

Original article

Exploring public awareness and spreading pattern analysis of COVID-19 outbreak in Bangladesh

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Abstract

Background: The highly transmissible coronavirus disease 2019 (COVID-19) has plagued the worldwide population with a continuous upward thrust of the death toll, which might be related to insufficient knowledge, attitudes, and behavioral (KAB) score, and public awareness.

Objective: The current research sought to explore public awareness in terms of knowledge, attitudes, and behavioral responses toward COVID-19 and analyze its spreading pattern during the embryonic phase in Bangladesh. **Methods:** From March 19 to April 15 of 2020, seventeen planned questions were answered by the Bangladeshi respondents recruited through a simple snowball sampling technique. Informed consent from each participant was taken in the survey.

Results: Out of the total participants (n = 1861), 34.65% were female, and 40.83% had an education level up to Junior School Certificate (JSC). Among all the demographic variables, the highest average knowledge, attitudes and behaviors scores (mean ± SD) were reported for 18-30 years age group (4.07 ± 1.01 out of 5; 95% confidence interval, [CI] = 4.01-4.13; p < 0.001), above 50 years age group (1.70 ± 0.64 out of 3; 95% CI = 1.59-1.80; p < 0.001), and bachelor or higher degree group (2.64 ± 0.83 out of 4; 95% CI = 2.57-2.70, p < 0.001), respectively. It was clearly depicted that the obtained knowledge score was associated with poor attitudes and behaviors. **Conclusion:** Education on basic health sciences as well as overwhelming campaign and publicity must be pointed at enhancing KAB scores towards COVID-19 in Bangladesh.

Keywords: Knowledge; Attitudes; Behavioral responses; COVID-19; Bangladesh.

*Bangladesh Journal of Medical Science, Special Issue on COVID-19, 2021. Page : 108-117
DOI: <https://doi.org/10.3329/bjms.v20i5.55403>*

Introduction

A rapidly rising global health issue in the 21st century, the coronavirus disease 2019, abbreviated by the WHO as COVID-19¹, is caused by the infection of a mysterious, contagious, and novel severe acute respiratory syndrome coronavirus 2,^{2,3} simply known as the SARS-CoV-2. On March 11, 2020, WHO had pronounced this outbreak officially as a new

pandemic threat,⁴ which was first identified in the city of Wuhan in China's Hubei province during late December 2019, initially as secondary pneumonia caused by an unknown virus.⁵ Bangladesh, a densely populated (8th most crowded) and developing country in the world, has reported its first three COVID-19 patients on March 8, 2020.^{6,7}

The implementation of viral disease control protocols

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may be possible through public awareness, and some policies must be adopted nationally as well as globally under clear and authentic recommendations of the policy creators. As plenty of people in Bangladesh are uneducated, and a significant percentage includes slum dwellers, it has been facing different challenges as compared to other countries. It needs more effective infection control measures and health policies that must be devised nationally according to public knowledge, attitudes, behavioral responses (KAB), and spreading patterns of COVID-19. The battle against COVID-19 may be difficult if the combined strategies of WHO guidelines and national policies are not correlated.

In fighting COVID-19, the people's views on these steps are vital, which are greatly affected by their KAB, as well as the spreading patterns of COVID-19 in Bangladesh, which conception is identical to the previous investigations.⁸⁻¹⁰ The learning from the SARS outbreak in 2003 was associated with knowledge, perceptions, and psychological behaviors of the general people toward the pandemic, which directly impact the pathway to prevent the transmission of this threat.^{11,12}

People must have good knowledge, positive attitudes and behaviors, and enough awareness to tackle the current COVID-19 pandemic. In this series of studies, we have immediately disclosed the preliminary results and partially reported on KAB scores of the Bangladeshi population during the beginning phase of the COVID-19 epidemic in Bangladesh.¹³ Herein, we want to report the extensive assessment of the KAB toward COVID-19 along with the spreading patterns of the outbreak in Bangladesh.

