RESEARCH ARTICLE

Knowledge and prevention practice against dengue vectors among dengue patients and general people in Chattogram, Bangladesh [version 1; peer review: awaiting peer review]

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V1 First published: 04 Feb 2022, 11:146
<https://doi.org/10.12688/f1000research.108731.1>

Latest published: 04 Feb 2022, 11:146
<https://doi.org/10.12688/f1000research.108731.1>

Open Peer Review

Approval Status *AWAITING PEER REVIEW*

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Abstract

Background: Due to the absence of an effective vaccine for dengue, community-led vector control strategy could be a sustainable approach for dengue prevention. Therefore, this study aimed to assess people's knowledge of dengue vectors and the practice of preventive measures to avoid vector mosquitoes by means of a structured questionnaire.

Methods: A telephone-based survey was conducted between July 2019 to December 2019 from confirmed dengue patients and general people without dengue fever living in Chattogram, Bangladesh. Patients' contact information was collected from two tertiary care hospitals. The level of knowledge and preventive practice were determined through the scoring of each participant against their responses. The association of individuals' knowledge and practice scores with demographic variables was measured through chi-square and binary logistic analyses.

Results: Overall, 61.9% of participants (72% case and 51.7% non-case) had good knowledge, whereas only 10.6% of them (12.7% case and 8.7% non-case) strongly practiced the mosquito prevention methods. However, significant variation in the level of knowledge was found between the two groups. Urban residents had 2.20 times higher knowledge compared to semi urban. Students and government officials had 3.39 times and 3.17 times better knowledge than general workers respectively. Permanent residents had 2.01 times better knowledge in comparison to the people living in temporary housing. In terms of mosquito preventive measures, semi-urban people showed 3.19 times (CI=0.97-10.52) stronger practice compared to rural people.

Conclusions: This study suggests that dengue control strategies should focus on the effective practice of mosquito prevention by engaging community people.

Keywords

Aedes mosquito, dengue fever, vector-borne disease, knowledge and practice, vector control, dengue prevention

This article is included in the **Health Services** gateway.

This article is included in the **Neglected Tropical Diseases** collection.

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Author roles: **Rahman S:** Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Software, Supervision, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Mehejabin F:** Data Curation, Formal Analysis, Methodology, Software, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Rashid R:** Conceptualization, Data Curation, Investigation, Methodology, Supervision, Validation, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: The author(s) declared that no grants were involved in supporting this work.

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How to cite this article: Rahman S, Mehejabin F and Rashid R. **Knowledge and prevention practice against dengue vectors among dengue patients and general people in Chattogram, Bangladesh [version 1; peer review: awaiting peer review]** F1000Research 2022, 11:146 <https://doi.org/10.12688/f1000research.108731.1>

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Introduction

Dengue fever is one of the most common vector-borne infectious diseases, endemic throughout the tropics and subtropics of the world. It is an acute mosquito borne illness and produces flu-like symptoms in humans after a short incubation period of 5-8 days (Du *et al.*, 2021). Dengue virus is a single-stranded RNA virus under the genus *Flavivirus* possessing four unique serotypes DENV 1, 2, 3, and 4. However a new serotype was discovered in Malaysia which also has the potential to affect humans (Freeman *et al.*, 2019). The virus is circulated through human-mosquito-human cycles and spreads through the bites of *Aedes aegypti* and *Aedes albopictus* mosquitoes. In addition, it may also spread from human to human without a carrier, in particularly through blood transmission, transplantation and needle puncture injuries (Wilder-Smith *et al.*, 2019). Due to the common symptoms of dengue infection including high fever, rash, severe headache, joints, and muscle pain, it has also been known as “break-bone fever” (Abbasi *et al.*, 2016). Sometimes, dengue fever can progress to the severe stage known as dengue hemorrhagic fever and manifest with blood in the urine or stool, bleeding gums, or bleeding from nose, indicating a critical condition of a patient.

Dengue fever has become one of the major public health concerns with a huge global burden in recent years. It has been representing a threat for around four billion inhabitants of more than 141 countries (World Mosquito Program, 2021). According to recent data, almost 100 million people show clinical manifestations every year with nearly 20,000 deaths (WHO, 2020). The 3/4th of the total burden was reported to be concentrated in the South East Asia and Western Pacific regions. A recent study has reported that about 52% of Southeast Asian people were found to be at risk of contracting dengue fever (Hossain *et al.*, 2021). In Bangladesh, the first dengue case was detected in 1964. However, in 2000, the outbreak turned into a catastrophic situation, with 93 deaths among the 5,551 dengue cases in Dhaka, Khulna, and Chittagong city (Mutsuddy *et al.*, 2019). In the following year, a remarkable reduction was observed in 2014 with 375 dengue cases, but the dengue fever epidemic has increased recently from 2,769 cases in 2017 to 10,148 cases in 2018 (Abir *et al.*, 2021). In 2019, the incidence of dengue fever rose sharply, with 164 deaths from more than 100 thousand confirmed cases, representing an 11-fold increase in the incidence of dengue compared to previous year (Directorate General of Health Services (DGHS), 2020; Rafi *et al.*, 2020).

