

# Assessment of Behavioral Risk Factors for Dengue: A Case–Control Study from Pune

Mallikarjun Biradar, Renuka Kunte, Dashrath Basannar

Department of Community  
Medicine, Armed Forces  
Medical College, Pune,  
Maharashtra, India

## ABSTRACT

**Introduction:** Dengue cases continue to be reported every year in India despite various measures being taken for the prevention. In the absence of an effective vaccine and a specific treatment, protective behavior at individual level is of paramount importance. This case–control study was undertaken to find the association of some important behavioral risk factors with dengue fever.

**Methods:** The study included all consecutive patients of dengue fever >15 years of age visiting a tertiary care hospital in Pune during 2018 confirmed by laboratory investigation as cases. Healthy individuals living in the same locality as cases were selected as controls. Cases and controls were interviewed using a pretested semistructured questionnaire called Dengue Risk Assessment to Initiate Control to collect information on behaviors for increased vulnerability to dengue infection. Relevant data were collected and compiled using Microsoft Excel and the data were analyzed using Statistical Package for the Social Sciences version 20 (IBM, USA).

**Results:** A total of 30 cases (mean age 30.2, standard deviation [SD] 9.2) and 60 controls (mean age 30.08, SD 7.7) were recruited in the study. The results showed that cases were more likely to have certain behaviors associated with dengue than controls, namely, not practicing container management at home during the last 2 weeks (odds ratio [OR] = 3.57 and 95% confidence interval [CI]: 1.20–10.63), not using repellents (OR = 2.89 and 95% CI: 1.16–7.19), not wearing full-sleeve shirt/trousers (OR = 6.14 and 95% CI: 1.75–23.8), and absence of source reduction practices in the surrounding area (OR = 8.84 and 95% CI: 1.10–71.42). A significantly larger proportion of cases had lower practice scores ( $\leq 7$ ) for dengue prevention than controls (OR = 5.20 and 95% CI: 1.41–19.23). **Conclusion:** This study found that odds of not practicing conventional personal protective measures and container management were higher among dengue fever individuals than controls.

**KEYWORDS:** Behavioral risk factors, dengue prevention, personal protection

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## INTRODUCTION

Mosquito-borne diseases are emerging as a major public health threat in the recent years. Dengue, a self-limiting acute mosquito-transmitted disease, is one of them and is characterized by fever, headache, muscle and joint pain, rashes, nausea, and vomiting. Severe form of dengue manifests as life-threatening dengue hemorrhagic fever (DHF). Dengue can be caused by any of the four serotypes of the virus. Infection with one dengue serotype results in lifelong immunity to that serotype, but there is

no cross-protection for other serotypes. Previously infected people with one or more serotypes are prone to develop severe disease complications in subsequent infections.<sup>[1–3]</sup>

Dengue is transmitted by mosquito vector mainly *Aedes aegypti* and to a lesser extent by the *Aedes albopictus*.

**Address for correspondence:** Dr. Mallikarjun Biradar,  
Department of Community Medicine, Armed Forces Medical  
College, Pune, Maharashtra, India.  
E-mail: msbiradar12@gmail.com

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Urban areas are the man habitat for *A. aegypti* where it breeds in man-made containers. *A. aegypti* is a daytime feeder with its peak biting periods being early in the morning and in the evening before dusk. Female *A. aegypti* bites multiple people during each feeding period. *Aedes* eggs can remain dry for over a year in their breeding habitat and hatch when in contact with water.<sup>[1,3]</sup>

Globally, yearly, there are around 50–100 million cases of DF with 0.25–0.5 million cases requiring hospitalization, majority of them being children under 15 years. DHF has an average case fatality of 5% accounting for approximately 25,000 deaths each year. With increase in human population, there is also a sharp increase in the cumulative dengue cases.<sup>[4]</sup>