Materials and Methods

Questionnaire development and design

We designed 17 questions at both English and Bangla versions on the discussed topic beneath some basic segments according to national guidelines. The survey started with some basic demographic questions like gender, age, and education. The fundamental portions were (a) general information about SARS-CoV-2, (b) transmission and spreading knowledge, (c) signs and symptoms, (d) precautions, (e) perceptions, and (f) behavioral responses of the population during the early stage of COVID-19 outbreak in Bangladesh. After drafting the initial copy of the questionnaire, it

was validated through previously published articles by Khan et al¹⁴ and Zhong et al.⁸ Besides, the selected queries related to KAB and spreading pattern of the COVID-19 outbreak are as similar as validated questions undertaken in the previous studies conducted in Bangladesh,¹⁵⁻¹⁷ and several infection prevention and control measures adopted by WHO.¹⁸

Participants, ethics, and approval

Individuals aged more than 18 years, who had understood the purpose of the survey and wished to take part in it, were asked to respond to the study. The questionnaire was introduced by a brief description of the background, aim, protocol, usefulness, announcing of anonymity and privacy, instructions for filling the survey, and sharing the link to his/her close community. This questionnaire-based survey was performed following all guidelines and ethical protocols of the World Medical Declaration of Helsinki.¹⁹ Besides, the informed consent from all respondents was taken before participating in the research, and the collected data were preserved in private and confidential. After reviewing the protocol and procedures of the research, the Ethical Review Committee of the Faculty of Biological Sciences, University of Dhaka, Bangladesh, approved and provided an ethical approval number on August 23, 2020 (Ref. No. 102/Biol. Scs.).

Sampling and recruitment of participants

In the survey research, we utilized a simple snowball sampling strategy to recruit the target respondents.²⁰ A standard formula, $n = (Z_{\alpha/2})^2 \times [p(1-p)/(d)^2]$, was used for generalizing the sample size, where n is the estimated sample size, and p denotes the expected proportion of the population (here assumed to be 50% for the maximum sample size, i.e., $p = 0.5$). $Z_{\alpha/2} = 1.96$, the value of normal distribution at 5% significance level, and d indicates the 5% tolerated standard error. Hence, the calculated sample size was 384. After adjustment of the missing data, the sample size reached 1,861. The study confidently endorsed the randomized recruitment of respondents from all divisions of the country that represents the more substantial population view regarding their KAB toward COVID-19.

Study area, and data collection

The whole of Bangladesh was selected for data collection to find out the genuine scenario of public

KAB towards the pandemic. This questionnaire-based survey started on March 19, 2020, and ended on April 15, 2020. The link of the created and designed Google form was shared in various prevalent Facebook groups, pages, some online news portals as well as some blogs to collect data across the country.

Statistical analysis

Descriptive statistics were conducted to find correct answers to KAB scores and demographic characterization of several associated factors. Besides, one-way analysis of variance (ANOVA) was employed to determine statistically significant differences between different groups of participants' KAB scores. Finally, a multivariate linear regression model was applied to observe the adjusted effects of demographic variables on KAB scores among the Bangladeshi population during the early phase of the COVID-19 outbreak. The two-sided statistical significance level was fixed at less than five percent, i.e., $p < 0.05$, during the statistical analyses.

Results

Demographic analysis

A total of 1861 individuals in Bangladesh participated in this questionnaire-based survey containing 17 relevant questions (supplementary **Table S1**). In this questionnaire-based study, the male participants and 18–30 years group participants were 1201 (64.53%) and 1330 (71.46%), respectively. The total respondents were also branched into four major classes based on education: Junior School Certificate (JSC) or lower, Secondary School Certificate (SSC), Higher Secondary Certificate (HSC), and bachelor degree or higher; the maximum participants were in first ($n = 760$; 40.83%) and fourth group ($n = 670$; 36.00%). The number of respondents for each question, along with their corresponding percentages for each demographic variable, was represented in **Table 1**.

