Knowledge and attitude towards COVID-19 among adult people in Bangladesh: evidence from an online survey

Md. Shahjahan[1], M. Mazharul Islam[2], Md Kamrul Hossain[3], Md. Ruhul Amin[4], Mostafa Kamal[5], Mohammad Saiful Islam[6]

[1]Department of Public Health, Daffodil International University, Dhaka, Bangladesh
[2]Department of Statistics, Sultan Qaboos University, Muscat, Oman
[3]Department of General Educational Development, Daffodil International University, Dhaka, Bangladesh
[4]Bangladesh Medical Research Council (BMRC), Dhaka, Bangladesh
[5]Department of Business Administration, Daffodil International University, Dhaka, Bangladesh
[6]Planning, Monitoring and Research, Directorate General of Health Services, Dhaka, Bangladesh

Article Info

ABSTRACT

The objective of this study was to examine the levels and determinants of knowledge and attitudes toward COVID-19 among adult people in Bangladesh, using data from an online survey, conducted in May 2021. Descriptive and inferential statistical analysis were performed to extract findings from data. The survey covered 993 respondents. A high level (78.4%) of effective knowledge and positive attitude (78.6%) were observed among the Bangladeshi people. More than eighty percent of the respondents could correctly mention at least one important symptom, mode of transmission, and preventive measures of COVID-19. Good knowledge and positive attitudes were found to be significantly higher among males, living in Dhaka city, having a higher level of education, health professionals, and the wealthiest people. Knowledge about COVID-19 has significant association with positive attitude of people towards COVID-19. Despite the high level of knowledge and positive attitudes, there still prevails some misconceptions among a group of people, as one-third of the respondents opined that COVID-19 is a divine punishment and 13% were in favor of keeping it secrete if COVID-19 infection happen to them. The findings underscore the need for more educational program and behavior change communication (BCC) for the subgroups of the population that has been identified with poor knowledge and negative attitudes towards COVID-19.

Corresponding Author:

Md. Shahjahan
Department of Public Health, Daffodil International University
Daffodil Smart City, Birulia 1216, Bangladesh
E-mail: drshahjahan@daffodilvarsity.edu.bd

1. INTRODUCTION

COVID-19 emerged as a major public health crisis across the world in recent times. It originated in the Wuhan region of China in December 2019 and rapidly spread all over the world within a very short time. In March 2020 the WHO declared it a pandemic [1]. COVID-19 is a highly infectious disease that can cause many illnesses including the common cold to severe acute respiratory syndrome (SARS) [2], [3]. Fever, dry cough, breathing difficulty, muscle or body aches, fatigue, myalgia, and dyspnea are the primary clinical symptoms for COVID-19 [4], [5]. Beside these,sore throat, diarrhea, lossing taste and smell, and arthralgia are also symptoms [6]–[8]. Studies have shown that COVID-19 spread among people through sneezing or coughing or contact with the person who is infected [9], [10]. According to the WHO, the possible modes of

the transmission of COVID-19, include contact, droplet, airborne, fomite, fecal-oral, bloodborne, mother-to-child, and animal-to-human transmission [11]. Therefore, it is necessary to assess the public knowledge and awareness to avoid the blowout of COVID-19 in any community.

On March 8, 2020, Bangladesh recorded its first COVID-19 case [12]. Soon after detection of the first COVID-19 patient, it became one of the top most affected country among the South Asian countries. It was predicted that the outcome of COVID-19 would be disastrous for Bangladesh because of its density of population which is more than 1,200 people in per square kilometer, and it is the 8th most populous country in the world with low socio-economic condition, relatively low-literacy level, the strict practice of traditional, cultural and religious values and weak health care system [13]. To control the outbreak of COVID-19, the government of Bangladesh imposed many restrictions and interventions, including lock-down, mandatory use of face masks in public, bans on large gatherings, social distancing, face to face classroom activities of schools, colleges and universities was stopped, business center was shut down, there was stay-at-home orders and so on. When the government imposed these restrictions, many people panicked and tended to ignore them as reported by various media. Thus, the success of all these efforts taken by the Government in containing the rapid spread of COVID-19 largely depends on acceptance of people and adopting the control measures that depends on the perception, knowledge, and attitude of people toward COVID-19. Recent studies of Southeast and South Asian countries found that effectiveness of the preventive measures for COVID-19 largely depends on the cooperation and compliance of the people [14].

