Knowledge, awareness and preventive practices of dengue outbreak in Bangladesh: a countrywide study

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Abstract

Background: Dengue, the mosquito borne disease has become a growing public health threat in Bangladesh due to its gradual increasing morbidity and mortality since 2000. In 2019, the country witnessed the worst ever dengue outbreak. The present study was conducted to characterize the socio-economic factors and knowledge, attitude and practice (KAP) status towards dengue among the people of Bangladesh.

Method: A cross-sectional study was conducted with 1,010 randomly selected participants from nine different administrative regions of Bangladesh between July and November 2019. A well-structured questionnaire was used covering socio-demographic characteristics of the participants including their knowledge, awareness, treatment and practices regarding Dengue fever.

Results: Although majority (93.8%) of the participants had heard about dengue, however, they had still misconceptions about *Aedes* breeding habitat. Around half of the study population (45.7%) had mistaken belief that *Aedes* can breed in dirty water and 43.1% knew that *Aedes* mosquito usually bites during sunrise/sunset. Fever indication was found in 36.6% of people which is the most common symptom of dengue. Living place, literacy and employment status were found significantly associated ($p<0.05$) with knowledge and awareness of dengue fever. The preventive practice level was moderately less than the knowledge level though there was a significant association ($p<0.05$) existed between knowledge and preventive practices. Our study noted that TV/Radio is an effective predominant source of information about dengue fever.

Conclusion: As dengue is emerging in Bangladesh, there is a need to increase health promotion activities through campaigns for eliminating the misconception and considerable knowledge gaps about dengue.

Introduction

Dengue, the mosquito-borne disease, transmitted by the bites of *Aedes* mosquitoes, primarily *Aedes aegypti* and *Aedes albopictus*, is considered the most prevalent human arboviral infection worldwide [1]. Approximately, 3.8 billion people dwelling in 128 countries are perceived to be in danger of dengue infection. According to the WHO, every year about 20,000 deaths occurred on account of dengue globally [2,3]. One of the four serotypes (DENV-1, 2, 3, and 4) of dengue virus are normally identified as the cause of least severe dengue fever (DF) as well as severe dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) [4,5].

The first dengue virus infection was found in South-East Asia and about 52% of the people who are at risk of dengue globally live in this territory. Bangladesh is situated in South Asia and has become an appropriate habitat for the dengue vector and its transmission [6]. In Bangladesh, the first dengue contagion was detected in 1964 [1]. The sporadic cases and small outbreaks clinically suggestive of dengue occurred across the country from 1964 to 1999 but those were not officially reported [7,8]. In the year 2000, a severe outbreak of dengue occurred in Bangladesh with 93 mortality among 5551 morbidity

cases [9]. In subsequent years dengue cases reduced remarkably to as low as 375 cases in 2014. After a while in 2016, around 6100 dengue cases have been reported with a DENV-2 outbreak in Bangladesh [10]. Three years later, in 2019, Bangladesh experienced a devastating dengue outbreak with the highest incidence (112 000 cases with 129 deaths) of recorded cases than ever before [11].

The incidence and transmission of dengue is influenced by a variety of factors such as uncontrolled population growth, urbanization, deterioration in waste management systems, changes in the climate and lack of effective vector control [12]. Water storage practice as the water supplies are inadequate mainly in metropolitan cities is also regarded as a major contributor to dengue epidemics [13].

In spite of its severity, dengue is a preventable disease. Since no vaccine is currently available to prevent dengue, the only possible solution is to control the vector mosquito breeding sites for preventing the transmission of dengue virus [14]. For this, the effective community participation is essential at the ground level. The participation largely depends on peoples' knowledge, awareness and attitude towards this disease. But the effective dengue prevention and control is a burning question today in Bangladesh as there is an ongoing challenge to ensure proper treatment and prevention options despite having continued progress in dengue research [15,16]. In prior studies, it was shown that illiteracy, poverty and social incognizance are responsible factors for poor dengue management [17]. Therefore, it is particularly important to know countrywide people's knowledge, attitude and practices on dengue fever for controlling dengue as a whole, the focus of this article.

We discuss the social awareness of dengue in Bangladesh and explore future disease risk. Causes for the sudden severe dengue outbreak and lacking prevention practices and treatment of the disease are considered, with a focus on population, human behavior and socio-demographic context. We also discuss with the possible out ways of the critical challenges of the disease in the near future.