Table 1. Demographic characteristics with average (95% CI) knowledge, attitudes, and behavioral scores of Bangladeshi populations toward COVID-19 during its early stage.

Criteria	Status	n	%	Knowledge score	Attitudes score	Behavioral score
Gender	Male	1201	64.53	4.03 (3.97-4.09)	1.51 (1.47-1.54)	2.53 (2.47-2.58)
	Female	645	34.65	3.78 (3.68-3.87)	1.53 (1.45-1.58)	2.38 (2.31-2.45)
	Others	15	0.80	2.73 (2.04-3.42)	1.31 (0.35-2.27)	2.42 (1.77-3.07)
Age group (years)	18-30	1330	71.46	4.07 (4.01-4.13)	1.50 (1.46-1.53)	2.58 (2.53-2.62)
	31-50	393	21.11	3.68 (3.56-3.80)	1.51 (1.44-1.58)	2.22 (2.12-2.31)
	50+	138	7.41	3.29 (3.04-3.54)	1.70 (1.59-1.80)	2.42 (2.26-2.57)
Education	≤JSC	760	40.83	3.42 (3.32-3.51)	1.44 (1.39-1.49)	2.37 (2.30-2.44)
	SSC	108	5.75	3.61 (3.40-3.82)	1.47 (1.35-1.58)	2.31 (2.13-2.48)
	HSC	323	17.35	3.71 (3.59-3.83)	1.43 (1.36-1.49)	2.47 (2.37-2.56)
	≥Bachelor	670	36.00	4.02 (3.93-4.10)	1.65 (1.59-1.70)	2.64 (2.57-2.70)

Note: n = number, 95% CI = 95% confidence interval. Each case, p value was found below 0.001 from ANOVA analysis. COVID-19 = coronavirus disease-2019.

Knowledge of participants toward COVID-19

The average knowledge score for total population was reported 3.69 out of 5 (95% CI = 3.63-3.75, $p = 0.001$) where the highest and lowest mean knowledge scores were 4.07 (95% CI = 4.01-4.13; $p < 0.001$) and 2.73 (95% CI = 2.04-3.42; $p < 0.001$) for 18-30 years age group and “others gender”, respectively. With respect to education, the highest knowledge score

4.02 (95% CI = 3.93-4.10; $p < 0.001$) was observed for bachelor's degree/highly educated people, and the lowest score was observed for JSC/lowly educated people (**Table 1**).

A significant association between the knowledge score and several demographic factors (age, gender, and education level) was found from multivariate linear regression analysis, and all the

results are summarized in **Table 2**. It was revealed from **Table 2** that female (vs. male, $\beta = -0.205, p < 0.001$), \leq JSC (vs. \geq Bachelor, $\beta = -0.601, p < 0.001$), SSC (vs. \geq Bachelor, $\beta = -0.368, p = 0.004$), and HSC (vs. \geq Bachelor, $\beta = -0.076, p = 0.003$) groups were significantly associated with lower knowledge level

than their reference group. On the other hand, 18-30 years (vs. > 50 years, $\beta = 0.691, p < 0.001$), and 31-50 years (vs. > 50 years, $\beta = 0.346, p < 0.001$) age groups of people acquired significantly higher knowledge score than their reference group.

Table 2. Multivariate linear regression on demographic factors associated with COVID-19 KAB scores among Bangladeshi residents.