Different biological and socio-cultural factors have been found responsible for the spread of dengue infection in an area. The literature counts various factors including age, blood group, female sex, genetic polymorphism, co-morbidities, urbanization, stagnant water, geographic location, among others (Liu *et al.*, 2018). A case-control study in study area (Chattogram city, Bangladesh) also revealed that traveling, house structure, day-time sleep, and house plants are potential risk factors for dengue infection of the residents (Rahman *et al.*, 2021a). On the other hand, season and climate parameters like temperature, humidity, and rainfall also play an indirect role on dengue transmission. However, *Aedes* mosquitoes have a unique affinity to certain types of containers for breeding. Previous study found that discarded tires, plastic buckets, plastic drums, and coconut shells around houses were preferred for *Aedes* larvae production. Moreover, 17.35% of household in the study area were infested with *Aedes* mosquito larvae or pupae (Rahman *et al.*, 2021b).

The lack of knowledge regarding dengue infection has been considered as one of the main problems in dengue epidemiology (Lian *et al.*, 2006). According to a study conducted in Malaysia, a lack of awareness about dengue transmission and prevention strategies can enhance the risk of infection (Nguyen *et al.*, 2019). A previous study in Malaysia revealed that people who have more knowledge about dengue are more likely to pursue more suitable dengue prevention measures compare to people with less knowledge (ROSLAN *et al.*, 2020). Factors based on the good awareness and knowledge of dengue prevention measures are also responsible for drastic reductions in dengue transmission (Abir *et al.*, 2021). Thus, evaluating people’s knowledge, attitude, and practice is of great importance for strengthening integrated control measures, which remain understudied. As there has been no effective vaccine approved so far, vector control and preventing mosquito bites through community empowerment and engagement is an effective option for prevention (Rahman *et al.*, 2021b). To ensure a sustainable dengue prevention, increasing people’s knowledge and awareness towards vector control is highly important. Previous knowledge, attitude, and practice (KAP) studies mainly focused on clinical aspects of dengue fever while the vector perspectives remained neglected. Therefore, in this study we focused on mosquito vectors and assessed the general knowledge of people on dengue vectors and their practices regarding the prevention of mosquito presence in the Chattogram district, Bangladesh. Moreover, we compared the level of knowledge and prevention practice between dengue-infected and non-infected people. The findings of this study could serve as baseline data for researcher and policymakers.

Methods

Study design

This cross-sectional study concerning knowledge, attitude and practices related to dengue prevention among the people in Chattogram, Bangladesh was conducted between July 2019 and December 2019. Our target participants were divided into two groups: recent dengue cases and apparently healthy people without dengue infection. We collected a list of confirmed dengue

cases with contact details from the record of dengue ward of Chattogram Medical College Hospital and Bangladesh Institute of Tropical and Infectious Diseases (BITID). Both of these are the government tertiary care hospitals in Chattogram city. We included only those who were residents of the Chattogram district and got infected within the previous 15 days. Contact information of non-case participants were collected from the people who visited the outpatient department of the same hospitals. A comprehensive review of the literature was conducted to identify the factors determining the level of knowledge and dengue prevention practices among the people. All research participants or their guardians (for children) were assured that the data would be kept anonymous and use for research purposes only. Each participant had the right to leave the survey process of this study at any time. Participation in this study was fully voluntary and proceeding to the main parts of the interview happened upon verbal informed consent. No incentives were given to any respondent. We contacted 184 dengue patients and 200 non-infected persons. A few mobile phone numbers were unresponsive or the number holder was the patient's relative. Moreover, partial data of participants who left without completing the survey were excluded from the analysis. Finally, we obtained complete data from 300 participants from a total of 384 contacted people with a response rate of 78.1%.

Questionnaire design and data collection

Data were collected within a two-month period, October and November 2019. We developed a survey questionnaire by reviewing literature and consulting experienced clinicians and epidemiologists. Data was collected through telephone-based interview. Most of the questions were multiple-choice checkbox types with Yes and No answers as well as 'other' options included with a few questions.

The aim and objectives of the study were clearly explained at the beginning of the survey. The questionnaire was divided into three parts. Part 1 comprised questions relating to socio-demographic details of the participants. Part 2 included questions on general knowledge of dengue and its vectors while Part 3 inquired on their regular practice of preventing mosquito presence and mosquito bites in order to prevent dengue fever.