Materials And Methods

Study area

The study was conducted among nine administrative regions across Bangladesh including Dhaka, the capital city of Bangladesh (Figure 1). We selected one area randomly from every specific region except Dhaka region. Dhaka is the biggest city of Bangladesh as it had a population of 11.8 million (based on 2011 census) and a study showed that Dhaka is the highest risk prone area for dengue transmission in Bangladesh [18]. Therefore, we selected two area named Dhaka metropolitan and Tangail from Dhaka region for doubling a specific regional sample size.

Data collection

Following informed consent, a cross-sectional survey was carried out among 1,010 randomly selected matured peoples in nine administrative regions (Dhaka, Comilla, Chittagong, Barisal, Khulna, Rajshahi, Rangpur, Mymensingh and Sylhet) of Bangladesh between July and November 2019 using a well-

structured questionnaire, translated into local language i.e. Bengali. Exactly, 100 samples per each region, a total of 800 samples were collected from eight regions except Dhaka and from Dhaka region, a total 210 samples were collected, 100 from Dhaka metropolitan area and remaining 110 from outside of Dhaka metropolitan area i.e. Tangail were collected. The questionnaire was divided into five sections. The first one covered the socio-demographic profile of the respondents, and second and third covered the knowledge and awareness about dengue fever, respectively. The section fourth consisted of knowledge and practices on dengue fever treatment and last one was formed with knowledge and awareness regarding dengue prevention as well.

Statistical analysis

Each filled questionnaire was checked, edited and coded individually at the end of interview. In order to avoid approaching the respondents for the missing/incomplete information a care was taken to confirm the accuracy and uniformity of the data. The data collected from the survey were analyzed by IBM SPSS version 20. Descriptive statistical analysis was used to provide estimates of population proportions with their respective 95% confidence intervals. Cross tabulations were performed with Chi-square tests to assess statistical significance ($p<0.05$). The area under the ROC curve were also calculated where 0.5 is referred as true area. Microsoft Excel version 2016 was used to draw graphs wherever appropriate.

Ethical clearance

Before the interview, the informed consent was taken according to the WHO and Bangladesh Medical Research Council (BMRC) guidelines of ethical consideration. Respondent’s right to refuse and withdraw from study any time was accepted. Confidentiality of the respondents was maintained.

Results

Socio-demographic characteristics

The profile of the respondents is given in **Table 1** that summarizes the socio-demographic characteristics of study participants. There were 506 male (50.1%) and 504 female (49.9%) respondents among the 1010 responders and the majority (54.6%; 551/1010) were 16 to 30 aged. Fifty four percent of the participants were from rural community (village) whereas 26.6% and 19.4% were from semi-town and city, respectively. About 12.6% of the respondents were illiterate and nearly 18% were graduates. Of the total respondents, 34.4% were students; 21.1% were housewives and 40.7% had monthly family income less than 15,000 BDT. Closely 16% peoples were from lower class family as well as almost 47% were from middle class family among the respondents.

Table 1: Socio-demographic characteristics of dengue fever in Bangladesh.

Characteristics	n (%)	95% CI
Gender		
Male	506 (50.1)	1.47 - 1.53
Female	504 (49.9)	
Age		
1 - 15	38 (3.8)	2.54 - 2.65
16 - 30	551 (54.6)	
31 - 45	249 (24.7)	
46 - 60	124 (12.3)	
>60	48 (4.8)	
Living place		
Village	545 (54.0)	1.61 - 1.70
Semi Town	269 (26.6)	
City	196 (19.4)	
Literacy status		
No formal schooling (illiterate)	127 (12.6)	3.21 - 3.38
Primary	172 (17.0)	
Secondary	258 (25.5)	
Intermediate	227 (22.5)	
Graduate	180 (17.8)	
Post Graduate	46 (4.6)	
Employment status		
Job holder	88 (8.7)	4.78 - 5.04
Teacher	75 (7.4)	
Businessman	107 (10.6)	
Farmer	53 (5.2)	
Student	347 (34.4)	
Laborer	49 (4.9)	
Housewife	213 (21.1)	
Nothing as mentions	38 (3.8)	
Others	40 (4.0)	
Family income (Taka/month)		
<15,000	411 (40.7)	1.86 - 1.97
<30,000	344 (34.1)	
<50,000	187 (18.5)	
>50,000	68 (6.7)	
Socio economic status		
Lower	163 (16.1)	2.39 - 2.50
Lower middle	303 (30.0)	
Middle	474 (46.9)	
Upper middle	70 (6.9)	

*CI = Confidence Interval

Knowledge, attitude and preventive practice (KAP) towards DF.