At the beginning of the pandemic, there was no proven vaccine or treatment for the disease. Since the beginning of the COVID-19 pandemic, controlling the spread of the disease has been considered the most effective measure to protect people. Thus, nonclinical interventions such as restricting unnecessary movement, maintaining social distancing, wearing masks, and frequent and appropriate hand washing have been suggested by the WHO [15]. As a result, worldwide countries imposed many strict infection control measures to contain the spread of the infection among people. These were largely behavioral, such as social distancing, cleanliness, regular hand washing, use of face masks in public, restriction in local and international travel flights, stop gatherings of people, maintaining social distancing, encouraging online education by closing educational institutes and even curfews in some cases [3], [16]–[18]. The compliance and practice of these control measures were mainly dependent on knowledge and attitudes toward the disease [6], [8], [11], [19].

Personal hygiene measures, such as frequently sanitizing hands, using face mask and shield helps reduce spread of COVID-19 [20]. It is necessary to maintain social distancing, avoiding direct contact and awareness about personal hygienc system for reducing the transmission [21]. Behavioral practice which can be determinant of knowledge and attitude needs to change for controlling and mitigating the transmission of COVID-19. A research found that ignorance about a disease controlled attitudes and practices of the people which employ negative effects on transmission of the disease [22]. Attitude is highly associated with knowledge about impact of a disease [23]. Therefore, gathering knowledge can motivate to positive attitudes and better reaction toward COVID-19. Knowledge and attitude are influential factors to change practice and behavior of people toward COVID-19 [24].

There are numerous literatures [25]–[28] which found that knowledge, attitudes, and necessary measures have significant influence on the mitigation of the pandemic of SARS, Ebola, and H1N1 human influenza flu. Studies [29]–[31] found that the knowledge and positive attitudes about infectious diseases allowed individuals to prevent infection. To identify the most vulnerable group where interventions are needed to change behavior of people, the determinants associated with knowledge, attitude, and practice (KAP) toward COVID-19 are necessary to measure. Recent studies on the COVID-19 pandemic conducted on different sub-groups of a population like healthcare workers, students, and the adult population also showed that good knowledge and positive attitude directed a individuals to adopteffective remedy [32]–[34]. Thus, it is important to study these domains of behavioral aspects of people in any country for developing effective coping mechanisms.

Over the period a good number of studies have been conducted on the KAP of COVID-19 in developed and developing countries, reporting various levels of COVID-19-related KAP and their determinants, emphasizing more country-specific studies in different settings. There are few studies on COVID-19 KAP in Bangladesh, but most of these studies were conducted in the early stage of the pandemic on specific population groups such as students, health professionals, or adolescents [35]–[37]. There is still limited information available on the knowledge and attitudes of adult people in the midst of the peak period of COVID-19 in Bangladesh. To fill this gap, we conducted an online survey among the adult people of Bangladesh in mid-2021. Thus, the objectives of this study were to explore the knowledge and attitude toward COVID-19 and identify their determinants. Findings of the study are expected to assist the policymakers to design effective policy which would help to change socity and individual's behavior for ensuring safety during and after the pandemic.

2.   RESEARCH METHOD

2.1. Study design, participants and ethics approval

The data for this study was obtained through a cross-sectional online survey among the adult people who were active social media users. Due to strict social distancing measures, restricted movement of the people, and stay-at-home orders, a web-based survey form which was a electric version of a semi structured questionnaire was developed and used for the study to collect data. The survey form was developed in the QuestionPro platform (https://www.questionPro.com). The questionnaire was pretested among twenty-five potential respondents as a pilot survey for necessary changes in language/words, style, and response categories based on pretested results. The questionnaire was shared with people via social media applications such as e-mail, Facebook, and WhatsApp. Data were collected for 15 days during May 2021.

Ethical approval for the study was provided by the Institutional Review Board of the Bangladesh Medical Research Council (BMRC) (Ref. BMRC/HPNSP-Research Gantl2020-2021 I 5 6(1-6)). There was a consent form at the beginning of the survey. Participants were allowed to drophim/herself from survey at any time without any explanations and no personal information was recorded. A total of 933 people provided informed consent and completed the questionnaire, which constituted our study sample.

2.2. Data collection tools and measurements

Data was collected using a web-based survey form which was self-administered. The knowledge was assessed using 13 true-false questions on three dimensions of knowledge about COVID-19, such as (1) signs and symptoms (5 items), (2) transmission (3 items), and (3) prevention mechanism (5 items). Each correct response was scored as 1 point and incorrect response as 0, giving an aggregate maximum score of 13 and a minimum score of 0. The higher the points scored, the more knowledgeable the people were. The mean score was observed to be 9.1 (SD=1.34). The overall knowledge was categorized into poor for scores less than 9 and good for scores 9 and above.