Dengue is showing resurgence in India with all four serotypes being reported from various parts of the country. This is mainly attributed to the rapid urbanization with poor water storage practices and increased movement of people between cities and states. Dengue predominantly had an urban distribution, but now is also being reported from periurban and rural areas.<sup>[5]</sup> At present, dengue is endemic to all states and union territories (UTs) of India. Around 136,422 cases and 132 deaths were reported from various states and UTs in 2019 (till November).<sup>[6]</sup> There is no specific treatment for dengue although disease control strategies are in place. Participation of the individual in the form of appropriate behavior is a vital component among measures to reduce the incidence of dengue and the most important being adequate knowledge of potential breeding sites for effective control and awareness and use of suitable personnel protective measures to minimize man-vector contact. These behavioral factors have been least studied and there are very few case-control studies to find the association between these risk factors and vulnerability to dengue. The present case-control study was undertaken to assess the behavioral determinants of dengue infections.

### Aims and objectives

**Aim:** To study the behavioral risk factors for dengue fever in patients reporting to a tertiary care hospital in Pune, Maharashtra.

**Objectives:** To identify and to find the association of behavioral risk factors for dengue fever.

## METHODS

### Study participants and sample

All consecutive laboratory-confirmed cases by NS1 antigen test (nonstructural protein 1) of dengue fever with more than 15 years of age reporting to a tertiary care hospital of Pune during 2018 were included as

cases. Two controls were selected for each case among healthy individuals living in the same locality, i.e., within 400 m from the residential address of the case. Those with a history of fever in the last 1 year were excluded. A total of 30 cases and 60 controls (1:2) were included in the study.

### Questionnaire and data collection

A semistructured questionnaire called Dengue Risk Assessment to Initiate Control was designed for the study and pilot tested on 10 individuals prior to use. It had four parts for information, namely sociodemographic details, awareness on dengue, behavior related to dengue prevention (container management at home during the last 2 weeks, use of personal protective measures such as repellents and full-sleeve shirt and trousers or equivalent, and others), and clinical and laboratory profile (for cases). A scoring system was used to assess the overall behavior related to dengue, i.e., protective practices by the individual at home and surroundings (maximum score 16). A practice score of <7 was taken as low indicating increased risk for the disease for analysis. The data were collected by interviewing both cases and controls.

### Ethical considerations

The study was approved by the institutional ethics committee. Written/verbal consent was taken prior to the start of the interview.

### Statistical analysis

The collected data were analyzed using statistical tools, namely, mean, standard deviation, percentages, and odds ratio (OR). Quantitative data were analyzed using unpaired “*t*”-test and qualitative by independent Chi-square test wherever applicable. Univariate analysis followed by multiple logistic regression analysis of variables with  $P < 0.1$  was carried out. Statistical Package for the Social Sciences version 20 (IBM SPSS statistics for windows, version 22.0 Armonk, NY: IBM Corp was used for analysis).

## RESULTS

The total number of cases and controls included in the analysis are 30 and 60, respectively. As depicted in Table 1, the study groups are homogeneous with respect to age, sex, religion, family size, education, income, occupation, and socioeconomic status as per Kuppuswamy scale ( $P > 0.05$ ).

Table 2 shows the distribution of awareness regarding various aspects about dengue.

## Behavioral risk factors for dengue fever

We used a scoring system for various personal protective practices by cases and controls both at home and surroundings with a maximum score of 16. A score of 7 or less was considered as a lower practice score for analysis. Table 3 shows the distribution of practice scores ( $\leq 7$  vs.  $> 7$ ) between the study groups. Cases were much more likely to have a score of  $< 7$  as compared to controls (OR = 5.20 and 95% confidence interval [CI]: 1.41–19.23).