Knowledge of dengue was measured by asking questions related to disease vector mosquitoes, mode of disease transmission, and breeding places of mosquitoes. Questions related to knowledge were asked before the questions of preventive measures to avoid bias. Different mosquito prevention measures were used to investigate their practices, which included checking the house and surroundings for removing stagnant water, use of mosquito nets at night and even during daytime sleep, and mosquito killing/avoiding devices.

The preliminary draft of the questionnaire was tested before finalizing. A few inappropriate questions were omitted, resulting in a total of 20 questions in the final questionnaire (*Extended data*, [Rahman, 2022b](#)). The questionnaire was designed in the English language and translated into Bengali (mother tongue of the participants) during interview. In case of children, data were collected from parents or a guardian.

Data management and analysis

We developed a numeric scoring system to assess general knowledge and awareness of dengue vectors. Knowledge-related questions were scored as 1 point for the correct or "Yes" answer, and 0 for the wrong or "No" answer. The maximum total score was 8 and participants were ranked into two groups: good knowledge (score 5 to 8) and poor knowledge (score 1 to 4). However, questions about prevention practices were scored mostly along a four-point scale ranging from 0 to 3, as regularly (score 3), frequently (score 2), occasionally (score 1), and never (score 0). Thus, the maximum total score was 20 and divided the participants under strong practice (11 to 20 points) and weak practice (1-10 points). The respondents' information was stored on the computer with a password and was accessible only to the investigators. People who failed to respond to all questions or who left before completing the interview were excluded.

First, the demographic variables were compared between the two groups of participants. Then, the associations between the ranks and socio-demographic characteristics were investigated using Chi-Square and Fisher exact probability tests. Non-overlapping 95% CI and a p-value $\leq 5\%$ were considered as statistically significant. Finally, logistic regression was used to identify determinants influencing the knowledge and prevention practice of dengue among the people.

Ethical policies

This study was conducted by following the Declaration of Helsinki, and the project protocol was approved by the Ethics Committee of the Chattogram Veterinary and Animal Sciences University, Bangladesh (permit reference number: CVASU/Dir(R&E) EC/2020/169/10, Date: 21/07/2020).

Results

In this study, a total of 300 respondents were surveyed, of which 150 were dengue patients and the remaining 150 were the general people without experience of being infected with dengue. [Table 1](#) compares the profiles of the two group of

Table 1. Comparison of socio-demographic variables of two groups of participants.

Variable name	Case (%)	Non-case (%)	p-value	Chi ² -value
Age				
≤15 years	14 (77.7)	4 (22.2)	0.00	54.82
16-30 years	95 (68.8)	43 (31.2)		
31-45 years	25 (39.1)	39 (60.9)		
46-60 years	12 (26.0)	34 (73.9)		
≥61 years	4 (13.3)	26 (86.6)		
Gender				
Male	105 (57.4)	78 (42.6)	0.001	10.21
Female	45 (38.5)	72 (61.5)		
Occupation				
Unemployed	14 (30.4)	32 (69.6)	0.00	40.69
Business	9 (42.9)	12 (57.1)		
Government service	26 (74.3)	9 (25.7)		
Housewife	20 (29.9)	47 (70.1)		
Private service	12 (50)	12 (50)		
Student	47 (73.4)	17 (26.6)		
Police	2 (50)	2 (50)		
Worker	20 (51.3)	19 (48.7)		
Geographic Location				
Rural	10 (11.6)	76 (88.4)	0.00	71.03
Urban	91 (65)	49 (35)		
Semi-urban	49 (66.2)	25 (33.8)		
Lived with dengue patient				
Yes	41 (89.1)	5 (10.9)	0.00	33.28
No	109 (42.9)	145 (57.1)		
Residence type				
Permanent	116 (45.6)	138 (54.3)	0.00	12.43
Temporary	34 (73.9)	12 (26.1)		

participants. All demographic variables showed a significant difference between the groups. A higher number of cases was found in young people aged below 15 years (77%) followed by 16 to 30 years (68%). On the other hand, middle-aged to older people were mostly found in the non-case group: 60% between 31 and 45 years, 73% between 46 and 60 years, and the highest, 86.6% were more than 60 years old. Male numbers were higher in cases (57.4%) and females were mostly non-case (61.5%). Among different occupation categories were government officials (74.3%), and students (73.4%) were frequently recorded in the case group. Housewives (70%) and unemployed people (69.6%) were mostly non-case. Cases were mostly from urban (65%) and semi-urban (66.2%) areas while 88.4% non-cases were from rural areas. People who lived or worked with dengue patients were mostly in the case group (89.1%). Among all participants, permanent residents showed a higher proportion of non-cases (54.3%) while most of the temporary residents (73.9%) were found as cases.