Parameter	Variables	Categories	Coefficient (β)	95% CI		p-value
				lower	upper	
Knowledge level	Gender	Female vs. Male	-0.205	-0.319	-0.091	< 0.001
	Age (years)	18-30 vs. > 50	0.691	0.474	0.908	< 0.001
		30 -50 vs. > 50	0.346	0.108	0.584	< 0.001
	Education level	\leq JSC vs. \geq Bachelor	-0.601	-0.723	-0.479	0.004
		SSC vs. \geq Bachelor	-0.368	-0.611	-0.125	<0.001
		HSC vs. \geq Bachelor	-0.076	-0.244	0.093	0.003
	Constant		3.702	3.423	3.980	0.379
Attitudes level	Gender	Female vs. Male	-0.001	-0.064	0.061	0.974
	Age (years)	18-30 vs. > 50	-0.179	-0.298	-0.060	0.003
		30 -50 vs. > 50	-0.119	-0.250	0.011	0.072
	Education level	\leq JSC vs. \geq Bachelor	-0.173	-0.240	-0.106	< 0.001
		SSC vs. \geq Bachelor	-0.169	-0.302	-0.036	0.013
		HSC vs. \geq Bachelor	-0.169	-0.262	-0.077	< 0.001
	Constant		1.788	1.636	1.941	< 0.001
Behavioral level	Gender	Female vs. Male	-0.030	-0.110	0.049	0.456
	Age (years)	18-30 vs. > 50	0.110	-0.042	0.262	0.156
		30 -50 vs. > 50	-0.145	-0.311	0.022	0.088
	Education level	\leq JSC vs. \geq Bachelor	-0.187	-0.273	-0.101	< 0.001
		SSC vs. \geq Bachelor	-0.139	-0.309	0.031	0.109
		HSC vs. \geq Bachelor	-0.018	-0.136	0.100	0.766
	Constant		2.182	1.987	2.377	< 0.001

The analyses of wrong answers and “I do not know” responses as per demography are enlisted in **Table 3**. Approximately 37% female, 40.6% JSC or lower educated, and 58.7% of 50+ year age group participants did not know that an individual could be a potential carrier of this virus without symptoms. This found statistics have suggested that a significant number of common people in Bangladesh still lack proper COVID-19 knowledge. It is evident from **Table 3** that a remarkable number of both genders

(male: n = 269, 22.3% and female: n = 192, 29.8%) of Bangladeshi residents have failed to vote for the right answer in case of major signs and symptoms of COVID-19. About 24.4% (186 out of 760) lower or uneducated (\leq JSC) and 28.2% of 50+ years age group (39 out 138) did not believe that there was no approved vaccine to tackle this pandemic, which played a vital role in the negative knowledge-based score for these groups of populaces.

Table 3. Analyses of wrong answer and “I do not know” responses in knowledge-based questions as per demography.

Criteria	Status	K1	K2	K3	K4	K5
		n (%)	n (%)	n (%)	n (%)	n (%)
Gender	Male	59 (4.9)	313 (26.0)	269 (22.3)	205 (17)	194 (16.1)
	Female	83 (12.86)	238 (36.9)	192 (29.8)	146 (22.6)	137 (21.3)
	Others	2 (13.3)	4 (26.6)	5 (33.3)	2 (13.3)	3 (20.0)
Age group (years)	18-30	81 (6.09)	325 (24.4)	280 (21.0)	218 (16.4)	203 (15.3)
	31-50	34 (8.65)	149 (37.9)	131 (33.3)	97 (24.7)	92 (23.4)
	50+	29 (21.01)	81 (58.7)	55 (39.85)	38 (27.53)	39 (28.2)
Education	≤JSC	107 (14.07)	309 (40.6)	245 (32.2)	195 (25.7)	186 (24.4)
	SSC	11 (10.2)	27 (25.2)	23 (21.5)	16 (14.8)	15 (14.0)
	HSC	3 (0.9)	75 (23.2)	56 (17.4)	49 (15.2)	43 (13.3)
	≥Bachelor	23 (3.4)	144 (21.4)	142 (21.1)	93 (13.9)	90 (13.4)