Among the total respondents, 93.8% had heard about dengue fever (DF) and most of the participants (61.3%) were aware about dengue outbreak in Bangladesh (**Table 2**). Most of them (91.3%) were believed that it was dispatched through mosquito bites. A few of them (2.1%) opined that this disease is transmitted through dirty drinking water.

Around two-third of the respondents could correctly response that *Aedes* mosquito spread dengue virus. The majority of the respondents (45.7%) had misconceptions that unclean water-holding containers

could be potential breeding places for *Aedes* mosquito. Less than half of the people (43.1%) knew that mosquito usually bites during sunrise/sunset.

Fever was the most consistent response (36.6%) when asked about the common symptoms of dengue. About half (50.7%) of the research participants believed that dengue could be transmitted and 1/3 (289; 28.6%) supposed it could be transmitted through blood transfusion. Dengue fever can be avoided by using preventive measures. For personal-protective measures, 38.5% and 22.1% were narrated that mosquito coils and mosquito nets were considered the most usual and effective options for prevention while some (8.8%) were used mosquito repellent/cream as an alternative **(Table 2)**.

Table 2: Knowledge, attitude and preventive practice (KAP) towards dengue fever in different regions of Bangladesh.

Variables	n (%)	95% CI
Heard about dengue fever		
Yes	947 (93.8)	1.05 – 1.08
No	63 (6.2)	
Mode of spread		
Mosquito's bite	922 (91.3)	1.21 – 1.33
Dirty drinking water	21 (2.1)	
Contaminated food	0 (0.0)	
Others	15 (1.5)	
Don't know	52 (5.1)	
Carrier of dengue fever		
Aedes	609 (60.3)	2.0 – 2.17
Anopheles	27 (2.7)	
All types of mosquito	55 (5.4)	
Don't know	319 (31.6)	
Most frequent mosquito biting time		
Sunrise/sunset	435 (43.1)	1.93 – 2.06
Night	301 (29.8)	
Afternoon	120 (11.9)	
Don't know	154 (15.2)	
Dengue is transmissible		
Yes	512 (50.7)	1.46 – 1.52
No	498 (49.3)	
Dengue is transmitted through		
Human to human contact	62 (6.1)	3.72 – 3.91
Blood transfusion	289 (28.6)	
Needle stick injury	25 (2.5)	
Sharing of food/ clothes with the patient	35 (3.5)	
Don't know	599 (59.3)	
Common breeding site		
In clean water	434 (43.0)	1.64 – 1.72
In unclean water	462 (45.7)	
Don't know	114 (11.3)	
Common symptoms		
High fever	370 (36.6)	3.95 – 4.31
Severe body aches	74 (7.3)	
Nausea and vomiting	81 (8.0)	
Red spots on the body	56 (5.5)	
Diarrhea	12 (1.2)	
Pain abdomen	8 (0.8)	
All of the above	195 (19.3)	
Don't know	214 (21.2)	
Awareness about dengue fever		
Yes	619 (61.3)	1.36 – 1.42
No	391 (38.7)	
Preventive measures		
Use mosquito spray	92 (9.1)	3.76 – 4.05
Use mosquito coil	389 (38.5)	
Use mosquito repellent/cream	89 (8.8)	
Keep closed windows & doors	54 (5.3)	
Use smoke to drive away mosquitoes	10 (1.0)	
Keep neat & clean surroundings	131 (13.0)	
Use mosquito net	223 (22.1)	
Cover body with long clothes	4 (0.4)	
Do nothing	18 (1.8)	

In Bangladesh, treatment seeking behavior, which is impacted by financial status subsequently, numerous individuals purchased medication from nearby pharmacy when they got affected of any diseases without any prescription. About 48% (485/1010) respondents were answered to take medicine without prescription followed by 29.3% (296/1010) took medicine with prescription after noticing any symptoms of fever (**Figure 2**).