Table 2 compares the level of knowledge and practice of prevention among participants. Good knowledge was found higher (72%) among the dengue-infected than the non-infected group (51.3%). The difference of knowledge level between the groups was significant ($p < 0.05$). On the other hand, participants of both groups were mostly demonstrated to have weak (87.3% cases and 91.3% non-cases) practices for dengue vector prevention.

Occupation and geographic location of the people showed a significant effect on their level of knowledge (see **Table 3**). The people living in urban areas (71.4%) were more knowledgeable than the semi-urban and rural area (p -value=0.00).

Table 2. Level of knowledge and practice of prevention in the case and non-case groups of participants.

Variable name	Total (%)	Dengue Case (%)	Non case (%)	p-value	Chi ² -value
Knowledge					
Good	185 (61.7)	108 (72.0)	77 (51.3)	0.00	13.55
Poor	115 (38.3)	42 (28.0)	73 (48.7)		
Practice					
Strong	32 (10.6)	19 (12.7)	13 (8.7)	0.26	1.26
Weak	268 (89.3)	131 (87.3)	137 (91.3)		

Table 3. Demographic variable with correspondent knowledge score.

Variable name	Good knowledge (%)	Poor knowledge (%)	p-value	Chi ² -value
Age				
≤15 years	11 (61.1)	7 (38.9)	0.30	4.82
16-30 years	92 (67.2)	45 (32.8)		
31-45 years	35 (54.7)	29 (45.3)		
46-60 years	24 (52.2)	22 (47.8)		
≥61 years	19 (63.3)	11 (36.7)		
Gender				
Male	116 (63.4)	67 (36.6)	0.49	0.45
Female	69 (59.5)	47 (40.5)		
Occupation				
Unemployed	25 (54.3)	21 (45.7)	0.01	18.36
Business	14 (66.7)	7 (33.3)		
Government service	27 (77.1)	8 (22.9)		
Housewife	36 (54.5)	30 (45.5)		
Private service	13 (54.2)	11 (45.8)		
Student	50 (78.1)	14 (21.9)		
Police	2 (50.0)	2 (50.0)		
Worker	18 (46.2)	21 (53.8)		
Geographic location				
Rural	46 (53.5)	40 (46.5)	0.00	10.19
Urban	100 (71.4)	40 (28.6)		
Semi-urban	39 (53.4)	34 (46.6)		
Lived with dengue patient				
Yes	29 (63.0)	17 (37.0)	0.86	0.03
No	156 (61.7)	97 (38.3)		
Residence type				
Permanent	159 (62.8)	94 (37.2)	0.42	0.66
Temporary	26 (56.5)	20 (43.5)		

Among the different occupations, students (78.1%), government officials (77.1%), and businessmen (66.7%) possessed comparatively better knowledge than others.

Table 4 shows that urban people had a 2.20 times higher knowledge compare to semi urban. The level of knowledge was 3.39 times stronger among students and 3.17 times stronger within government officials in comparison with workers. Moreover, the binary analysis shows a significant association of permanent residents who had 2.01 times with a strong knowledge compared to the people who lived in temporary homes.

Our study found a strong association between the geographical location and the practice level where 25.7% of the people living in the semi-urban area were reported to have higher preventive practices than the people who lived in the rural or urban area. Additionally, living with dengue patients was also significantly associated with good preventive practices with a p-value of 0.00 (see **Table 5**).

In **Table 6**, showing the binary regression results, it was found that the people who lived in semi-urban were practicing 3.19 times (CI=0.97-10.52) stronger preventive measures compared to those living in rural areas. Furthermore, respondents who had never lived with dengue patients were significantly less practiced for different mosquito preventive

Table 4. Association between knowledge score and demographic variables.

