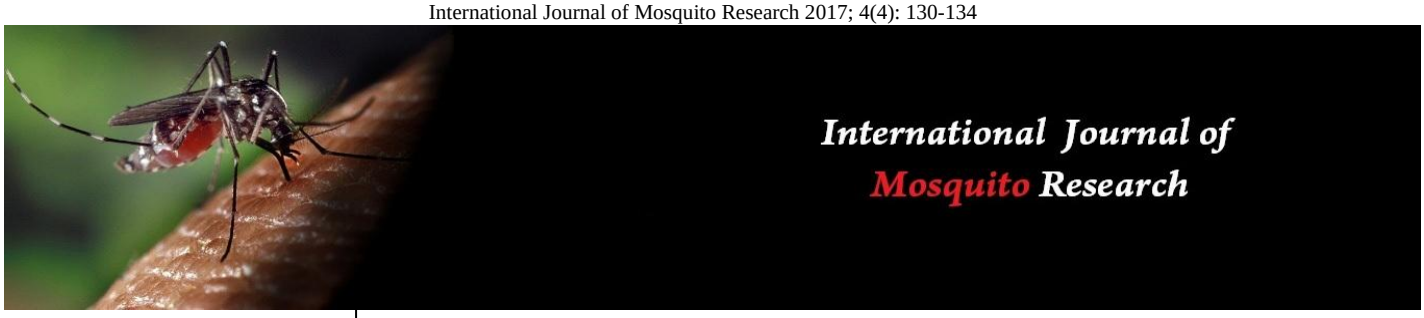

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Knowledge gap and risk for dengue epidemic in a Panchayath in central Kerala

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Abstract
Background: The present study was conducted with the objective to assess knowledge, attitude and practice of source reduction in Thirumarady grama panchayath in central Kerala which was repeatedly affected by dengue outbreaks in the past.
Methodology: 130 households were selected by systematic random sampling. Respondents were interviewed and the premises were inspected for mosquito breeding with a pilot tested questionnaire. Numerators for aedes larval indices were calculated by multiplying a correction factor of 0.88 to number of houses and number of containers with any mosquito larvae. Appropriate statistical methods were applied to explore factors associated with mosquito breeding and to eliminate confounding.
Results: Among the 130 respondents, 19% were elderly and 70% were females and 70% were poor. Proportion of respondents with correct knowledge was as followed – dengue as a mosquito borne disease(65%), clean artificial water collection as source of mosquito breeding(25%), weekly frequency of source reduction(31%), identification of aedes mosquito(51%) and day biting habit of aedes (16%). House index, container index, Breteau index were 19.2%, 10.9% and 53.4 respectively. The households with elderly respondents were at higher risk (a-OR=3.75, 95% CI: 1.44 – 9.79, $p<0.05$) for peridomestic mosquito breeding whereas other socio demographic, knowledge and attitude factors had no association.
Conclusion: The larval indices suggested high risk of dengue transmission and there were crucial knowledge gaps. The houses with only elderly during working hours should be given special attention during source reduction activities.

Keywords: Dengue, Aedes mosquito, Larval indices, Breteau index, Kerala

Introduction
Dengue is a fatal disease caused by flavi virus infection which is spread by Aedes mosquitoes [1]. The mortality rate can be around 1% with best quality treatment and can be as high as 20% if goes untreated [1]. The vector mosquitoes of dengue which belong to Aedes genus are highly adapted to breed in artificial water collections in peridomestic areas [2]. Source reduction strategy with community participation is a well appreciated approach in dengue control [3]. Kerala, the southern-most state of India had been reporting cyclic epidemics of dengue since 2001[4]. Despite all public health measures, dengue epidemic was reported in 2015 in Kerala [5]. Aedes mosquitoes breed in water collections in artificial containers which could be seen plenty in peridomestic environment. The larvae and pupae are commonly found in coconut shells, plastic wastes, tires, flower pots, glass products, egg shells and unused grinding stones [6]. They breed well in latex collection shells in rubber plantations which are plenty in central Kerala [7, 8, 9]. The larvae were found even in cocoa pods hanging on trees [7]. Source reduction is a very important strategy to control aedes mosquitoes, and this could be successfully implemented with community participation [3]. This study was conducted to assess knowledge, attitude and practice of source reduction in Thirumarady panchayath situated in central Kerala.