**Table 1: Sociodemographic characteristics**

Variable	Categories	Case, <i>n</i> (%)	Control, <i>n</i> (%)
Age (years)	<35	10 (33.3)	18 (30)
	>35	20 (66.7)	42 (70)
Sex	Male	23 (76)	44 (73)
	Female	7 (23)	16 (26)
Religion	Hindu	29 (97)	57 (95)
	Others	1 (3)	3 (5)
Residence	Urban area	30 (100)	60 (100)
Family size	<4	18 (60)	39 (65)
	>4	12 (30)	21 (35)
Education	>graduate	21 (70)	40 (66.7)
	<graduate	9 (30)	20 (33.3)
Income	>24,660	29 (96.7)	59 (98.3)
	<24,660	1 (3.3)	1 (1.7)
Occupation	Professional	16 (53.3)	40 (66.7)
	Below professional	14 (46.7)	20 (33.3)
SES class	Upper middle and above	16 (53.3)	35 (58.3)
	Below upper middle	14 (46.7)	25 (41.7)

SES: Socioeconomic status

**Table 2: Awareness about dengue**

Awareness about dengue	Case, <i>n</i> (%)	Control, <i>n</i> (%)
Heard about dengue	29 (97)	60 (100)
Means of getting dengue infection	30 (100)	60 (100)
Name of the mosquito	15 (50)	26 (43)
Recognize the mosquito	14 (46)	24 (40)
Preferred dengue mosquito breeding site	14 (46)	36 (60)
Preferred biting time	20 (66)	51 (85)
Season in which dengue is common	25 (83)	60 (100)
Risk of getting dengue if his/her neighbor gets dengue	23 (76)	57 (95)
It is possible to protect oneself from dengue	30 (100)	60 (100)
Dengue complication can cause death	29 (97)	59 (98)

**Table 3: Practice scores and dengue status**

Practice scores	Case, <i>n</i> (%)	Control, <i>n</i> (%)	OR (95%)	<i>P</i>
$\leq 7$	27 (88.9)	38 (63.3)	5.20 (1.41–19.23)	0.01
$> 7$	3 (11.1)	22 (36.7)		

OR: Odds ratio

Table 4 shows the distribution of behavioral factors between the study groups and its association with dengue using univariate analysis. The results showed that there was a significant association between certain behavioral factors and dengue, namely, not practicing container management at home during the last 2 weeks (OR = 3.57 and 95% CI: 1.20–10.63), not using repellents (OR = 2.89 and 95% CI: 1.16–7.19), not using full-sleeve shirt/trousers (OR = 6.14 and 95% CI: 1.75–23.8), and absence of source reduction practices in the surrounding area (OR = 8.84 and 95% CI: 1.10–71.42).

Logistic regression analysis of behavioral factors which are significant by univariate analysis is depicted in Table 5. The behavioral factors which are significantly associated with dengue are used repellents at home (OR = 3.144 and 95% CI: 1.09–9.087) and using full-sleeve shirt/trouser (OR = 6.126 and 95% CI: 1.04–16.37).

## DISCUSSION

Although studies on environmental, climatic, and epidemiological determinants for dengue fever are available, those in the field of behavioral factors for vulnerability to dengue are very few.<sup>[7]</sup> Our study found that using repellents and wearing full-sleeve clothes/trousers were found to be significant protective factors, whereas practicing container management at home and source reduction practices in the surroundings were not strongly associated with dengue prevention in the binary logistic regression analysis. In a study by Chen *et al.* in Guanzhou, China, it was seen that removing trash and stagnant water from around the residence (OR = 0.02, 95% CI = 0.00–0.17) and using mosquito repellent oils (OR = 0.36, 95% CI = 0.16–0.81) were protective factors.<sup>[8]</sup> Similarly, in India, in a study of behavioral factors for dengue by Ramachandran *et al.* in Chennai, a significant association of dengue was seen for individuals not wearing clothes that fully cover the body (adjusted odds ratio [AOR]: 4.7%, 95% CI: 1.95–11.11) and storing water (AOR: 4.6, 95% CI: 2.64–7.88).<sup>[9]</sup>

We found better awareness and higher practice score levels among controls and it has been reiterated in many studies that better knowledge leads to good attitudes and good attitudes are followed by better practices.<sup>[10–12]</sup>

