SOCIO-DEMOGRAPHIC FACTORS ASSOCIATED WITH THE KNOWLEDGE, ATTITUDE AND PRACTICE (KAP) OF DENGUE PATIENTS OF DHAKA CITY DURING 2021 DENGUE OUTBREAK

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ABSTRACT: Dengue has emerged as one of the most serious mosquito-borne viral infections, with an increasing global occurrence. In Bangladesh, it has become endemic with recurrent occurrences. The present study aims to evaluate the socio-demographic factors affecting the knowledge, attitude and practice (KAP) of 526 dengue patients of Dhaka city in 2021. As face-to-face interviews in the hospitals were prohibited due to COVID-19 restrictions during 2021, contact number of the dengue patients admitted to different hospitals of Dhaka city were obtained from Directorate General of Health Services (DGHS) and data were collected according to a questionnaire by interviewing the patients over telephone. Association between socio-demographic factors and knowledge-attitude scores, and between socio-demographic factors and practice scores were analyzed statistically. Among the 526 patients, majority were from Dhaka South City Corporation (DSCC) (53.8%), lived in small sized families (76.43%), had a Masters degree (22.43%) and a family income above 30000 BDT (Bangladeshi Taka) per month (66.92%). 74.33% patients had good level of knowledge and attitude, and 27.19% had good practice level. Education level, monthly income, area of residence and house type were associated with good knowledge and attitude but only house type was associated with good practice. A significant correlation was found between knowledge-attitude and preventive practice scores. The study findings indicate that though majority had good knowledge and attitude, people were still affected by dengue due to lack of enough preventive practices. The study suggests that there should be effective preventive practices with community participation to reduce dengue transmission.

Key words: Dengue, socio-demographic factors, knowledge, attitude, practices.

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INTRODUCTION

Dengue is one of the most frequent arboviral infections which has become a serious international public health problem in recent years. The causative agent of dengue infection, the dengue virus (DENV) which is a member of the family Flaviviridae, has four antigenically distinct serotypes, any one of which can cause the disease (WHO, 2023), albeit a fifth serotype (DENV-5) has been reported from Malaysia in 2013 (Mustafa *et al.*, 2015). Humans get infected with the virus through the bite of infected female *Aedes* mosquitoes, particularly *Aedes aegypti* and *Aedes albopictus.*

Dengue is occurring widely in the tropics and subtropics including Africa, the Middle East, Asia, the Americas and the Pacific islands. About 3.9 million people are at risk and among them 70% is from Asia (WHO, 2023). In Bangladesh, alarming number of dengue cases has been recorded for past few years and most of them are from Dhaka which has been designated as the country's most dengue-endemic urban region (Paul *et al.*, 2018). The first official dengue incidence in Bangladesh was recorded in 2000 (5551 cases of infection and 93 deaths) (Sharmin *et al.*, 2015; Paul *et al.*, 2018; Mutsuddy *et al.*, 2019). Directorate General of Health Services (DGHS) recorded 101,354 cases of infection and 164 confirmed cases of death from dengue in 2019 which is the second highest number of infected cases from dengue till now. The infection rate declined somewhat in 2021 with 28,429 cases of dengue and 105 deaths (DGHS, 2023). But the situation in 2023 defied all the prior records, with Bangladesh seeing the greatest dengue fever epidemic in history (321179 infected cases with 1705 deaths). But it is quite feasible that these cases might be under-ascertained due to inadequate monitoring and lack of effective case definition (Abir *et al.*, 2021). Besides, these data only contain the hospital-based information (Sharmin *et al.*, 2015) and people who had asymptomatic infection or minor symptoms but did not seek medical help are not included in these statistics (Ahsan *et al.*, 2021). Poor city management, including a lack of efficient garbage disposal, sanitation, drainage, and water supply, as well as the usage of unprotected water reservoirs, have resulted in favorable habitat for the dengue vectors throughout the nation (Sharmin *et al.*, 2015).