Attitudes of participants toward COVID-19

The obtained mean attitudes rates for total participants were calculated to be 50.33% (1.51/3*100), that is, mean value was 1.51 (95% CI = 1.48-1.54; $p < 0.001$) out of 3, where the highest and lowest attitude level were 1.70 (95% CI = 1.59-1.80; $p < 0.001$) and 1.31 (95% CI = 0.35-2.27; $p < 0.001$) out of 3 for above 50 years age group and “others gender” group, respectively. All other demographic variables with their mean attitude scores were presented in Table 1. Furthermore, multivariate linear regression analysis demonstrated that 18-30 years (vs. > 50 years, $\beta = -0.179$, $p = 0.003$), ≤JSC (vs. ≥ Bachelor, $\beta = -0.173$, $p < 0.001$), SSC (vs. ≥ Bachelor, $\beta = -0.169$, $p = 0.013$), and HSC (vs. ≥ Bachelor, $\beta = -0.169$, $p < 0.001$) groups

were significantly associated with lower attitude score than their reference group (Table 2).

The distribution of participants' responses to attitude-based surveys regarding COVID-19 is summarized in Table 4. A significant number of male and female participants ($n = 677$; 56.1% and $n = 336$; 52.1%, respectively) opined that the steps taken by the government for fighting this outbreak were not followed strictly and effectively. Participants of all age groups had shown their confidence (64.7 to 81.9%) that the country will overcome the situation. Most participants in all education levels believed (65.6 to 74.1%) the same. However, it is to be noted that a significant number of all educational groups of participants (25 to 34%) voted their lack of confidence in the final battle of the pandemic.

Table 4. Frequency distribution of two important attitudes-based responses towards COVID-19 from demographic factors.

Criteria	Status	A2 (obeying government steps)		A3 (confidence for overcome)	
		Yes (%)	No (%)	Yes (%)	No (%)
Gender	Male	524 (43.6)	677 (56.3)	836 (69.6)	365 (30.4)
	Female	309 (47.9)	336 (52.1)	463 (71.8)	182 (28.2)
	Other	5 (33.3)	10 (66.6)	14 (93.3)	1 (6.6)
Age group (years)	15-30	562 (42.2)	768 (57.7)	897 (67.4)	433 (32.5)
	31-50	207 (52.6)	186 (47.3)	303 (77.1)	90 (22.9)
	50+	69 (50.0)	69 (50.0)	113 (81.9)	25 (18.1)
Education	≤JSC	328 (43.1)	432 (56.9)	531 (69.8)	229 (30.1)
	SSC	45 (41.6)	63 (58.3)	74 (68.5)	34 (31.5)
	HSC	171 (52.9)	152 (47.1)	212 (65.6)	111 (34.3)
	≥Bachelor	294 (43.8)	376 (56.1)	496 (74.1)	174 (25.9)

Behavioral responses of participants toward COVID-19

The behavioral response of the population of the country is the most important factor in fighting a disease outbreak. The average score obtained for behavioral responses was 2.48 (95% CI = 2.44, 2.52), and 52.12% of the total participants showed good behavioral responses. The behavioral scores for various genders, age groups, and education categories are listed in **Table 1**. The highest mean value was observed for male 2.53 (95% CI = 2.47-2.58; $p < 0.001$), 18–30 age group 2.58 (95% CI = 2.53-2.62; $p < 0.001$) and for highly educated (\geq bachelor’s degree) group 2.64 (95% CI = 2.57-2.70; $p < 0.001$). In remarkable contrast, the lowest behavioral score (2.22; 95% CI = 2.12-2.31; $p < 0.001$) was observed

for 31–50 years of age group, indicating that they were not following the behavioral guidelines strictly.

Moreover, multivariate linear regression analysis revealed that \leq JSC (vs. \geq Bachelor, $\beta = -0.187$, $p < 0.001$) was significantly associated with the lower behavioral score than the reference group (**Table 2**). About 24.5% of the female respondents did not wear the mask at all, whereas 14.1% wore the mask on an irregular basis. Among the education group JSC or lower, a significant number of people ($n = 255$; 33.5%) did not wear the mask, and 19.6% wore the mask sometimes during an outing to a crowded place. About 83.5% of individuals in the bachelor’s degree or higher group wore a mask regularly when they went outside (**Table 5**).