**Table 4: Behavioral risk factors for dengue fever (univariate analysis)**

Behavioral factors	Category	Case, n (%)	Control, n (%)	OR (95% CI)	P
Container management practiced at home during last 2 weeks	Not done	25 (83.3)	35 (58.3)	3.57 (1.20-10.63)	0.018
	Done	5 (16.7)	25 (41.7)		
Repellents used at home	Not done	16 (53.3)	17 (28.3)	2.89 (1.16-7.19)	0.020
	Done	14 (46.7)	43 (71.7)		
Full sleeves shirt/trouser used	Not done	27 (90)	35 (58.3)	6.41 (1.75-23.80)	0.002
	Done	3 (10)	25 (41.7)		
Spraying done at home	Not done	29 (97)	55 (91.7)	2.63 (0.29-23.80)	0.165
	Done	1 (3)	5 (8.3)		
Source reduction practices in the surrounding area	Not done	29 (97)	46 (26.7)	8.84 (1.10-71.42)	0.016
	Done	1 (3)	14 (23.3)		

OR: Odds ratio, CI: Confidence interval

**Table 5: Behavioral risk factors for dengue fever (binary logistic regression analysis)**

Behavioral factors	B	SE	Wald	df	Significant	Exp(B)	95% CI for EXP(B)	
							Lower	Upper
Container management practiced at home	1.191	0.632	3.56	1	0.060	3.29	0.95	11.35
Repellents used at home	1.146	0.541	4.48	1	0.034	3.14	1.09	9.09
Full sleeves shirt/trouser used	1.417	0.703	4.07	1	0.044	4.13	1.04	16.37
Source reduction practices in the surrounding area	1.800	1.159	2.41	1	0.120	6.05	0.63	58.63
Constant	-4.747	1.377	11.89	1	0.001	0.01		

 $R^2=0.303$ , Hosmer and Lemeshow Test  $P=0.457$  and Omnibus Tests of Model Coefficients  $P<0.01$ . SE: Standard error, CI: Confidence interval

In the absence of specific antiviral treatment or vaccine against dengue, the key available options for the prevention and control of dengue are to control larval habitats in and around people's homes and workplaces and to reduce human-vector contact by personal protection in addition to ensuring prompt diagnosis of cases of fever and appropriate clinical management.<sup>[4]</sup>

Integrated vector management has community participation as an essential component. There needs to be a strong partnership between the government and the community for a sustainable vector control program, especially for dengue. Any vertical program on dengue prevention will fail if it does not involve the local community considering the breeding and biting habits of the vector mosquito.<sup>[4]</sup> Behavior of the people regarding effective source reduction especially container management at home and surroundings and use of personal protective measures are possible only with their active participation. Increased community ownership can NOT ONLY prevent dengue transmission and reduce related morbidity and mortality in India, but will also provide added benefit for other Aedes vector transmitted diseases.<sup>[4]</sup>

Numerous descriptive studies including knowledge, attitude, and practices studies in the past both in India and abroad have described the risks, found associations with behavioral factors, and identified a knowledge practice gap for dengue prevention among the general population.<sup>[10-16]</sup> The present study has highlighted and

computed the relative vulnerability of the individuals not using simple personal protective measures to dengue infection. These actions are entirely self-determined, can be practiced at both home and workplace, and are independent of vector control measures. There are very few case-control studies when dengue is concerned, and this study on behavioral factors despite its limitations of a small sample size and selection of cases from a single hospital being rare adds strength to the case for promotion of use of actions to reduce human-vector contact. Notwithstanding some bias due to recall and that the practices were self-reported in this study, the importance of personal protection needs to be emphasized.

We believe that while IEC is an important component of control of all vector-borne diseases, scientifically designed strategies for behavior change communication targeted toward these activities, i.e., personal protective measures, are the need of the hour for more effective control of dengue.

## CONCLUSION

Our study found that cases of dengue had significantly higher chance of not using personal protective measures or practicing vector control in and around their homes as compared to controls. We also found better awareness regarding dengue and higher practice scores among people who did not have dengue. Hence, the study elucidates the importance of actions to be



taken by the individuals in the prevention of dengue. There is a need to plan targeted intervention toward this end.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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