The Government of Bangladesh launched different public health initiatives including the media (TV, newspaper), seminars and volunteer organizations to boost community knowledge and participation in mosquito control (Hossain *et al.*, 2000). The mosquito control program in Bangladesh is focused on thermal fogging with a combination of pyrethroid insecticides, including permethrin, prallethrin, and tetramethrin/bioallethrin during the vector season and spraying larvicide into the drainage system (Al-Amin *et al.*, 2020). But permethrin resistance was found in high numbers and intensity in mosquito populations

(Al-Amin *et al.*, 2020). Indoor mosquito control relies largely on mosquito coils, aerosol sprays, and similar mosquito repellants. However, these are not always effective, rather may pose health risks. Moreover, many of the hospitals that used to give dengue treatment were not admitting dengue patients when COVID-19 occurrence was at its peak. The lack of sufficient medical manpower and facilities are impeding epidemic responses. After the large dengue outbreak in 2019, Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC) undertook intensive surveillance and elimination of larval *Aedes* mosquito supplies, particularly stagnant water, with the support of locally elected public representatives (Ahsan *et al.*, 2021). DGHS also conducts surveys in the capital to locate and eradicate *Aedes* larvae, especially during the monsoon season. But still, Bangladesh is facing drastic increase in dengue cases. At a time like this, strengthening public health management like vector control programs, raising community awareness and regular surveillance (both entomological and seroprevalence) and assessment of knowledge, attitude and practice (KAP) have become very crucial.

As surveillance provides the information necessary for risk assessment, epidemic response, and program evaluation, it is an important component of any dengue prevention and control program. According to a study, a good proportion of people in Bangladesh keep sufficient knowledge about this disease and its vectors and different control measures for the prevention of the disease, but still information on knowledge and practice regarding the disease at the community level is inadequate (Rahman *et al.*, 2019). Hence regular surveillance of the disease is needed that will assist in the prediction and control of the outbreaks. The current study is an epidemiological survey among 526 dengue patients admitted in the hospitals of Dhaka city in 2021 which aimed to evaluate the demographic characteristics of infected people and to assess the knowledge, awareness, prevention and control measures of the disease.

MATERIAL AND METHODS

Study design: A cross-sectional study was conducted among the 526 dengue patients of the capital Dhaka city hospitalized in 2021. In 2021, out of the total 28,429 dengue cases in Bangladesh, Dhaka alone had 23,625 cases (DGHS, 2023). Data were collected from September 2021 to February 2022 over the phone. Due to COVID-19 restrictions, survey or collecting data from dengue patients in the hospitals was not possible. Therefore, contact number of the patients admitted in different hospitals were collected from DGHS on request. Patients were contacted through the mobile number and data were collected by interviewing them over the telephone. Studies by telephone interview were also done previously by Chen *et al.*, (2016); Gyawali *et al.*, (2016) and Chan *et al.*, (2021).

Sample size: The required sample size was estimated using the following statistical formula:

$$n_0 = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + (\frac{z^2 \times p(1-p)}{e^2 N})}$$

where n_0 = sample size, z = standard value of normal distribution at 95% confidence level (1.96), p = sample proportion (proportion is set at 0.05 to adopt a conservative approach, ensuring the largest possible sample size, e = margin of error (5%), and N = population size (23,625 dengue cases of Dhaka were taken as the population size). Accordingly, the estimated minimum required sample size was 378. In this study, data of 526 patients were collected to account for potential non-responses so that a strong statistical impact can be obtained.

Questionnaire format: A questionnaire was developed in both English and Bengali, and pre-tested according to which patients were interviewed and data were collected. The questionnaire had two parts- (1) socio-demographic characteristics of the patients, and (2) their KAP regarding dengue.

Data collection: Due to COVID-19 restrictions, necessary information was collected from the patients over the phone. In case of child patients, data were collected from their parents or guardians. Prior to interview, each respondent was informed about the purpose of the study and consent was taken from each respondent (Fig. 1).
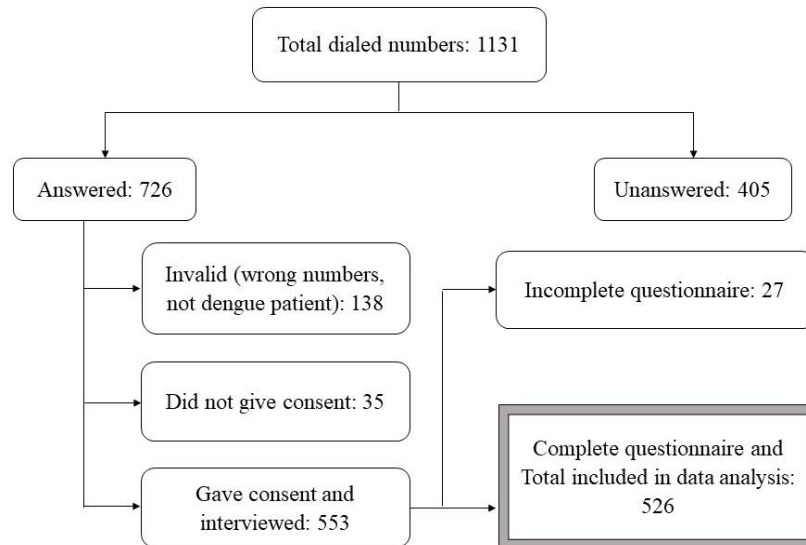