Table 5. Frequency distribution (n) with percentages (%) of participants towards preventative measures in Bangladesh.

Question	Best options to prevent COVID-19 transmission?					Do you wear a mask during outing?		
	Status	staying home	Wait for vaccine	immunity	hospital facility	Yes	No	irregularly
Gender	Male	928 (77.2)	84 (7)	248 (20.6)	356 (29.6)	837 (69.7)	170 (14.2)	194 (16.1)
	Female	507 (78.7)	37 (5.7)	138 (21.4)	199 (30.9)	396 (61.5)	158 (24.5)	91 (14.1)
	Others	9 (60.0)	2 (13.3)	4 (26.7)	4 (26.7)	9 (60.0)	4 (26.7)	2 (13.3)
Age group (years)	18-30	847 (63.6)	92 (6.9)	250 (18.8)	401 (30.1)	891 (66.9)	209 (12.1)	230 (23.5)
	31-50	350 (89)	24 (6.1)	98 (24.9)	162 (41.2)	276 (70.2)	92 (27)	25 (5.3)
	50+	111 (82.8)	6 (4.4)	26 (19.4)	28 (20.9)	75 (55)	31 (22.4)	32 (23.1)
Education	\leq JSC	581 (76.4)	54 (7.1)	154 (20.2)	242 (31.8)	356 (46.8)	255 (33.5)	149 (19.6)
	SSC	91 (85)	3 (2.8)	13 (12.1)	29 (27.1)	85 (78.7)	7 (6.8)	16 (14.8)
	HSC	254 (78.6)	23 (7.1)	65 (20.1)	84 (26)	241 (74.6)	35 (10.8)	47 (14.5)
	\geq Bachelor	591 (88.2)	41 (6.1)	156 (23.2)	204 (30.4)	560 (83.5)	35 (5.2)	75 (11.1)

Spreading pattern analysis during the early stage

Most of the participants ($n = 1533$; 82.37%) thought that the main mode of transmission of the virus was intimate contact with the infected person. A large number of participants ($n = 530$; 28.47%) believed that coming in contact with someone who had recently returned from infected zones, especially Italy, America, China, European countries, might be risky, and they could be potential sources for transmission. Most of the participants of different genders, age groups, and education levels (66.7% to 93.1%) believed that intimate contact with the infected person was the main cause of transmission of the virus (**Table 6**). The highest percentage ($n = 366$; 93.1%) of positive response was reported in

the 31–50 years age group. A remarkable percentage of participants (almost 40–50%) in all categories (except a negligible number for ‘others gender’) also thought that COVID-19 spread is closely related to public gatherings. A significant percentage of males ($n = 354$, 29.4%) and females ($n = 167$, 25.9%) voted for another major source—individuals who recently returned from the infected countries. A significant number of participants suggested that viral transmission could happen through breathing air. Only a negligible number ($n = 15$) of participants did not comment on the transmission pattern of the virus. All these frequencies, along with the corresponding percentages, are listed in supplementary appendix.

Table 6. Frequency distribution of the public's views on spreading patterns of COVID-19 outbreak in Bangladesh during the early phase.