When respondents were asked about the treatment, majority (89.6%) of them were answered dengue fever was treatable but most of them (59.3%) not to be aware of the primary treatment. Only 21.8% of people believed that different test was performed immediately after suffering from dengue fever though 38.3% of people didn't face dengue fever yet (**Table 3**).

Table 3: Knowledge about dengue fever treatment in Bangladesh.

Variables	n (%)	95% CI
Dengue fever is treatable		
Yes	905 (89.6)	1.12 - 1.18
No	59 (5.8)	
Don't know	46 (4.6)	
Knowing primary treatment of Dengue fever		
Yes	411 (40.7)	1.56 - 1.62
No	599 (59.3)	
Knowledge about which tests are required to diagnose		
Yes	308 (30.5)	1.67 - 1.72
No	702 (69.5)	
Test after suffering from fever		
Immediately	220(21.8)	3.39 - 3.58
After getting serious condition	67(6.6)	
After a few days	110 (10.9)	
Never do test	226 (22.4)	
Didn't face yet	387 (38.3)	

Source of information on dengue fever

In this study, 44.2% respondents identified television/radio was the leading source of information about dengue fever followed by friends and family (26.8%). On the other hand, 13.2% stated that newspapers/social media cover information on dengue and about 6.3% of respondents had obtained knowledge through different educational institutions (**Figure 3**).

Association among knowledge, awareness, and practice about dengue

Literacy have a significant association with the basic knowledge about dengue. The educated participants significantly ($p<0.001$) had clear concept about *Aedes* mosquito and their breeding sites than the illiterate participants (**Figure 4: A and B**).

Around all of the participants who had formal education had sufficient knowledge about dengue virus and its transmission. There was an apparent trend noticed among the different occupations whereby the

better paid the occupation the better knowledge. Significant associations ($p<0.001$) were found between knowledge scores of dengue and living place, education level, and occupation (**Table 4**).

The respondents who lived in the city were more aware than those who were lived in villages/rural area and semi town in Bangladesh. Participants with a qualification of graduate were 1.5 times more aware as compared to illiterate. There were found significant association ($p<0.05$) among all of the socio-demographic variables with awareness on dengue except age and gender (**Table 5**). **Table 6** represents the significant positive association of knowledge with preventing ways and preventing practice of *Aedes* reproduction ($p<0.05$).

Table 4: Association between knowledge and socio-demographic variables on dengue fever (n = 1010).

Description	Knowledge on dengue					
	Insufficient Knowledge n (%)	Sufficient Knowledge n (%)	Chi-square	P-value	OR	95% CI
Age (years)				0.256	-	-
1-15	3(7.9)	35 (92.1)	5.319			
16-30	26(4.7)	525 (95.3)				
31-45	19(7.6)	230 (92.4)				
46-60	10(8.1)	114 (91.9)				
>60	5(10.4)	43 (89.6)				
Gender			14.115	<0.001	0.349	0.197-0.618
Male	46(9.1)	460 (90.9)				
Female	17(3.4)	487 (96.6)				
Living place						
Village	56(10.3)	489 (89.7)	33.133	<0.001	-	-
Semi town	5(1.9)	264 (98.1)				
City	2(1)	194 (99)				
Literacy status			80.264	<0.001	-	-
No formal schooling	29(22.8)	98 (77.2)				
Primary	16(9.3)	156 (90.7)				
Secondary	8(3.1)	250 (96.9)				
Intermediate	3(1.3)	224 (98.7)				
Graduate	5(2.8)	175 (97.2)				
Post-graduate	2(4.3)	44 (95.7)				
Employment status			62.435	<0.001	-	-
Job holder	2(2.3)	86 (97.7)				
Teacher	2(2.7)	73 (97.3)				
Businessman	5(4.7)	102 (95.3)				
Farmer	6(11.3)	47 (88.7)				
Student	13(3.7)	334 (96.3)				
Laborer	14(28.6)	35 (71.4)				
Housewife	11(5.2)	202 (94.8)				
Nothing as mention	7(18.4)	31 (81.6)				
Others	3(7.5)	37 (92.5)				
Socio-economic status			0.855	0.836	-	-
Lower	9(5.5)	154 (94.5)				
Lower middle	21(6.9)	282 (93.1)				
Middle	30(6.3)	444 (93.7)				
Upper middle	3(4.3)	67 (95.7)				

*OR= Odd Ratios

Table 5: Association between awareness and socio-demographic variables on dengue.