Using a 7-item measurement scale, attitude of the people towards COVID-19 was measured. Each item has two options - agree or disagree. Thus, the overall attitude was categorized as negative for scores less than 5 and positive for scores 5 and above as the average score was 5.3.

In the absence of a direct measure of economic status, a proxy measure, called the wealth index was created based on information from housing characteristics and ownership of household durable goods (such as television, car, and refrigerator), using principal component analysis. Details on the calculation of the wealth index from household assets can be found in [38].

2.3. Statistical analysis

The study considered knowledge and attitude as the outcome variables and socio-demographic and COVID-19 related factors as explanatory variables. Descriptive statistics was performed to know status of knowledge and attitude towards COVID-19 whereas inferential statistics were applied to find association and odds of the determinants with appropriate statistical test. Statistical Package for Social Sciences (SPSS), Version 25.0 was used to conduct the statistical analysis. A p-value <0.05 was considered statistically significant.

3.   RESULTS

3.1. Characteristics of respondents

Of the total 993 respondents, about half (50.3%) were female (Table 1) Nearly one-third (32.3%) of the respondents were young adults of age less than 24 years. The mean age of the participants was 29.4 years. About half (51.4%) of the respondents were single. Respondents were literate persons with two-third (65.5%) having educational level graduate and above. About one fourth (24.6%) of the respondents were students, while 38% were health workers. About 18% of the respondents were from outside Dhaka City area, the national Capital City. Our sample included 361 (36.4%) participants who were diagnosed to know COVID-19 infection status, among them 210 (21%) were tested COVID-19 positive. In general, 97% of the respondents reported their general health status as moderate to good.

3.2. Knowledge about COVID-19

The overall knowledge was categorized as poor and good based on the total scores of the correct answers of the 13 knowledge items (scores <mean as poor and scores ≥mean as good). The results indicate that 78% respondents had high level of knowledge about COVID-19 among the adult people of Bangladesh as shown in Table 2. An overwhelming majority (87%) of the respondents reported coughing/sneezing as signs and symptoms of COVID-19, while difficulty in breathing was reported by 84% of the respondents. Other symptoms like fever were mentioned by 78%, and muscle/body aching was mentioned by 62%. Diarrhea was mentioned by 55% of respondents. About 82% of the people knew that the COVID-19 virus

can transmit to the human body through the mouth, nose, and eyes, 85% knew that transmission can happen through touching an infected person and 89% knew that being in close contact with the infected person could be the cause of transition. Around 90% of the people correctly reported that social distancing, wearing masks and keeping hand clean can prevent COVID-19 infection, while about 76% reported that avoiding contact with an infected person and avoiding travel or visit to crowded places can prevent COVID-19 infection.

Gender, place of permanent residence, level of education, occupation, and wealth index appeared as significant predictors of knowledge about COVID-19 among the adult people Table 3. Males were found to be 1.34 times more likely to have good knowledge about COVID-19 (AOR=1.34, 95% CI=1.11–1.86). As expected, people from Dhaka city exhibited higher knowledge than those from outside Dhaka (AOR=1.46, 95%CI=1.12–2.31). Level of education showed a significant positive association with knowledge about COVID-19. People with educational level graduate or above had about 3 times higher good knowledge about COVID-19 than the people with a primary level of education (AOR=2.98, 95%CI=1.89–3.45). The wealth index also showed a positive association with good knowledge about COVID-19. The wealthiest people were found to be 2.1 times more likely to have had good knowledge about COVID-19 than the people with the poorest wealth index (AOR=2.13, 95%CI=1.62–3.23).

Table 1. Distribution of respondents according to socio-demographic characteristics

Characteristics	Number	Percent
Total respondents	993	100.0
Age		
<24	321	32.3
25-29	352	35.4
30-39	204	20.5
40+	116	11.7
Mean age (SD)	29.4 (9.3)	
Gender		
Male	494	49.7
Female	499	50.3
Marital status		
Single	510	51.4
Married	483	48.6
Level of education		
Primary	41	4.1
Secondary	67	6.7
Higher secondary	235	23.7
Graduate or above	650	65.5
Occupation		
Student	244	24.6
Health worker	373	37.6
Service holder	216	21.8
Business	100	10.1
Others	60	6.0
Monthly HH income (in OR)		
Up to 15,000	210	21.1
15,001-30,000	354	35.6
Above 30,000	429	43.2
Mean (SD)	40.545±58.973	
Place of permanent residence		
Dhaka	817	82.3
Outside Dhaka	176	17.7
Wealth Index		
Poorest	199	20.0
Poorer	198	19.9
Middle	200	20.1
Wealthier	197	19.8
Wealthiest	199	20.0
Diagnose of COVID-19		
Not tested	632	63.6
Tested negative	210	21.1
Tested positive	151	15.2
Health status		
Good	584	58.8
Moderate	382	38.5
Bad	27	2.7