Fig 1. The data collection details in the telephone survey.

Interviews were conducted according to the questionnaires only after obtaining verbal consent. During the interview, participants were free to leave at any moment. The respondents were not offered any incentive to participate in the study, their participation was entirely voluntary. Each question was asked clearly and answers were recorded without any bias. Anonymity of the patients was strictly maintained.

Statistical analysis: To find out the significant association between the socio-demographic factors and KAP, the KAP scores were categorized as 'good' and 'poor'. Greater than half of the total score in each part ('knowledge-attitude' and 'practice') was categorized as 'good' and lower than or equal to the half of the total score was categorized as 'poor'. Out of a total score of 5 for knowledge-attitude part, 2.5 > score was given the level 'good', and score ≤ 2.5 was given the level 'poor'. In case of practice, out of a total score of 6, 3 > score was given the level 'good', and score ≤ 3 was given the level 'poor'. The cut off values were taken according to a previous study by Alyousefi *et al.*, (2016). Chi-square test of association and logistic regression analysis was used to determine the association of socio-demographic factors and different categories of each socio-demographic status with KAP scores. The odds ratio (OR) and its 95% confidence interval (CI) were also reported. We conducted a complete-case analysis to handle the missing values in the income variable. The independent variables of the multivariate logistic regression were chosen based on the results of the univariate (unadjusted) logistic regression analyses. Kolmogorov–Smirnov test result showed that the KAP scores of this study were not normally distributed. That is why Spearman's rank correlation was chosen to calculate correlation value between knowledge-attitude scores and practice scores. The statistical programing language R (R Core Team, 2022, version 4.2.1) has been used for all the statistical analysis.

Ethical clearance: Ethical approval was obtained from the ethical review committee, Faculty of Biological Sciences, University of Dhaka and oral consent was taken from each participant prior to interview. Anonymity of the patients was strictly maintained.

RESULTS AND DISCUSSION

Socio-demographic characteristics of the dengue patients: Among 526 patients, 271 (51.52%) were male and 255 (48.48%) were female. Majority of the respondents were from DSCC (53.8%) followed by DNCC (43.73%) and areas of Dhaka other than city corporation (2.47%) (Table 1). This is similar to a study conducted by Abir *et al.*, (2021) where patients from DSCC were larger in number than those from DNCC. The possible reason might be the lack of proper drainage system as well as small roadways of DSCC which cause flood during

the rainy season. Besides, poor urban design and dense drainage system may cause blockage when there is heavy rain. This also creates outdoor breeding places for *Aedes* (Seidahmed *et al.*, 2018).

Apart from 5.7% respondents who lived in tin-shed houses, majority (94.3%) lived in buildings (Table 1). Similar finding was reported by Khan *et al.*, (2021). Median age of the patients was 30.8. Family size was categorized according to the family members. 402 (76.43%) respondents lived in small families (comprising 1-5 family members). 22.24% and 1.33% came from medium (6-10 family members) and large families (10 > family members) respectively. Majority of the respondents had a Masters (22.43%) and Honours degree (21.67%), followed by higher secondary, secondary and primary level education. 20 patients (3.8%) had no formal education. This is consistent to the studies conducted in India, Pakistan and Yemen where most of the respondents were post graduate (Matta *et al.*, 2006), graduate and above (Syed *et al.*, 2010) and university students (Alyousefi *et al.*, 2016) respectively. Among the respondents, housewife respondents (28.71%) were greater in number than respondents of other occupation. This is similar to a study by Nalongsack *et al.*, (2009). Majority of patients had monthly family income above 30001 BDT (Bangladeshi Taka) (66.92%) (Table 1). Farhana *et al.*, (2014) conducted a study among the dengue patients of a local hospital and reported that majority of the patients were from highest income group (10000 > BDT). It is possible that people with higher income are more likely to have ornamental plants in pots or tubs in the house which may hold waters for a long time. Moreover, many high-income people use air conditioner, accumulated water of which can act as a breeding ground for *Aedes*. People with high income live in more confined places and lead such a lifestyle in which they do not have to face too much foul ambiences or germs compared to the lower income people living in slums. That is why high-income people are less exposed and more susceptible to infections than lower income people. Moreover, the empty containers are usually abandoned by higher income people which can hold water and can become *Aedes* breeding sites whereas they are often reused by the poor people which lessen the risk of generating *Aedes* breeding sites around them.