Question	Spreading style of COVID-19 in Bangladesh. Number (%)						
Criteria	Status	infected person	Public gatherings	returned infected countries	breathing of infected one	unhealthy environments	I do not know
Gender	Male	990 (82.4)	544 (45.3)	354 (29.4)	190 (15.8)	339 (28.2)	5 (0.4)
	Female	533 (82.7)	307 (47.7)	167 (25.9)	200 (31.1)	42 (6.5)	10 (1.5)
	Other	10 (66.7)	3 (20.0)	9 (60.0)	4 (26.7)	0 (0)	0 (0)
Age group (years)	18-30	1049 (78.8)	620 (46.6)	364 (27.3)	365 (27.4)	52 (3.9)	9 (0.6)
	31-50	366 (93.1)	192 (48.8)	120 (30.5)	136 (34.6)	25 (6.3)	6 (1.5)
	50+	118 (88.1)	42 (31.3)	46 (34.3)	40 (29.8)	1 (0.7)	0 (0)
Education	≤JSC	641 (84.3)	367 (48.2)	207 (27.2)	191 (25.1)	28 (3.6)	6 (0.7)
	SSC	80 (74.7)	47 (43.9)	32 (29.9)	29 (27.1)	15 (14.0)	2 (1.8)
	HSC	277 (85.7)	128 (39.6)	85 (26.3)	109 (33.74)	11 (3.4)	1 (0.3)
	≥Bachelor	535 (79.8)	312 (46.5)	206 (30.7)	212 (31.6)	24 (3.5)	6 (0.9)

Discussion

The outcomes from the KAB analysis recognized some critical demographic factors which might be useful for the public health workers and policymakers in the country. The health policy creators and workers will be able to trace the target group of vulnerable people and easily apprise them about COVID-19 to overcome this pandemic. Based on our knowledge, this study is the first to examine the knowledge, attitudes, and behavioral responses towards COVID-19 and its spreading pattern during the early phase in Bangladesh. Our primary assessment of KAB and results from regression analyses of several demographic parameters were observed to be similar to the studies conducted on the SARS outbreak in 2003.^{21,22} About 64% of participants gained a good knowledge score, but it was not a satisfactory level for battling the epidemic. Moreover, around half of the participants asserted destitute demeanors and poor behavior toward COVID-19 during the starting phase in Bangladesh, which indicated the real state of the country with its preparedness and preplanning in battling the outbreak.¹³ However, the association between education level and knowledge score regarding COVID-19 has demonstrated a significant viewpoint: lack of public awareness and web-based knowledge of a great percentage of the lower or uneducated population have been revealed to be the reason behind the poor knowledge score of Bangladesh.

We anticipated that the optimistic attitudes of Bangladeshi residents would be correlated to the measures for COVID-19 counteraction, such as

controlling public transport and social gatherings throughout the country as well as lockdown of the tainted areas, which could propel positive demeanors toward this threat. In reality, the obtained poor attitudes among Bangladeshi residents indicated some concerning issues. Firstly, there was a lack of strictness in maintaining social distance among the people, the authorities were inexperienced, and arrangement for handling the upcoming pandemic was poor. Secondly, it was reported that doctors or health workers were perplexed and panic-stricken as they were not prepared for this contagious virus with proper personal protective equipment, had no proper training about COVID-19 and other therapeutic materials. Thirdly, very few samples were tested at the early phase of this outbreak in Bangladesh, which has failed to illustrate the real picture and exacerbated the situation. Initial five weeks after the first detection of COVID-19 patients, only 11,223 suspected individuals were tested in Bangladesh, which has uncovered the lowest COVID-19 testing rate in the country.^{23,24} Fourthly, the lack of integrated efforts among the various private and public agency has deteriorated the confidence level of the people responsible for destitute attitudes of the Bangladeshi population toward COVID-19.

A large number of individuals did not wear the mask completely, and some wore them irregularly when going to crowded places, and which can be improved by expanding public awareness. Numerous foreign returnees did not remain in-home quarantine and follow effective practices to prevent community transmission. Overall, risky behavioral responses

were observed in female, lowly educated people and those who obtained a poor COVID-19 knowledge score. Unfortunately, more than 70% of respondent' perceptions were that people of Bangladesh did not maintain social distance by staying at home, which possessed a higher risk factor for spreading the infection. In such cases, the authorities must take strict actions to control this infringement. It is a matter of dismay that poor attitudes and behavioral responses toward the COVID-19 outbreak were communicated by even individuals with good knowledge scores, as depicted in this epidemiological study. These outcomes clearly suggest the necessity of improving COVID-19 knowledge through public awareness or basic health education, which may ameliorate the attitudes and behavioral responses toward this disease.