Table 2. Percentage of adults providing correct response to the questions related
to knowledge about COVID-19

Knowledge items	Correct response	
	Number	%
The symptoms of COVID-19 are		
Coughing and sneezing	865	87.1
Breathing difficulty	832	83.8
Fever	770	77.5
Muscle/body aching	619	62.3
Diarrhea	546	54.9
Transmission mechanisms of COVID-19:		
Being in close contact with an infected person	885	89.1
Touching the infected person	844	84.9
Mouth, nose and eyes are the routes of entry of coronavirus into human body	814	82.0
Prevention mechanism of COVID-19:		
Social distancing	905	91.1
Wearing mask	884	89.0
Keeping hand clean	890	89.6
Avoiding contact with infected person	759	76.4
Avoiding travel and visit to crowded places	698	70.3
Overall knowledge about COVID-19		
Good	779	78.4
Poor	214	21.6
Mean knowledge scores (SD)	(1.34)	

Table 3. Distribution of knowledge about COVID-19 and odds of good knowledge about COVID-19

Characteristics	Knowledge about COVID-19			Adjusted odds ratio (AOR) of good knowledge		
	Poor	Good	p-value	AOR	95% CI	p-value
Total sample	21.6	78.4				
Age						
<20	19.7	80.3	0.521	1.24	0.83-2.16	0.137
20-24	26.4	73.6		1.19	0.79-2.12	0.263
25-29	27.9	72.1		1.13	0.61-1.87	0.634
30+ (ref.)	30.0	70.0		1.00		
Gender						
Male	20.8	79.2	0.023	1.34	1.11-1.86	0.032
Female	28.2	71.8		1.00		
Marital status						
Single	21.9	78.1	0.734	1.08	0.85-1.96	0.464
Married (ref.)	20.8	79.2		1.00		
Place of residence						
Dhaka	19.3	80.7	0.001	1.46	1.12-2.31	0.005
Outside Dhaka	25.0	75.0		1.00		
Level of education						
Primary	25.5	74.5	0.032	1.00		
Secondary	22.0	78.0		1.18	0.37-2.12	0.400
Higher secondary	19.4	80.6		1.86	1.09-2.59	0.023
Graduate or above	17.3	82.7		2.98	1.89-3.45	0.003
Occupation						
Student	21.7	78.3	0.042	1.36	0.89-2.56	0.127
Health worker	10.9	89.1		2.13	1.19-3.23	0.021
Service holder	24.8	75.2		1.16	0.78-2.65	0.114
Business	27.7	72.3		1.09	0.89-3.12	0.110
Others	31.8	68.2		1.00		
Monthly HH income (in OR)						
Up to 15,000	19.7	80.3	0.142	0.80	0.45-1.62	0.267
15,001-30,000	19.2	80.8		0.75	0.61-1.95	0.133
Above 30,000	15.2	84.8		1.00		
Wealth index						
Poorest	30.8	69.2	0.041	1.00		
Poorer	31.5	68.5		0.86	0.67-1.89	0.776
Middle	27.4	72.6		1.06	0.78-2.03	0.486
Wealthier	18.0	82.0		1.34	1.06-2.33	0.048
Wealthiest	12.2	87.8		2.13	1.62-3.23	0.031
Test for COVID-19						
Not tested	22.1	77.9	0.478	0.85	0.68-1.92	0.775
Tested negative	19.5	80.5		108	0.56-2.17	0.353
Tested positive	20.2	79.8		1.00		
Health status						
Good	22.1	77.9	0.782	0.86	0.56-1.98	0.785
Moderate	19.8	80.2		1.02	0.79-2.12	0.561
Bad	20.9	79.1		1.00		

3.3. Attitudes towards COVID-19

Respondents were asked about seven different attitudinal questions, and they reported their agreement or disagreement about them. About 87% of the respondents agreed that COVID-19 is a deadly disease and 90.8% believed that one can get infected with COVID-19 at any time. More than eighty percent (87.4%) of the respondents opined that one should not hide if he/she is infected by COVID-19 Table 4. However, more than one-third (34.2%) of the respondents believed that COVID-19 is a divine punishment, indicating that a group of people was stigmatized to some extent. The majority of people had positive thinking toward other attitudinal statements. The mean score of the positive agreement was found to be 5.3 out of 7. The overall attitude was defined as a positive attitude for scores 5 and above. According to this definition, 78.6% of the respondents were found to have positive attitudes toward COVID-19.