KAP of the respondents: 73.95% had given the correct answer of the name of the mosquito that transmits dengue (Table 2). Selvarajoo *et al.*, (2020) reported similar findings that 90.2% of the study population knew which mosquito causes dengue. 80.99% respondents had correct knowledge about the mosquito biting time. This is consistent with the study of Kumaran *et al.*, (2018) where 74% respondents knew that *Aedes* bites daytime. Upon answer to the question of *Aedes* breeding sites, respondents mentioned different sites among

Table 1. Socio-demographic characteristics of the patients

Socio-demographic characteristics	Number of Patients (n)	Percentage (%)
Gender		
Male	271	51.52
Female	255	48.48
Area of residence		
Dhaka north city corporation (DNCC)	230	43.73
Dhaka south city corporation (DSCC)	283	53.8
Areas of Dhaka outside city corporation	13	2.47
House type		
Building	496	94.3
Tin-shed	30	5.7
Family size (members)		
Small (1-5)	402	76.43
Medium (6-10)	117	22.24
Large (10 >)	7	1.33
Education level		
Primary	102	19.39
Secondary	104	19.77
Higher secondary	68	12.93
Honours	114	21.67
Masters	118	22.43
No formal education	20	3.8
Occupation		
Student	147	27.95
Business	47	8.94
Housewife	151	28.71
Day laborer	4	0.76
Unemployed	6	1.14
Other jobs	171	32.51
Monthly income (BDT)		
≤ 10000	17	3.23
10001-20000	65	12.36
20001-30000	83	15.78
30001 ≥	352	66.92
Not willing to tell	9	1.71

BDT= Bangladeshi Taka

which the exact answer 'clear stagnant water' was given by about 37.83% respondents. 23.52% and 37.07% had agreed that COVID-19 had affected the treatment of dengue and people overlooked or ignored dengue due to COVID-19 respectively.

Most of the respondents always used mosquito net (76.81%) and 5.89% sometimes used it. But still they were affected by dengue. This is because most of them use mosquito nets at night (69.77%) which could not resist dengue transmission as *Aedes* bites daytime. Only 6.08% respondents used it both daytime and night. More than half of the respondents always used mosquito repellents, despite that, they became affected by dengue. It is possible that the current commercially available repellents are ineffective against *Aedes* bites. Further studies are needed to find out the cause of the inefficiency of currently

Table 2. Knowledge and attitude of respondents regarding dengue

Knowledge items	Number of patients responded (n)	Percentage (%)
Name of mosquito that cause dengue		
Aedes	389	73.95
Anopheles	2	0.38
Culex	0	00
Do not know	135	25.67
Time of mosquito biting		
Only daytime	426	80.99
Only at night	7	1.33
Daytime + night	7	1.33
Do not know	86	16.35
Mosquito breeding sites		
stagnant water	218	41.44
clear stagnant water	199	37.83
dirty stagnant water	4	0.76
clear water	13	2.47
dirty water	2	0.38
water	6	1.14
garbage	1	0.19
sewerage	2	0.38
damp places	1	0.19
stagnant water, damp places	3	0.57
stagnant water, garbage	16	3.04
stagnant water, sewerage	2	0.38
dirty water, garbage	1	0.19
water, damp places	1	0.19
do not know	57	10.84
Agree that COVID-19 has affected treatment of dengue		
Yes	121	23.52
No	379	72.05
May be	11	2.09
Do not know / No comments	15	2.85
Agree that people overlooked or ignored dengue due to COVID-19		
Yes	195	37.07
No	261	49.62
May be	37	7.03
Do not know / No comments	33	6.27

used mosquito repellents. Only a few respondents of the present study (1.14%) stored water in large quantities for daily use. Only 6.65% respondents had taken part in any health promotion activities or workshop on prevention of dengue. Approximately half of the respondents (52.66%) had taken different steps to prevent mosquito borne disease transmission (Table 3).