Materials and Methods
Study design, setting and participants
This cross sectional study was conducted in pre monsoon season (May 2016) in Thirumarady grama panchayath situated in Eranakulam district of Kerala which had experienced dengue outbreaks in the previous years. The adult members of the families available at the house were the respondents in the study

Sample size and sampling technique
The expected prevalence of peridomestic mosquito breeding was 15% [10] and the sample size was 136 for precision of 6% and α-error of 5%. We selected 130 households by systematic random sampling giving equal representation to all the 13 wards of panchayath.

Study tool
We administered a pilot tested structured questionnaire intended to find out the socio-demographic features of the families, knowledge and attitude on mosquito larval control measures emphasizing aedes mosquito and inspection details of artificial water collections in household premises. Socio economic classes were determined by modified Kuppuswamy Socioeconomic Scale, 2014. The study participants were enquired whether they knew the identification features of the larvae and adults of aedes mosquito and then their skills to identify the same were cross checked with the live specimens. Attitude questions were scored by a 5 point Likert scale with a minimum score of six and maximum score of 30 and the questions were developed from five brief key informant interviews with community members. Lower scores represent better attitude. The attitude scale is shown in Table 1.

Table 1: Scale used to measure attitude towards peridomestic source reduction (N=130)

	Statement	Totally disagree (1)	Partially disagree (2)	Neutral (3)	Partially agree (4)	Totally agree (5)
		N (%)	N (%)	N (%)	N (%)	N (%)
1	Mosquito bite does not cause disease always	15(11.5%)	3(2.3%)	4(3.1%)	36(27.7%)	72(55.4%)
2	Capsizing containers alone will not stop disease	28(21.5%)	0(0%)	2(1.5%)	7(5.4%)	93(71.5%)
3	I do not have time to go around and check mosquito breeding	74(56.9%)	5(3.8%)	3(2.3%)	23(17.7%)	25(19.2%)
4	It is governments duty to check mosquito breeding	113(87.6%)	5(3.9%)	7(5.4%)	1(0.8%)	3(2.3%)
5	Mosquito borne diseases are trivial	116(89.9%)	4(3.1%)	5(3.9%)	4(3.1%)	0(0%)
6	There are better ways to avoid mosquito bite than capsizing water collections	16(12.4%)	3(2.3%)	21(16.3%)	21(16.3%)	68(52.7%)

Analysis
The data entry was done in Epi Info software, version 7 and data analysis was done in R software version 3.1.1. Appropriate univariate analysis was done according to the type and distribution of variables. In a district wide study done in Trivandrum in Kerala, involving 1750 households, it was found that 88% of the households with mosquito larval breeding actually had aedes larvae and also 88% of the containers with larvae actually had aedes larvae.[10] Applying this as a correction factor, the number of containers with aedes larvae and number of houses with aedes larvae were estimated which were then used as numerator to estimate Breteau Index, Container Index and House Index as appropriate. Factors associated with mosquito larval breeding in the household premises were explored with chi square test and the associations were quantified as odds ratios with 95% confidence intervals. Binomial logistic regression model was created to identify factors having independent association.

Ethical consideration
The study was approved by Institutional Ethics Committee of the institution. The participation in the study was voluntary and written informed consent was taken. The participant was a educated on mosquito larval control after completing the questionnaire. Water holding objects were capsized by the investigators with the help and consent of the household members. The key results of the study were informed to the local healthcare authorities for initiating public health measures.

Results
Socio-demographic characteristics
We studied 130 households, of which majority (69%) belonged to low socioeconomic class (Table 2). Among the respondents, one-fifth were elderly (age, 60 years and above), 70% were females and 84% had completed at least high school level of education (Table 2).