Table 4. Attitude of adult people towards COVID-19

Attitudes	Response	
	Agree	Disagree
COVID-19 is a deadly disease	867 (87.3)	126 (12.7)
One can get infected with COVID-19 any time	902 (90.8)	71 (9.2)
One can prevent COVID-19 by maintaining hygienic practices	868 (87.4)	125 (12.6)
If infected by COVID-19, one should not keep it secrete	856 (86.2)	137 (13.8)
COVID-19 is a divine punishment	340 (34.2)	653 (65.8)
People should maintain safe distance from COVID-19 patients	795 (80.1)	198 (19.9)
COVID-19 patients should be kept in isolation	619 (62.3)	374 (37.7)
Mean score of attitudes (SD)	5.3 (1.14)	
Overall attitude towards COVID-19		
Positive	780 (78.6)	
Negative	213 (21.4)	

Table 5 (see in Appendix) presents the socio-economic differentials and predictors of the positive attitude of adult people toward COVID-19 in Bangladesh. Positive attitudes were found to vary significantly with age, gender, place of residence, level of education, occupation, wealth index, and level of knowledge about COVID-19. Gender, place of residence, education, occupation, and knowledge about COVID-19 were found as significant factors for positive attitudes toward COVID-19 from logistic regression. Males were found to be 1.58 times more likely to have a positive attitude towards COVID-19 than females (AOR=1.58, 95% CI=1.20–2.98). The positive attitude was found to be about 36% higher among the people from Dhaka city, compared to the people from outside Dhaka city (AOR=1.36, 95%CI=1.12–2.31). Level of education showed a positive association with a positive attitude towards COVID-19. People with educational level graduate or above were found to be 2.56 times more likely to have a positive attitude towards COVID-19, compared to the people with a primary level of education (AOR=2.56, 95%CI=1.87–3.85). The respondent's occupation was found as a significant factor for positive attitude toward COVID-19. Health workers which include doctors, nurses, and other health professionals had 2.83 times higher odds of positive attitudes towards COVID-19 than people from other occupations (AOR=2.83, 95%CI=1.19–3.23). Respondents' good knowledge about COVID-19 appeared as the most important significant predictor of positive attitude towards COVID-19. People with good knowledge about COVID-19 were found to be more than 3 times more likely to have positive attitudes towards COVID-19, compared to the people with poor knowledge about COVID-19 (AOR=3.13, 95%CI=1.24–4.76).

4. DISCUSSION

This online cross-sectional study was conducted in Bangladesh during May 2021. The study comprised adult people who were active users of social media and living in Dhaka city during the survey. The study was conducted with the support of the health, population, nutrition and sector development program (HP&NSP) of the Ministry of Health as part of an ongoing effort to provide effective information for the prevention and treatment of COVID-19 in Bangladesh. Proposal of the study was accepted by the Institutional Review Board of the Bangladesh Medical Research Council (BMRC).

The findings of this study indicate a high rate of knowledge and positive attitudes about COVID-19 among the adult people in Bangladesh. Overall, more than three fourth (78%) of adult people in Bangladesh had high level of knowledge and positive attitudes about COVID-19 which is higher than observed in some previous studies in Bangladesh. For example, Ferdous *et al.* [39] observed that 48.3% and 62% of Bangladeshi citizens aged 12-64 years had accurate knowledge and attitudes toward COVID-19, respectively. Rabbani *et al.* [37] also observed that 44% of Bangladeshi adults had adequate knowledge about COVID-19

and 49% respondents had positive attitudes toward COVID-19. These differences between the finding of the study and previous studies are mainly because of the time of conducting studies. Most of the previous study was conducted at the initial stage of the pandemic in 2020 when knowledge about COVID-19 was poor however, the study was conducted during the pick period of the pandemic. Differences in results could also be attributed to differences in study designs, and measuring tools used for assessing the knowledge and characteristics of the study participants.

Nevertheless, this study finding indicates that over the period the knowledge and positive attitudes levels have increased among the adult people in Bangladesh. However, the knowledge level among the adult people in Bangladesh is comparable to Ethiopia (76%) [40], Saudi Arabia (80%), and Pakistan (80%) [41], and India (70%) [42], but lower than observed in the Philippines (92%) [43] and Iraq (92%) [44]. These differences in knowledge across the countries might be because of differences in populations and tools of examination to assess knowledge about COVID-19. This study documented a high level of knowledge about COVID-19 etiology, signs and symptoms, the main route of transmission, and prevention mechanisms among the adult people in Bangladesh, which is appreciable and would help in adopting and implementing preventive measures in spreading COVID-19.