Variable name	Co-efficient	Standard error	P-value	Odd ratio	95% CI
Age					
≤15 years old (Reference)	Ref	–	–	–	–
16-30 years old	0.26	0.52	0.61	1.30	0.46-3.63
31-45 years old	-0.24	0.55	0.66	0.79	0.27-2.30
46-60 years old	-0.34	0.57	0.55	0.71	0.23-2.19
≥61 years old	0.13	0.63	0.83	1.14	0.33-3.92
Gender					
Male	0.40	0.38	0.29	1.49	0.71-3.13
Female (Reference)	Ref	–	–	–	–
Occupation					
Unemployed	0.06	0.46	0.89	1.06	0.43-2.64
Business	0.66	0.58	0.25	1.94	0.63-6.01
Government service	1.15	0.53	0.03	3.17	1.11-9.04
Housewife	0.42	0.51	0.41	1.52	0.56-4.15
Private service	0.14	0.53	0.79	1.15	0.40-3.28
Student	1.22	0.47	0.009	3.39	1.35-8.47
Police	-0.09	1.08	0.93	0.91	0.10-7.65
Worker (Reference)	Ref	–	–	–	–
Geographic Location					
Rural	0.09	0.35	0.79	1.09	0.55-2.18
Urban	0.79	0.33	0.01	2.20	1.15-4.20
Semi-urban (Reference)	Ref	–	–	–	–
Lived with dengue patients					
No (Reference)	Ref	–	–	–	–
Yes	-0.10	0.34	0.76	0.90	0.46-1.76
Residence type					
Permanent	0.69	0.38	0.07	2.01	0.95-4.24
Temporary (Reference)	Ref	–	–	–	–

Table 5. Demographic variables with corresponding practice of prevention score.

Variables Name	Strong practice (%)	Weak practice (%)	p-value	Chi ² -value
Age				
≤15 years old	4 (22.2)	14 (77.8)	0.34	4.33 (F)
16-30 years old	11 (8.0)	127 (92.0)		
31-45 years old	8 (12.5)	56 (87.5)		
46-60 years old	5 (10.9)	41 (89.1)		
≥61 years old	4 (13.3)	26 (86.7)		
Gender				
Male	18 (9.8)	165 (90.2)	0.56	0.34
Female	14 (12.0)	103 (88.0)		
Occupation				
Unemployed	3 (6.5)	43 (93.5)	0.08	11.74
Business	2 (9.5)	19 (90.5)		
Government service	0 (0.0)	35 (100.0)		
Housewife	12 (17.9)	55 (82.1)		
Private service	4 (16.7)	20 (83.3)		
Student	5 (7.8)	59 (92.2)		
Police	0 (0.0)	4 (100.0)		
Worker	6 (15.4)	33 (84.6)		
Geographic location				
Rural	7 (8.1)	79 (91.9)	0.00	24.05
Urban	6 (4.3)	134 (95.7)		
Semi-urban	19 (25.7)	55 (74.3)		
Lived with dengue patient				
Yes	14 (30.4)	32 (69.6)	0.00	–
No	18 (7.1)	236 (92.9)		
Residence type				
Permanent	29 (11.4)	225 (88.6)	0.44	
Temporary	3 (6.5)	43 (93.5)		

measures than those who were experienced with living with dengue patients. In addition to that, males were reported to practice almost 1.02 times more preventive measures than females.

The responses of participants for different knowledge-related questions are presented in [Table 7](#) and show significant differences among responses between the two groups. A total of 50.3% of participants with good knowledge correctly answered that the dengue fever caused by a virus while 92.2% of those with poor knowledge had no idea regarding the causal agent. A total of 99.5% participants with good knowledge recognized that dengue was transmitted by mosquitoes, and 82.2% of them knew the name *Aedes* spp. and that this mosquito breeds in clean water. Most of the participants (94.6%) having good knowledge mentioned that dengue fever is treatable whereas 21.1% of participants possessing poor knowledge did not know the availability of treatment for dengue.

[Table 8](#) presents significant differences in the responses of prevention practices-related questions between strong and weak-practice groups of participants. Most of the participants in the strong practice group regularly used mosquito nets at night (84.4%) and in daytime as well (12.5% regularly and 31.3% frequently). A higher number of people belonging to the strong-practice group frequently (56.3%) and regularly (40.6%) used different mosquito killing devices in their home, while on the other hand, 22% people from the weak practices group never used any mosquito killing devices. A total of

Table 6. Association between prevention practice score and demographic variables.

Variable name	Co-efficient	Standard error	p-value	ODD ratio	95% CI
Age					
≤15 years old (Reference)	Ref	–	–	–	–
16-30 years old	-0.84	0.78	0.28	0.43	0.09-2.00
31-45 years old	-0.47	0.86	0.58	0.62	0.11-3.36
46-60 years old	-0.60	0.94	0.52	0.55	0.08-3.47
≥61 years old	-0.18	0.98	0.86	1.19	0.17-8.18
Gender					
Male	-0.02	0.76	0.97	1.02	0.23-4.59
Female (Reference)	Ref	–	–	–	–
Occupation					
Unemployed	-0.14	0.87	0.87	0.87	0.16-4.78
Business	-0.24	0.98	0.80	0.79	0.11-5.40
Government service	-18.51	6527.76	0.99	0.00	0.00
Housewife	0.74	0.92	0.42	2.09	0.34-12.70
Private service	-0.06	0.83	0.94	0.93	0.18-4.80
Student	-0.26	0.74	0.73	0.77	0.18-3.32
Police	-17.79	20081.68	0.99	0.00	0.00
Worker (Reference)	Ref	–	–	–	–
Geographic location					
Rural (Reference)	Ref	–	–	–	–
Urban	-0.34	0.65	0.59	0.70	0.19-2.53
Semi-urban	1.16	0.60	0.05	3.19	0.97-10.52
Lived with dengue patient					
Yes (Reference)	Ref	–	–	–	–
No	-1.17	0.52	0.02	0.31	0.11-0.86
Residence type					
Permanent	-0.53	0.73	0.47	0.59	0.14-2.48
Temporary (Reference)	Ref	–	–	–	–