Overall KAP condition: Majority of the respondents (74.33%) had a good knowledge-attitude regarding dengue (Figure 2). Media, various campaigns of the government and health authorities made people aware of dengue. This finding is similar to studies done by Abir *et al.*, (2021) and Selvarajoo *et al.*, (2020). Despite the fact that the majority of respondents had a basic knowledge of dengue, relatively few of them had good preventative practices (27.19%).

Table 3. Dengue preventive practices of the respondents

Preventive practice	Number of Patients (n)	Percentage (%)
Use of mosquito net		
Yes	404	76.81
Sometimes	31	5.89
No	91	17.30
Time of using mosquito net		
Only at night	367	69.77
Daytime + night	32	6.08
Use of mosquito repellents		
Yes	272	51.71
Sometimes	104	19.77
No	150	28.52
Type of mosquito repellent used by the respondents		
Coil	145	27.57
Aerosol	97	18.44
Liquid vaporizer	20	3.8
Repellent cream	3	0.57
Incense	2	0.38
More than one repellent	109	20.72
Storing water in large quantities for daily use		
Yes	6	1.14
No	520	98.86
Taking part in any health promotion activities or workshop on prevention of dengue		
Yes	35	6.65
No	491	93.35
Steps taken to prevent mosquito borne disease transmission		
Yes	277	52.66
No	249	47.34

Moreover, respondents having good practice level were still affected by dengue. The reason for this might be that preventive practices were confined to the houses or indoors. When people were outside or in their respective workplaces, they might have been bitten by *Aedes* mosquitos and were infected. This result is similar to that conducted by Hossain *et al.*, (2021) among dengue patients of Dhaka, but contrasting to the study of Indonesia by Harapan *et al.*, (2018). This discrepancy may be due to differences of people's knowledge and behavior from place to place.

Association between socio-demographic variables and KAP: We checked for multicollinearity in the multivariate logistic regression model using the variance inflation factor (VIF) values and found no multicollinearity. Chi-square test of association showed that education level, monthly income, area of residence and house type- these factors are associated ($P < 0.05$) with good knowledge and attitude (Table 4). Univariate logistic regression analyses were conducted for

Table 4. Analysis of socio-demographic variables associated with good knowledge-attitude and practice by Chi-square test of association

Characteristic	Knowledge and attitude			Practice		
	Poor N = 135	Good N = 391	*P*-value*	Poor N = 383	Good N = 143	*P*-value*
Gender						
Male	75 (56%)	196 (50%)	0.3	202 (53%)	69 (48%)	0.4
Female	60 (44%)	195 (50%)		181 (47%)	74 (52%)	
Education level						
No formal education	12 (8.9%)	8 (2.0%)		15 (3.9%)	5 (3.5%)	
Primary	37 (27%)	65 (17%)		72 (19%)	30 (21%)	
Secondary	40 (30%)	64 (16%)	<0.001	78 (20%)	26 (18%)	0.6
Higher secondary	24 (18%)	44 (11%)		48 (13%)	20 (14%)	
Honours	16 (12%)	98 (25%)		89 (23%)	25 (17%)	
Masters	6 (4.4%)	112 (29%)		81 (21%)	37 (26%)	
Monthly income (BDT)						
≤ 10000	12 (9.1%)	5 (1.3%)		14 (3.7%)	3 (2.2%)	
10001-20000	43 (33%)	22 (5.7%)		49 (13%)	16 (12%)	
20001-30000	32 (24%)	51 (13%)	<0.001	69 (18%)	14 (10%)	0.083
30001 ≥	45 (34%)	307 (80%)		247 (65%)	105 (76%)	
Unknown	3	6		4	5	
Family size						
Small	108 (80%)	294 (75%)		298 (78%)	104 (73%)	
Medium	24 (18%)	93 (24%)	0.2	80 (21%)	37 (26%)	0.5
Large	3 (2.2%)	4 (1.0%)		5 (1.3%)	2 (1.4%)	
Area of residence						
Areas outside of DCC	9 (6.7%)	4 (1.0%)		10 (2.6%)	3 (2.1%)	
DNCC	50 (37%)	180 (46%)	0.001	159 (42%)	71 (50%)	0.2
DSCC	76 (56%)	207 (53%)		214 (56%)	69 (48%)	
House type						
Tin-shed	22 (16%)	8 (2.0%)	<0.001	28 (7.3%)	2 (1.4%)	0.009
Building	113 (84%)	383 (98%)		355 (93%)	141 (99%)	
Occupation						
Student	42 (31%)	105 (27%)		103 (27%)	44 (31%)	
Business	15 (11%)	32 (8.2%)		35 (9.1%)	12 (8.4%)	
Housewife	33 (24%)	118 (30%)	0.063	112 (29%)	39 (27%)	>0.9
Day labourer	3 (2.2%)	1 (0.3%)		3 (0.8%)	1 (0.7%)	
Unemployed	3 (2.2%)	3 (0.8%)		5 (1.3%)	1 (0.7%)	
Other jobs	39 (29%)	132 (34%)		125 (33%)	46 (32%)	