Males had a significantly higher level of good knowledge about COVID-19 than females. Findings of the study is supported by the findings of the studies conducted in Southeast and South Asian countries and Bangladesh [14], [37], [45]. This might be due to the fact that males were more concerned about the disease and its preventive mechanisms. Besides males have higher mobility and access to different sources of information and thus gained more knowledge than females. However, there are mixed results regarding the association between gender and knowledge about COVID-19. A research in Uganda found no association between gender and knowledge [46].

Respondents with permanent residence in the Dhaka city area had a higher level of knowledge, compared to the respondents with permanent residence outside Dhaka, which is similar as found in the previous studies [35], [47], [48]. This might be due to the fact that people having permanent residence in the Dhaka city area might have higher chance of access to the main sources of information including social media and internet facilities. Level of education showed a consistent positive association with the level of good knowledge, which is consistent with the result of previous studies.

The results also indicate a high level of positive attitudes towards COVID-19, as nearly eighty percent (78.6%) of the participants had a positive attitude to COVID-19. The result was in line with the findings of the studies in Pakistan (82%) [36], Ethiopia (82%) [49] and Nigeria (80%) [23]. However, to some extent, there exists a COVID-19-related stigma, as slightly more than one-third (34%) of the participants believe that COVID-19 is a divine punishment. Regarding factors associated with a positive attitude, males were found to be more likely to have positive attitudes toward COVID-19 than their female counterparts. The result is similar with the result of Ferdous *et al.* [39]. Good knowledge of COVID-19 was found to be significantly associated with a positive attitude about COVID-19, which is consistent with findings of the previous studies [40], [50], [51].

The study has few limitations. As the data collection method was self-reporting, it can be considered as main limitation of the study. The data was collected through an online survey, which has limitation to cover sampling frame. This limitation also leads to appropriateness of sampling techniques, resulting in sampling bias, and thus could limit the representativeness of the study findings. Because of online self-administrated form, many people declined to participate in the survey even many people have limited access of internet, and thus they were excluded from the survey. On the other hand, in the online survey, appropriate sampling design is difficult to maintain because of self-administration. Another limitation of this study is measuring knowledge and attitudes from a self-administered questionnaire. Without validated and reliable questionnaire, it is not possible toaccept that respondents were completely objective at the time of sharing information. Besides, the majority of the survey respondents were young, educated, and living in the Capital city of Dhaka, which might exaggerate the knowledge and attitude level.

5. CONCLUSION

This study demonstrates a high prevalence of knowledge and attitude of the adult people of Bangladesh towards COVID-19. Although the findings suggest an overall satisfaction level of knowledge and positive attitude, there still prevails some misconceptions or stigma to a group of people as about one-third of the participants opined that COVID-19 is a divine punishment and 13% were in favor of keeping it secrete if infected by corona various. Also, about 21% of the people had negative attitudes and the same percentage had poor knowledge about COVID-19. The positive attitude has a highly significant association with knowledge about COVID-19 among the people. All these findings underscore the need for more educational programs and behavior change communication.

REFERENCES

[1]   World Health Organization, "Severe acute respiratory infections treatment centre: practical manual to set up and manage a SARI treatment centre and a SARI screening facility in health care facilities." pp. 1–120, 2020. [Online]. Available: https://apps.who.int/iris/handle/10665/331603

[2]   World Health Organization, "WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020," *WHO Director General's speeches*, no. March. p. 4, 2020. [Online]. Available: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020%0Ahttps://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19

[3]   World Health Organization, "WHO Coronavirus Disease (COVID-19) Dashboard," *Bangladesh Physiotherapy Journal*, vol. 10, no. 1. Nov. 03, 2020. doi: 10.46945/bpj.10.1.03.01.

[4]   Q. Gao, Y. Hu, Z. Dai, F. Xiao, J. Wang, and J. Wu, "The epidemiological characteristics of 2019 novel coronavirus diseases (COVID-19) in Jingmen, Hubei, China," *Medicine*, vol. 99, no. 23, p. e20605, Jun. 2020, doi: 10.1097/MD.0000000000020605.

[5]   B. Zhong, Y. Huang, and Q. Liu, "Mental health toll from the coronavirus: Social media usage reveals Wuhan residents' depression and secondary trauma in the COVID-19 outbreak," *Computers in Human Behavior*, vol. 114, p. 106524, Jan. 2021, doi: 10.1016/j.chb.2020.106524.