29% of participants having strong practices checked and cleaned stagnant water daily in and around their house, whereas 50.4% of participants with weak practices never checked stagnant water.

Figure 1 shows that people mostly (58%) used coil to prevent mosquitoes. However, 15.33% used both coil and mosquito killing spray. A small number of people (1.33%) also used electric appliances in their houses.

Discussion

In this study we have investigated the level of basic knowledge on dengue vectors and practice of preventive measures in dengue-infected and non-infected people. Both groups were significantly different in terms of socio-demographic characteristics such as age, gender, occupation, geographic location, living with dengue patients, and residence types. Among different occupational categories, state workers and students were in the case group. Housewives and unemployed people were mostly found in the non-case group.

In light of the findings of this study, the level of knowledge was high among the participants of both groups. This finding was consistent with a similar study conducted over the same period throughout Bangladesh, which found more than half of the participants (65.9%) had sufficient knowledge regarding dengue (Hossain *et al.*, 2021). Another study conducted in

Table 7. Comparison of participant responses with their knowledge score.

Variable name	Good knowledge (%)	Poor knowledge (%)	p-value	Chi ² -Value
Causal agent of dengue				
Virus	93 (50.3)	3 (2.6)	0.00	100.87
Bacteria	5 (2.7)	0 (0.0)		
No idea	87 (47.0)	106 (92.2)		
Dengue virus transmitted by mosquito				
Yes	184 (99.5)	94 (82.5)	0.00	31.22
No	1 (0.5)	20 (17.5)		
Name of the vector mosquito				
<i>Aedes</i> spp	152 (82.2)	21 (18.3)	0.00	124.95
<i>Culex</i> spp	2 (1.1)	5 (4.3)		
No idea	31 (16.8)	89 (77.4)		
<i>Aedes</i> mosquito bite in daytime				
Yes	137 (74.1)	26 (22.6)	0.00	75.64
No	48 (25.9)	89 (77.4)		
A healthy person will get infected in contact of dengue patient				
Yes	73 (39.5)	36 (31.3)	0.17	2.03
No	112 (60.5)	79 (68.7)		
<i>Aedes</i> mosquito prefer to breed				
Clean water	152 (82.2)	29 (25.2)	0.00	96.17
Dustbin	10 (5.4)	24 (20.9)		
Jungle	3 (1.6)	9 (7.8)		
No idea	20 (10.8)	53 (46.1)		
<i>Aedes</i> mosquito more available				
Urban area	159 (85.9)	40 (34.8)	0.00	86.38
Rural area	12 (6.5)	32 (27.8)		
Don't know	12 (6.5)	42 (36.5)		
Dengue fever has treatment				
Yes	175 (94.6)	90 (78.9)	0.00	17.13
No	10 (5.4)	24 (21.1)		

Philippines also demonstrated that 61.45% of the people had a good knowledge on causes, signs and symptoms, method of transmission, and prevention strategies of dengue (Yboa and Labrague, 2013). However, a cross-sectional survey in Indonesia showed opposite findings, where more than half of the participants had no prior knowledge of dengue fever (Harapan *et al.*, 2018). Despite the fact that the majority of participants of both groups had a good understanding on the dengue vector, they were found to have weak practices in terms of preventive measures. Previous literature supports these findings by stating that over 75.7% of cases and 73.6% of controls were totally unaware of how to prevent dengue (Degife *et al.*, 2019). This indicates that having a good knowledge does not always ensure a good practice. Nevertheless, a study in Vietnam showed a completely opposite result, revealing people with good knowledge of dengue fever were found to have good prevention practices and awareness with a co-efficient = 0.44; 95% CI = 0.35–0.53 (Nguyen *et al.*, 2019)

Among participants, the young (16-30 years) had a good knowledge of dengue vectors in comparison to older people, which was supported by a previous study (Patil *et al.*, 2020). The similar result found in another study done in Cambodia in 2018, where younger people aged less than 35 years showed strong knowledge about dengue vector, breeding place,

Table 8. Comparison of participant responses with their practice score.