Conclusion

In this study, we sought to assess the prevailing KAB toward COVID-19. From the statistical analysis, it was clearly understood that a large number of participants submerged to achieve a satisfactory grade of knowledge, optimistic attitudes, and good behaviors toward the COVID-19 during its early phase. It was revealed from the specific outcomes of the study that the Bangladeshi populations were not completely aware of the gravity of the outbreak during its inception phase. The results of this research suggest that public awareness must be ameliorated, and health education and programs must aim at progressing COVID-19 knowledge among all classes of residents of Bangladesh, especially for elderly or lower educated people, which will play a role in promoting positive attitudes and good behaviors toward any pandemic.

Authors' contributions

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Acknowledgments

The authors of the article acknowledge to the respondents, volunteers, and social media admins, who were involved in this research for their valuable cooperation and altruistic support.

Conflict of interest

The authors declare no conflict of interest.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Supplementary file

Table S1. Questionnaire for evaluating knowledge, attitudes, and behavioral responses toward COVID-19 and analyzing spreading patterns during the early phase of the outbreak in Bangladesh.

Questions	Options
*Your gender=?	Male
	Female
	Others
*Your age=?	18-30 years
	31-50 years
	Above 50 years
*Your education=?	JSC or lower
	SSC
	HSC
	Bachelor or higher
K1. Do you know WHO has declared the novel coronavirus 2019 as a pandemic?	Yes
	No
	I do not know
K2. A person may be a carrier without any symptoms of this virus, do you agree?	Yes
	No
	I do not know
K3. Which are the major signs and symptoms of coronavirus, according to you?	Nausea/vomiting/headache/diarrhea
	Fatigue/coughing/diarrhea/vomiting
	Fever/sore throat/chest pain/nausea
	Fever/coughing with sneezing/sore throat/breathing problem
	I do not know
K4. From how many days can coronavirus show its signs and symptoms?	1-3 days
	4-14 days
	15-30 days
	I do not know

Questions	Options
K5. There is no approved medication for its treatment, do you agree?	Yes
	No
	I do not know
A1. What is your perception of this novel coronavirus?	As usual disease
	Simple like flu virus
	Fatal but manageable
	Completely fatal and dangerous
	I do not know
A2. The Government has taken enough and strict steps to prevent this virus, do you obey these properly?	Yes
	No
A3. Finally, we will succeed to overcome this pandemic, do you agree?	Yes
	No
B1. Do you wear a mask during the outing?	Yes
	No
	Irregularly
B2. Maintaining social distance and staying at home may be the best options to prevent its transmission, do you agree?	Yes
	No
B3. In reality, everyone follows these options, do you agree?	Yes
	No
B4. Did you see anyone who has visited recently from infected countries but did not follow home quarantine?	Yes
	No
	Not see anyone
S1. Spreading style of this virus, according to you? (You can choose more than one option)	Intimate contact with infected persons
	Public gatherings
	who have recently visited abroad
	Due to unhealthy environments
	Air-breathing from an infected one
S2. Which step(s) may be the best option for stopping coronavirus spreading? (You can choose more than one option)	I do not know
	Being cautious and staying home
	Wait for the corona vaccine
	Improve immunity
	Improvement of hospital facility

Note: K1–K5: Knowledge-based, A1–A3: Attitudes-based, B1–B4: Behavioral response-based, and S1–S2: Spreading pattern-based questions. JSC=Junior School Certificate, SSC=Secondary School Certificate, HSC=Higher Secondary Certificate. Star sign (*) means the mandatory answer to the question.

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