[6]   B.-L. Zhong *et al.*, "Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey," *International Journal of Biological Sciences*, vol. 16, no. 10, pp. 1745–1752, 2020, doi: 10.7150/ijbs.45221.

[7]   Centers for Disease Control and Prevention, "symptoms of coronavirus. Centers for Disease Control and Prevention. 2020." 2019. [Online]. Available: https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html

[8]   A. S. Abdelhafiz *et al.*, "Knowledge, Perceptions, and Attitude of Egyptians Towards the Novel Coronavirus Disease (COVID-19)," *Journal of Community Health*, vol. 45, no. 5, pp. 881–890, Oct. 2020, doi: 10.1007/s10900-020-00827-7.

[9]   J.-Y. Li *et al.*, "The epidemic of 2019-novel-coronavirus (2019-nCoV) pneumonia and insights for emerging infectious diseases in the future," *Microbes and Infection*, vol. 22, no. 2, pp. 80–85, Mar. 2020, doi: 10.1016/j.micinf.2020.02.002.

[10]   J. Liu *et al.*, "Community Transmission of Severe Acute Respiratory Syndrome Coronavirus 2, Shenzhen, China, 2020," *Emerging Infectious Diseases*, vol. 26, no. 6, Jun. 2020, doi: 10.3201/eid2606.200239.

[11]   World Health Organization., "Coronavirus Disease (COVID-19) Advice for the public," *WHO web page*. 2020. [Online]. Available: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public

[12]   World Health Organization Bangladesh, "COVID-19 Situation Report No. 10." 2020. [Online]. Available: https://www.who.int/docs/default-source/searo/bangladesh/covid-19-who-bangladesh-situation-reports/who-ban-covid-19-sitrep-10.pdf?sfvrsn=c0aac0b8_4

[13]   W. Bank, "World Bank Country Profile: Bangladesh - World Development Indicators." 2019. [Online]. Available: https://data.worldbank.org/country/bangladesh?view=chart

[14]   M. M. Rahman *et al.*, "Knowledge, Attitude and Practices Toward Coronavirus Disease (COVID- 19) in Southeast and South Asia: A Mixed Study Design Approach," *Frontiers in Public Health*, vol. 10, Jun. 2022, doi: 10.3389/fpubh.2022.875727.

[15]   World Health Organization, "Modes of transmission of virus causing COVID-19: implications for infection prevention and control (IPC) precaution recommendations," *WHO.int*. pp. 1–10, 2020. [Online]. Available: https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations

[16]   J. Bedford *et al.*, "COVID-19: towards controlling of a pandemic," *The Lancet*, vol. 395, no. 10229, pp. 1015–1018, 2020, doi: 10.1016/S0140-6736(20)30673-5.

[17]   M. Khatatbeh, "Efficacy of Nationwide Curfew to Encounter Spread of COVID-19: A Case From Jordan," *Frontiers in Public Health*, vol. 8, Aug. 2020, doi: 10.3389/fpubh.2020.00394.

[18]   A. S. Al Dhaheri *et al.*, "Impact of COVID-19 on mental health and quality of life: Is there any effect? A cross-sectional study of the MENA region," *PLOS ONE*, vol. 16, no. 3, p. e0249107, Mar. 2021, doi: 10.1371/journal.pone.0249107.

[19]   H. Harapan *et al.*, "Coronavirus disease 2019 (COVID-19): A literature review," *Journal of Infection and Public Health*, vol. 13, no. 5, pp. 667–673, May 2020, doi: 10.1016/j.jiph.2020.03.019.

[20]   S. Feng, C. Shen, N. Xia, W. Song, M. Fan, and B. J. Cowling, "Rational use of face masks in the COVID-19 pandemic," *The Lancet Respiratory Medicine*, vol. 8, no. 5, pp. 434–436, May 2020, doi: 10.1016/S2213-2600(20)30134-X.

[21]   S. Lai *et al.*, "Effect of non-pharmaceutical interventions to contain COVID-19 in China," *Nature*, vol. 585, no. 7825, pp. 410–413, Sep. 2020, doi: 10.1038/s41586-020-2293-x.

[22]   K. M. Almutairi *et al.*, "Awareness, Attitudes, and Practices Related to Coronavirus Pandemic Among Public in Saudi Arabia," *Family & Community Health*, vol. 38, no. 4, pp. 332–340, Oct. 2015, doi: 10.1097/FCH.0000000000000082.