Table 2: Socio-demographic details of study participants (N=130)

Factor	Category	n	%
Age	Elderly	25	19.2
	Others	105	80.8
Sex	Male	39	30
	Female	91	70
Socio economic class	Lower	90	69.2
	Middle	39	30
	Upper	1	0.8
Education of the respondent	Illiterate / Primary	8	6.1
	Middle School	13	10
	High School	43	33.1
	Intermediate / diploma	31	23.8
	Graduate / post graduate	35	27

Knowledge on spread of mosquito borne diseases with emphasis on dengue
When asked about the mosquito borne diseases, two-third of the participants named dengue, half of them named malaria and about one-third of them named chikungunya and filariasis (Table 3). Most of the participants considered dirty water collections as potential mosquito breeding sites. The proportion of participants who knew that clean water in artificial containers, clean natural water bodies and overhead water tanks were potential mosquito breeding sites were

24.6%, 11.5% and 15.4% respectively (Table 3). Most of them (91.5%) could identify mosquito larvae and half of the respondents could correctly identify the adult aedes mosquito as the vector of dengue when cross examined with live specimens (Table 3). Less than one fifths of the study participants (16%) knew that aedes mosquito is a day time biter (Table 3).

Table 3: Knowledge about mosquito borne diseases with emphasis on Dengue (n=130)

Knowledge questions	Responses	n	%
Mosquito borne disease	Dengue	84	64.6
	Chikungunya	50	38.8
	Malaria	68	52.3
	Filariasis	39	30
Mosquito larval breeding sites (quality of water, container/ water body)	Clean, natural	15	11.5
	Clean, artificial	32	24.6
	Clean, overhead tanks	20	15.4
	Dirty, natural	87	66.9
	Dirty, artificial	125	96.2
Frequency of capsizing water containers to prevent dengue	Correct (Weekly)	40	30.8
Identification of specimen	Mosquito larva	119	91.5
	Aedes mosquito	66	50.8
Biting time of aedes	Correct (day time)	21	16.2

Attitude and practice of source reduction in household premises

The attitude score of the participants ranged from 6 to 24. The median score was 18 with inter quartile range from 15 to 19. The score above 18 was considered to indicate a relatively bad attitude and score up to 18 was considered to indicate a good attitude. There were 95 participants (73%) with good attitude and 35(27%) with bad attitude. The distribution of participant responses are shown in Table 1.

The household premises were surveyed for potential breeding sites of aedes. Among the 130 households surveyed, 93 houses had potential containers of which 62 houses had water holding containers, 29 houses had containers breeding any mosquito larvae and the number of houses with aedes breeding was estimated (multiplying correction factor 0.88) to be 25(Table 4). The total number of containers identified was 632 of which 192 held water and 79 contained any mosquito larvae and the number of containers with aedes breeding was estimated (multiplying correction factor 0.88) to be 69(Table 4). Prevalence of mosquito larvae breeding households (29 out of 130 households) was 22.3% (95% CI: 15.2% to 29.5%). House index, container index and Breteau index specific for aedes were derived using the corrected estimates. The house index was 19.2% (95% CI: 12.4% to 25.9%), container Index was 10.9% (95% CI: 5.6% to 16.4%) and the Breteau Index was 53.4.

The houses with elderly respondents had a significantly higher risk for mosquito larval breeding in their premises and this was seen to be an independent association in binomial logistic regression model (Adjusted Odds Ratio – 3.75, p value- 0.003); the other variables in the model were sex, knowledge on weekly frequency of source reduction and attitude score for peridomestic mosquito larval control measures which had no association with observed mosquito larval breeding in the household premises (Table 5).