Description	Awareness on dengue					
	Aware n(%)	Unaware n(%)	Chi-square	P-value	OR	95% CI
Age (years)			5.4	0.248	-	-
1-15	21(55.3)	17(44.7)				
16-30	351(63.7)	200(36.3)				
31-45	151(60.6)	98(39.4)				
46-60	66(53.2)	58(46.8)				
>60	30(61.3)	18(37.5)				
Gender	305(60.3)	201(39.7)	0.436	0.509	0.918	0.713-1.183
Male	314(62.3)	190(37.7)				
Female						
Living place			7.035	0.030	-	-
Village	331(60.7)	214(39.3)				
Semi town	153(56.9)	116(43.1)				
City	135(68.9)	61(31.1)				
Literacy status			40.233	<0.001	-	-
No formal schooling	65(51.2)	62(48.8)				
Primary	87(50.6)	85(49.4)				
Secondary	142(55)	116(45)				
Intermediate	158(69.6)	69(30.4)				
Graduate	135(75)	45(25)				
Post-graduate	32(69.6)	14(30.4)				
Employment status			27.521	0.001	-	-
Job holder	59(67)	29(33)				
Teacher	52(69.3)	23(30.7)				
Businessman	70(65.4)	37(34.6)				
Farmer	24(45.3)	29(54.7)				
Student	231(66.6)	116(33.4)				
Laborer	20(40.8)	29(59.2)				
Housewife	121(56.8)	92(43.2)				
Nothing as mention	23(60.5)	15(39.5)				
Others	19(47.5)	21(52.5)				
Socio-economic status			11.139	0.011	-	-
Lower	91(55.8)	72(44.2)				
Lower middle	171(56.4)	132(43.6)				
Middle	306(64.6)	168(35.4)				
Upper middle	51(72.9)	19(27.1)				

Table 6: Association among aware and preventing ways with knowledge of dengue fever.

Independent variable	P value	OR	95% CI
Aware	0.667	1.120	0.667 - 1.882
Preventing ways	0.002	2.248	1.335 - 3.786
Preventing practice of <i>Aedes</i> reproduction	< .001	1.113	1.084 - 1.143

4. Discussion

As Bangladesh is situated in the Southeast Asian (SE) region, vector-borne diseases like dengue, are perceived as a major health threat [9]. Over population, impromptu and uncontrolled urbanization are

identified as the key factor for increasing transmission of mosquito-borne diseases like dengue [1]. For dengue epidemics and control; KAPs among the population could be played a critical role [19]. To control the dengue virus, it was revealed that lack of knowledge about clinical features or control measures is the most common problem [20]. However, this study was conducted to assess the dengue knowledge, attitudes, and practices of people throughout the Bangladesh.

In the present study, nearly most of the respondents heard of dengue though many of them do not have still the basic knowledge on dengue. For example, there were still misconceptions about the breeding sites of the dengue vector. Many of the research participants stated the dirty and unclean water such as sewage drains are the most common breeding sites for dengue mosquitoes. The knowledge level on DF found in our study is comparable to similar KAP study findings previously conducted in the Dhaka city of Bangladesh [21], India [22], Pakistan [23], Malaysia [5], Thailand [24], Brazil [25] and Jamaica [26]. In this study, some of the participants were able to correctly identify all of the symptoms of DF apart from many respondents who identified fever as an obvious symptom. Most of the participants belong to this study had not personally experienced with dengue fever nor their family member infected with this disease, that's why they didn't state the other typical symptoms of DF. Among the study population with poor knowledge of symptoms associated with DF, the disease might easily be confused with other common causes of fever such as influenza and typhoid [26] even COVID-19.

A large portion of respondents in this study mentioned dengue spreads through mosquito bites that is similar to other studies done in India [27], Malaysia [28] and Brazil [25], but only 60.3% of the respondents stated that *Aedes* mosquitoes transmit dengue virus (DENV). The dengue vector *A. aegypti* bite mostly during several hours after dawn and before dusk [26]. More importantly, 43.1% of respondents reported that mosquitoes bite during the period of sunrise/sunset. This finding was similar to some previous studies which were performed in different countries where majority of respondents knew that dengue vectors might bite at sunrise or sunset [25,29].