BDT= Bangladeshi Taka, DCC= Dhaka City Corporation, DNCC= Dhaka north city corporation, DSCC= Dhaka south city corporation; *Pearson's Chi-squared test; Fisher's exact test

each variable to determine the final variables to be included in the multivariate model (Table 5 and 6). Only variables that demonstrate significance in univariate analysis are considered for inclusion in the multivariate model (education level, monthly income, area of residence, house type in Table 5 and only house type in Table 6). The analyses revealed that higher education (especially a Masters degree), higher income, and living in DNCC or DSCC are strongly associated with better knowledge and attitudes. The multivariate logistic regression showed
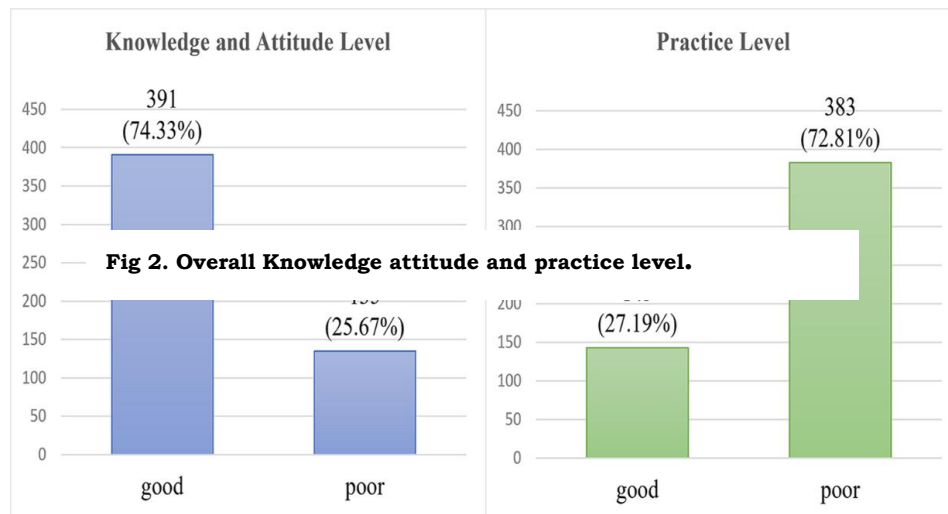
Fig 2. Overall Knowledge attitude and practice level.

that, after adjusting for other factors, individuals with a Masters degree had significantly higher odds (OR = 4.70, *P*= 0.030) compared to individuals with no formal education, indicating that higher education is strongly associated with better knowledge and attitudes. The odds were reduced to 2.36 for those with an Honours degree but were not statistically significant (*P* = 0.16). For other education levels, the odds of having good knowledge and attitudes generally increase with education level in the unadjusted model, however, this association either diminished or became non-significant in the adjusted model. Regarding monthly income, the adjusted analysis indicated that individuals earning ≥30,001 BDT had significantly greater odds of exhibiting good knowledge and attitudes (OR = 7.93, *P* = 0.001) compared to people earning ≤10000, underscoring the strong connection between income and access to information. Even after controlling for other factors, residents of DNCC had significantly higher odds (OR = 5.32, *P* = 0.020) compared to those living in areas of Dhaka outside the city corporation (Table 5). For DSCC residents, the odds were slightly reduced (OR = 4.49, *P* = 0.035) but remained significant, indicating that residence in DNCC or DSCC is associated with better knowledge and attitudes. Moreover, this result also implies that the people of DNCC had better knowledge and attitude than people of DSCC. This is possibly as a result of that, in DNCC, there are more high- and upper-middle-income families who are more likely to have good knowledge than people in DSCC which is distinguished by staggeringly high population density, low-income households as well as lower education level (Sarker *et al.*, 2022). Consistent with these findings, Harapan *et al.* (2018) also reported that education level, income level, and area of residence