Variable name	Weak practice	Strong practice	p-value	Chi ² -value
Use of mosquito net				
Occasionally	56 (20.9)	0 (0.0)	0.00	21.59
Frequently	62 (23.1)	5 (15.6)		
Regularly	116 (43.3)	27 (84.4)		
Never	34 (12.7)	0 (0.0)		
Use of mosquito net in daytime				
Occasionally	21 (7.9)	8 (25.0)	0.00	51.89
Frequently	8 (3.0)	10 (31.3)		
Regularly	4 (1.5)	4 (12.5)		
Never	234 (87.6)	10 (31.3)		
Use of mosquito repellent				
Occasionally	31 (11.6)	12 (37.5)	0.00	45.04
Frequently	5 (1.9)	7 (21.9)		
Regularly	0	0		
Never	232 (86.6)	13 (40.6)		
Type of clothing				
Short sleeve	95 (35.4)	9 (28.1)	0.68	1.72
Long sleeve	140 (52.2)	18 (56.3)		
Both	32 (11.9)	5 (15.6)		
Use of mosquito killing appliance				
Occasionally	131 (48.9)	1 (3.1)	0.00	56.88
Frequently	47 (17.5)	18 (56.3)		
Regularly	31 (11.6)	13 (40.6)		
Never	56 (22)	0 (0.0)		
Name of appliance				
Coil/spray/electric	186 (69.4)	15 (46.9)	0.00	34.53
Both (Coil & spray)	30 (11.2)	16 (50.0)		
Cleaning of stagnant water				
Daily	29 (11.1)	9 (29.0)	0.01 (F)	9.63
weekly	78 (29.8)	4 (12.9)		
Monthly	23 (8.8)	4 (12.9)		
Never checked	132 (50.4)	14 (45.2)		

and prevention (Kumaran *et al.*, 2018). In contrast, the literature also indicated that people over 40 years have a better understanding of dengue fever than younger people (Roslan *et al.*, 2020). The poor knowledge among middle-aged to older people (31 to 60 years) found in this study could be explained by the fact that they may be less concerned about disease.

Results showed relatively good knowledge of dengue infection among males. The results of our binary logistic regression show that males had 1.49 times higher knowledge than females, however, the effect was statistically non-significant. This finding was concordant with a previous study conducted in Malaysia (Zamri *et al.*, 2020). Likewise, a study in Ethiopia found an association between gender and the knowledge level of participants (Yusuf and Ibrahim, 2019). On the other hand, a study in Yangon found gender was a significant factor and females had more knowledge about dengue (p-value <0.01) (World Health Organization, 2004).

Figure 1. Different types of appliances used by the participants to prevent mosquitoes.

We found a significant association between occupation, and particularly students ($OR=3.39$) and government workers ($OR=3.17$), with the knowledge score. A prospective study in Northern Thailand also revealed a significant association with profession, where students had a 10.6 times higher knowledge on dengue compared to housewives or unemployed people (Van Benthem *et al.*, 2002). Another study in Ethiopia also stated that the type of profession was associated with the knowledge of dengue and found higher levels of knowledge among public health officers ($AOR=38.79$) and physicians ($AOR=6.15$) than nurses (Yusuf and Ibrahim, 2019). However, a study in Vietnam found no association of occupation with the knowledge level (Nguyen *et al.*, 2019).

Geographical location is another significant factor that was found to be strongly associated with the knowledge level of participants. The binary logistic regression analysis showed that urban people had 2.20 times more knowledge ($CI=1.15-4.20$) compared to those who lived in semi-urban area. Similarly, a previous study also demonstrated that the city residents were 1.09 times more likely to have good knowledge than the people living in a village or semi-urban ($CI=0.635-1.897$) (Hossain *et al.*, 2021). Another cross-sectional study also investigated that urban residents have better knowledge about the *Aedes* mosquito, breeding site, symptoms of dengue fever than the rural residents (Singru *et al.*, 2013). The literature also revealed associations with topography: people living in high land have five times less knowledge than those who lived in low land in Kathmandu, Nepal (Dhimal *et al.*, 2014). Besides, a binary regression showed that permanent residents of the city had significantly better knowledge ($OR=2.01$) than the temporary residents.

Although most of the participants were found to have a better understanding of dengue vectors, their engagement in terms of practicing preventive measures was very inadequate. A cross-sectional study in Indonesia found a significant effect of age (above 41 years) and gender (female) on better prevention practices than younger and males (Rakhmani *et al.*, 2018). A Malaysian study also discovered that participants between the ages of 25 and 40 had a higher preventative behavior score than those between the ages of 18 and 24 (Roslan *et al.*, 2020). However, we did not find any significant effect of age and gender on the level of prevention practice of respondents which was found to be consistent with a study conducted in Malaysia (Zamri *et al.*, 2020). However, binary logistic demonstrated that males were 1.02 times more likely to have less awareness than females.