In this study, 28.6% of the participants stated that the dengue virus could be contracted through blood transfusion. However, during blood or organ transplant the virus might be passed but it is in rare instances [30]. For example, an estimated risk was reported for dengue-infected blood transfusions to be 1.625–6/10,000 in Singapore in 2005 [31].

Most of the participants (44.2%) in this study indicated that television/radio was the most common source of DF information. Similar findings were reported in previous studies from India [32], Indonesia [33], Nepal [34], Laos [35] and the Philippines [36]. This indicated that the mass media have an impact to convey health information more rapidly to the general people in Bangladesh. A study from Laos where friends or relatives were the major source of information regarding dengue fever [37]. Health personnel were also mentioned as a source of dengue fever information in a study from Thailand [38].

Most of the respondents in the current study (89.6%) knew that dengue fever is treatable. More than 40% people agreed that they had known about the primary treatment like get plenty of bed rest and drink lots of water. Similar finding was reported in a study from Jamaica [26]. In this study, around one-third of the

respondents reported to know about the tests normally required to diagnose dengue and 21.8% participants stated that these tests were performed immediately to confirm dengue.

The mostly favored preventive measures used by the respondents reported in this study was using of mosquito coils (38.5%). Using bed nets would be ineffective in preventing *Aedes* mosquito bites as most of them were used only at night [22]. Only a few of the research participants (13%) responded that cleaning the surroundings can be preventive measures. This finding was incongruous with a previous study where more than half (55.7%) mentioned that cleaning of the surroundings as an important preventive practice [27]. In the study setting, though majority of the respondents have moderate knowledge about *Aedes* mosquito and dengue fever, very few respondents adopted practices for preventing and controlling *Aedes* mosquito. The good practice level was moderately less than the knowledge level though there was significant association existing between knowledge and practice. This shows that the level of knowledge of dengue does not necessarily influence the practice of dengue control. Thus, poor practices along with a high density of the human population, and a suitable environment for the reproduction of *Aedes* in Bangladesh more specifically in major cities might contribute to the greater risk of transmission. This findings on practice levels are similar to those of other studies which reported high levels of knowledge but low levels of practice [39,40]. In fact, if the gap between knowledge and practice don't decreased, then it will be an important challenge for controlling dengue and *Aedes* populations.

This study found, all socio-demographic variables were significantly associated with the overall knowledge of the participants except age and socio-economic status. This finding consistent with a result from Malaysia [40]. The associations between literacy level and knowledge about dengue have also been shown in another study [23] which indicates that the higher the education level, the better the knowledge on dengue.

Based on our study, it could be recommended that public education on dengue should be emphasized for successful dengue control program [41]. Effective education programs should be performed especially in rural and densely populated area specifically about dengue transmission, *Aedes* mosquitoes breeding sites, early dengue diagnosis and treatment procedure. Adequate health personnel should be provided and trained them to give appropriate counseling in an effort to bring about behavioral changes among the population for promoting prevention practice of dengue.

5. Conclusion

The mosquito-borne disease dengue is emerging in Bangladesh gradually with alarm. In spite of having moderate knowledge of regarding dengue transmission vector and symptoms, the preventive practices are not well expected. However, it was found that the paucity of basic knowledge on dengue epidemiology and vector bionomics among the population could be a major cause for increasing trend of dengue in this highly populated country. So, an emphasis should be provided on health education

programmes especially on dengue disease to increase community knowledge, changing the behaviors for *Aedes* mosquitoes and DF prevention countrywide.

Declarations

Acknowledgments

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Competing interests:

The authors declare no competing interests.

Ethical Approval statement:-

This research study was approved by the faculty of Life sciences, Mawlana Bhashani Science and Technology University, Tangail-1902, Bangladesh

Participants Consent:-

All the data were received with the confidential format. All the participants agreed to provide their written consent to participate in the research questionnaire.

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Figures

Figure 1

Map of the objective regions of Bangladesh.

Figure 2

Steps after noticing any symptoms of dengue fever.

Figure 3

Source of information on dengue fever in Bangladesh.

A. AUC: 0.731 (95% CI: 0.699 - 0.762)
P value: <0.001

B. AUC: 0.723 (95% CI: 0.691 - 0.755)
P value: <0.001

Figure 4

Receiver-operating characteristics curve analysis predicting the association of (A) Knowledge about carrier of dengue fever and (B) Common breeding sites with literacy status.