Table 5. Analysis of socio-demographic variables associated with good knowledge and attitude by logistic regression

Characteristic	Unadjusted Model			Adjusted Model		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Gender						
Male	—	—				
Female	1.24	0.84, 1.85	0.28			
Education level						
No formal education	—	—		—	—	
Primary	2.64	1.00, 7.29	0.053	1.16	0.37, 3.74	0.80
Secondary	2.40	0.91, 6.61	0.079	0.70	0.22, 2.30	0.56
Higher secondary	2.75	1.00, 7.92	0.053	0.92	0.28, 3.10	0.89
Honours	9.19	3.31, 27.0	**<0.001**	2.36	0.70, 8.05	0.16
Masters	28.0	8.72, 102	**<0.001**	4.70	1.19, 19.9	**0.030**
Monthly income (BDT)						
≤ 10000	—	—		—	—	
10001-20000	1.23	0.40, 4.26	0.73	1.15	0.33, 4.36	0.83
20001-30000	3.83	1.29, 13.0	**0.020**	2.75	0.77, 10.6	0.12
30001 ≥	16.4	5.79, 53.5	**<0.001**	7.93	2.28, 30.0	**0.001**
Family size						
Small	—	—				
Medium	1.42	0.88, 2.39	0.17			
Large	0.49	0.11, 2.52	0.36			
Area of residence						
Areas outside of DCC	—	—		—	—	
DNCC	8.10	2.53, 30.9	**<0.001**	5.32	1.36, 24.2	**0.020**
DSCC	6.13	1.94, 23.2	**0.003**	4.49	1.17, 20.1	**0.035**
House type						
Tin-shed	—	—		—	—	
Building	9.32	4.20, 22.8	**<0.001**	2.59	0.94, 7.66	0.074
Occupation						
Unemployed	—	—				
Student	2.50	0.45, 14.0	0.27			
Business	2.13	0.36, 12.8	0.39			
Housewife	3.58	0.64, 20.1	0.13			
Day labourer	0.33	0.01, 4.66	0.44			
Other jobs	3.38	0.61, 18.9	0.15			

OD= Odds ratio, CI= Confidence interval, BDT= Bangladeshi Taka, DCC= Dhaka City Corporation, DNCC= Dhaka north city corporation, DSCC= Dhaka south city corporation

were associated with good knowledge among the inhabitants of Indonesia. Another mentionable finding is that, in the unadjusted model, individuals living in buildings had significantly higher odds (OR = 9.32, *P* < 0.001) of having good knowledge and attitudes than people living in tin-shed. That might be because people with low-income status live in tin-shed houses who do not have much access to sources with information. However, in the adjusted model, the odds decreased to (OR = 2.59) and were no longer statistically significant (*P* = 0.074) at 5% significance level, although a notable association remains. Chi-square test of association showed that only respondents' house type has significant association (*P*<0.05) with prevention practice (Table 4). The multivariate logistic

Table 6. Analysis of socio-demographic variables associated with good practice by logistic regression