Furthermore, logistic analyses revealed that housewives practiced preventive measures 2.09 times more than workers; however the association was not significant. The result was consistent with a paper from India in which homemakers were reported to have greater awareness regarding dengue prevention than other professionals (Chellaiyan *et al.*, 2017). Studies conducted in Vietnam and Ethiopia found a significant association between occupation and the awareness of dengue prevention (Yusuf and Ibrahim, 2019; Nguyen *et al.*, 2019).

We found a significant effect of location of participants on prevention practices, and people living in semi-urban area practiced 3.19 times more mosquito prevention methods than people in rural area. On the other hand, a multinomial regression analysis reported that people living in suburban areas were 1.01 times less aware of preventive measures than the people living in city ($CI=0.67-1.53$) (Harapan *et al.*, 2018).

More than half of our respondents positively replied that dengue is transmitted by mosquito and could also mention the name of vector mosquito. Similar literature also reported that nearly 89% of participants identified that *Aedes* mosquitoes transmit dengue in human (Chellaiyan *et al.*, 2017). However, a study in Nepal observed opposite results, where only 19% of the participants properly named *Aedes* mosquito (Dhimal *et al.*, 2014).

Furthermore, most of the participants marked that *Aedes* mosquitoes bite in daytime which was supported by a previous study that also found 43.1% Bangladeshi participants knew that *Aedes* mosquitoes bite during the dawn or dusk (Hossain *et al.*, 2021). Similarly, a study in Thailand also revealed that most of the people were aware about the biting time of the dengue-causing mosquito (Dégallier *et al.*, 2000; Van Benthem *et al.*, 2002). On the contrary, previous studies in Laos and Nepal also showed that these majority of the research participants did not have proper knowledge about the biting time of *Aedes* mosquito (Mayxay *et al.*, 2013; Dhimal *et al.*, 2014).

Furthermore, results showed that participants were aware that personal contact with dengue patients did not transmit dengue, which contradicted the findings of a previous study that found 56% of people had no enough knowledge about this (Dhimal *et al.*, 2014). Regarding the breeding site, half of the research population stated that *Aedes* mosquitoes can grow in clean water, which was similar to a study in Laos, while studies also reported that 71% of people believed containers with filthy water can be a breeding site for dengue vectors (Malhotra *et al.*, 2014) and had limited knowledge about the breeding site (Syed *et al.*, 2010). A study conducted in India found that 40% of the respondents had proper knowledge regarding the breeding site of the vectors (Chellaiyan *et al.*, 2017). We found that, most of the participants with good knowledge answered correctly that dengue fever has a treatment, which was concordant with the finding of a previous study in Bangladesh that stated that 89.6% of people were aware about the treatment of dengue (Hossain *et al.*, 2021).

Along with dengue patients, we interviewed an equal number of non-infected people which was a great strength of this study. Furthermore, data were collected from cases within two weeks after patient release from hospital which reduced the chance of recall bias. The limitation of the study was the fewer number of questions used for scoring of knowledge and prevention practice. Besides, the data was collected through telephone interview which caused a higher number of incomplete responses.

Conclusions

Assessing the existing perception of people is crucial for confirming active community engagement in dengue vector control program. We found good knowledge among most of the participants on dengue vector, however, the practice of mosquito vector prevention was weak. Urban people had good knowledge on dengue vectors while the people living in semi-urban areas were found to strongly practice mosquito prevention methods. Among different occupation groups, students and government officials possessed good knowledge. The results indicated that having a good knowledge does not always ensure a good practice in humans. This study could help policy makers and regulatory bodies for controlling dengue through promoting and monitoring good vector prevention practice among the people.

Data availability

Underlying data

Figshare: Knowledge and prevention practice regarding dengue fever, <https://doi.org/10.6084/m9.figshare.18093836> (Rahman, 2022a).

This project contains the following underlying data:

- dengue knowledge-raw data.xlsx (individual survey answers and scores)

Extended data

Figshare: Questionnaire on Knowledge and Prevention Practice of Dengue Vector in Chattogram, Bangladesh, <https://doi.org/10.6084/m9.figshare.19064078.v1> (Rahman, 2022b).

The project contains the following extended data:

- Questionnaire.docx

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](#) (CC-BY 4.0).

Acknowledgment

The authors acknowledge the support of the department of medicine of Chittagong medical college hospital and the Bangladesh institute of tropical and infectious diseases for providing the patient's record data.

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