Table 4: Number and Details of containers and the number of houses where they were

Details of Containers	Total Number	Number of houses with the containers
Potential containers[a]	632	93
Water holding containers[a]	192	62
Containers with any mosquito larvae[a]	79	29
Containers with aedes larvae[b]	69	25

Table 5: Factors associated with breeding of mosquito larvae in household premises

Characteristics of Respondent	Houses positive for mosquito larvae	p-value	OR (95% CI)	a-OR (95% CI)
Age	Elderly (11/25, 44%) *Vs.* Others (18/105, 17.1%)	0.004	3.75* (1.31 – 10.65)	3.75* (1.44 – 9.79)
Sex	Female (19/91, 20.9%) *Vs.* Male (10/39, 25.6%)	0.55	0.77 (0.29 – 2.08)	0.84 (0.34 – 2.19)
Attitude score	Bad (10/35, 28.5%) *Vs.* Good (19/95, 20%)	0.29	1.59 (0.58 – 4.19)	1.67 (0.65 – 4.19)
Knowledge on weekly source reduction	Weekly (10/40, 25%) Vs. Incorrect (19/90, 21.1%)	0.62	1.24 (0.46 – 3.22)	1.27 (0.50 – 3.14)

Discussion

The present study was done in a dengue epidemic prone panchayath in central Kerala during premonsoon season. Among the 130 households studied, 94% of the respondents had studied up to middle school or beyond but, only 65% of the respondents knew that mosquitoes spread dengue. Kerala

has a literacy rate of 93.9% [11] and to the best of investigators knowledge the mass media had been reporting about dengue prevention and control for several years.

Aedes mosquitoes are generally container breeders and breed in clean water collections [12]. In this study, only one-fourth of the respondents knew that mosquitoes can breed in clean water collection in containers which is a major knowledge gap. This has a great implication in effective dengue control. Active health education by community peer educators could be an effective means to achieve source reduction [13]. It takes about one week for the aedes eggs to hatch and metamorphose into adult mosquito so [14]. Weekly dry day observation is suggested as important aedes control measure [15]. Correct frequency (weekly) of source reduction activities was known to less than one third of participants. Aedes mosquito is a day biter [12]. which was known to only 16% of participants. More than 90% of the participants could identify mosquito larvae but only half of them could identify aedes mosquito. Lack of information about the habits and habitats of aedes mosquitoes could be critical factor for repeated outbreaks in this area. The knowledge gaps identified in this study are crucial for dengue control. Effective health education sessions with community participation can be the key to correct these knowledge gaps.

Aedes specific larval indices were calculated using correction factor assumed from results of a large study on container breeding mosquito [10]. This enabled us to save time and resource otherwise needed to identify mosquito species. x`However, this approximation may also be regarded as a limitation of the study. House Index and Breteau Index estimated were 19.2% and 53.4 respectively, both of which indicate high risk for dengue transmission in this panchayath. According to National Vector Borne Disease Control Programme guidelines, House index less than 1% indicates low risk, 1% and above but less than 10% indicates moderate risk and 10% and above indicates high risk for dengue transmission in the locality [15]. According to the same guideline Breteau index less than 5 indicates low risk, 5 and above but less than 50 indicate moderate risk and 50 and above indicate high risk for dengue transmission [15]. The alarmingly high level of both the indices were intimated to the medical officer of the Primary Health Centre in the panchayath immediately and preventive measures were taken up.

The study was conducted during working hours of the day. In 25(19%) houses, elderly (aged 60 years and above) were available for interview. Interestingly, these houses had higher risk for mosquito breeding in their premises. Older adults are known to have fear of moving outdoors [16]. which may be due to a number of physiological, lifestyle and interpersonal factors affecting mobility in old age [17]. This could be explained by the fact that elderly people would be less active and would not move around and look after the household premises. Other socio demographic variables, knowledge factors and attitude were also explored for association with mosquito breeding in household premises but they were not associated. However, a study from a different setting suggests that low income levels may be associated with mosquito breeding [18]. Gender, attitude and knowledge of weekly source reduction were examined for the plausibility of confounding with age in binomial logistic regression model but they were not confounding the association. This finding may have operational importance, the houses with only elderly during the working hours may need assistance to do source reduction activities. Active planning from the field workers is necessary to enumerate those houses with elderly population and a specific action plan to conduct source reduction in those houses may help to address the problem.

Conclusion

The estimates of larval indices suggested that there was a high risk of dengue transmission in the selected panchayath and there were crucial knowledge gaps which needed to be addressed. The houses with only elderly during working hours probably have a higher risk of peridomestic mosquito breeding. Such houses need special attention when source reduction activities are charted at the grass root level.

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