Characteristic	Unadjusted Model			Adjusted Model		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Gender						
Male	—	—				
Female	1.20	0.81, 1.76	0.36			
Education level						
No formal education	—	—				
Primary	1.25	0.44, 4.12	0.69			
Secondary	1.00	0.35, 3.31	>0.99			
Higher secondary	1.25	0.42, 4.26	0.70			
Honours	0.84	0.29, 2.79	0.76			
Masters	1.37	0.49, 4.47	0.57			
Monthly income (BDT)						
≤ 10000	—	—				
10001-20000	1.52	0.43, 7.21	0.55			
20001-30000	0.95	0.26, 4.49	0.94			
30001 ≥	1.98	0.63, 8.73	0.29			
Family size						
Small	—	—				
Medium	1.33	0.84, 2.07	0.22			
Large	1.15	0.16, 5.41	0.87			
Area of residence						
Areas outside of DCC	—	—				
DNCC	1.49	0.44, 6.79	0.55			
DSCC	1.07	0.32, 4.89	0.91			
House type						
Tin-shed	—	—		—	—	
Building	5.56	1.64, 34.7	**0.020**	5.56	1.64, 34.7	**0.020**
Occupation						
Unemployed	—	—				
Student	2.14	0.33, 41.6	0.49			
Business	1.71	0.24, 34.6	0.64			
Housewife	1.74	0.27, 33.9	0.62			
Day labourer	1.67	0.05, 54.5	0.75			
Other jobs	1.84	0.29, 35.8	0.58			

OD= Odds ratio, CI= Confidence interval, BDT= Bangladeshi Taka, DCC= Dhaka City Corporation, DNCC= Dhaka north city corporation, DSCC= Dhaka south city corporation

regression for preventive practice showed that, after adjusting for other factors, individuals living in buildings had significantly higher odds (OR = 5.56, *P* = 0.020) of having good practice compared to individuals living in tin-shed houses (Table 6).

In contrast to the factors associated with knowledge and attitude, only house type was found to be associated with good preventive practice in this study. Education level, monthly income or area of residence - neither of these factors were associated with preventive practices. High level of education or higher income did not result in undertaking high levels of effective methods to stop dengue outbreaks. Similar finding was reported in the study by Abir *et al.*, (2021). It suggested that the reason might be people's perception that only

government is responsible for implementing mosquito control measures and they are not required to do so. Some folks believed they were unable to meaningfully contribute to the broader control effort. Thus, there are not enough deliberate efforts of common people to stop dengue from spreading. Additionally, in educational institution, besides giving knowledge, the absence of undertaking preventive initiatives can also be responsible for the fact that respondents' higher educational background did not result into adopting improved preventive practices.

Correlation between knowledge-attitude and practice: To find out the relation between knowledge-attitude scores and practice score, Spearman's rank correlation was done between these two scores. The *P*-value for this was < 0.001 which reveals that there was a significant correlation between knowledge-attitude and preventive practices. That means, respondent's preventive practice behavior improves with the improve of their knowledge and attitude. This is consistent with the study of Malaysia conducted by Selvarajoo *et al.*, (2020). Harapan *et al.*, (2018) also found strong association between good attitude and good practice. Knowledge regarding dengue control and prevention is important, but without meaningful preventive practice and community participation in control methods it is not possible to reduce dengue outbreaks. So, the goal of education and awareness campaign programs should be linking the knowledge to appropriate preventive practices and establish community-oriented control strategies.

The current study does, unavoidably, have some certain limitations. The study was done only among the dengue patients, so prevalence of the disease could not be determined. The study was only able to determine if respondents had used preventive measures, but not the frequency or quality of use due to time constraints in the telephone survey. The study depended on self-reported approach which might concern the accuracy. As the residences of respondents were not visited, it could not be assessed if the reported practices are actually practiced or not. Because it is likely that some respondents answered some questions in a way that was socially desirable. Finally, the dengue experience might have influenced their KAP score regarding the disease which may not be present in all unaffected people. More associated factors need to be included in future research with a larger scale involving both patients and unaffected population nationwide, and the accuracy of the measurements need to be investigated.

CONCLUSION

Dengue fever has become a serious public health concern in Bangladesh over the last few years. The present study found that education level, monthly income, area of residence and house type were associated with good knowledge

and attitude but only house type was associated with good practice. It implies that although people having higher education (Masters), higher monthly income (BDT 30001 ≥), living in DNCC and buildings have better knowledge and attitude towards dengue than other groups, only people living in buildings have better preventive practices in place. This gap between knowledge and practice is impeding dengue prevention largely. Hence people need to be encouraged and persuaded more to maintain appropriate preventive practice behaviors by convincing its importance. Proper inspection should be done by health authorities from the very onset of monsoon so that no such source is available that creates a vector habitat. Educational campaigns and such programs and measures should be devised that aim not only to raise knowledge and attitude in people from all educational levels and socio-economic statuses but also ensure community participation in preventive actions closing the gap between knowledge and application.

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(Manuscript received on 30 May 2024 revised on 20 August 2024)