[23]   R. C. Reuben, M. M. A. Danladi, D. A. Saleh, and P. E. Ejembi, "Knowledge, Attitudes and Practices Towards COVID-19: An Epidemiological Survey in North-Central Nigeria," *Journal of Community Health*, vol. 46, no. 3, pp. 457–470, Jun. 2021, doi: 10.1007/s10900-020-00881-1.

[24]   A. Asaad, R. El Sokkary, M. Alzamanan, and M. El Shafei, "Knowledge and attitudes towards Middle East respiratory sydrome-coronavirus (MERS-CoV) among health care workers in south-western Saudi Arabia," *Eastern Mediterranean Health Journal*, vol. 26, no. 04, pp. 435–442, Apr. 2020, doi: 10.26719/emhj.19.079.

[25]   D. M. Bell, "Public Health Interventions and SARS Spread, 2003," *Emerging Infectious Diseases*, vol. 10, no. 11, pp. 1900–1906, Nov. 2004, doi: 10.3201/eid1011.040729.

[26]   A.-M. Vartti *et al.*, "SARS Knowledge, Perceptions, and Behaviors: a Comparison between Finns and the Dutch during the SARS Outbreak in 2003," *International Journal of Behavioral Medicine*, vol. 16, no. 1, pp. 41–48, Mar. 2009, doi: 10.1007/s12529-008-9004-6.

[27] N. M. Dorfan and S. R. Woody, "Danger Appraisals as Prospective Predictors of Disgust and Avoidance of Contaminants," *Journal of Social and Clinical Psychology*, vol. 30, no. 2, pp. 105–132, Feb. 2011, doi: 10.1521/jscp.2011.30.2.105.

[28] J. Z. Yang and H. Chu, "Who is afraid of the Ebola outbreak? The influence of discrete emotions on risk perception," *Journal of Risk Research*, vol. 21, no. 7, pp. 834–853, Jul. 2018, doi: 10.1080/13669877.2016.1247378.

[29] J. Brug, A. R. Aro, A. Oenema, O. de Zwart, J. H. Richardus, and G. D. Bishop, "SARS Risk Perception, Knowledge, Precautions, and Information Sources, the Netherlands," *Emerging Infectious Diseases*, vol. 10, no. 8, pp. 1486–1489, Aug. 2004, doi: 10.3201/eid1008.040283.

[30] C. J S and Y. N. Y, "Perceived Knowledge, Attitude, and Compliance with Preventive Behavior on Influenza A (H1N1) by University Students," *The Korean Academic Society of Adult Nursing*, vol. 22, no. 3, pp. 250–259, 2010.

[31] Z. A. Hussain, S. A. Hussain, and F. A. Hussain, "Medical students' knowledge, perceptions, and behavioral intentions towards the H1N1 influenza, swine flu, in Pakistan: A brief report," *American Journal of Infection Control*, vol. 40, no. 3, pp. e11–e13, Apr. 2012, doi: 10.1016/j.ajic.2011.12.004.

[32] D. Tsegaye, M. Shuremu, D. Oljira, S. Dubale, G. Befekadu, and K. Bidira, "COVID – 19 related knowledge and preventive practices early in the outbreak among health care workers in selected public health facilities of Illu aba Bor and Buno Bedelle zones, Southwest Ethiopia," *BMC Infectious Diseases*, vol. 21, no. 1, p. 490, Dec. 2021, doi: 10.1186/s12879-021-06218-0.

[33] J. Zhang *et al.*, "Knowledge, Attitude, and Practice Survey of COVID-19 Among Healthcare Students During the COVID-19 Outbreak in China: An Online Cross-Sectional Survey," *Frontiers in Public Health*, vol. 9, Oct. 2021, doi: 10.3389/fpubh.2021.742314.

[34] M. Lee, B.-A. Kang, and M. You, "Knowledge, attitudes, and practices (KAP) toward COVID-19: a cross-sectional study in South Korea," *BMC Public Health*, vol. 21, no. 1, p. 295, Dec. 2021, doi: 10.1186/s12889-021-10285-y.

[35] M. M. Patwary *et al.*, "Knowledge, Attitudes, and Practices Toward Coronavirus and Associated Anxiety Symptoms Among University Students: A Cross-Sectional Study During the Early Stages of the COVID-19 Pandemic in Bangladesh," *Frontiers in Psychiatry*, vol. 13, Apr. 2022, doi: 10.3389/fpsyt.2022.856202.

[36] I. Hussain *et al.*, "Knowledge, Attitude, and Practices Toward COVID-19 in Primary Healthcare Providers: A Cross-Sectional Study from Three Tertiary Care Hospitals of Peshawar, Pakistan," *Journal of Community Health*, vol. 46, no. 3, pp. 441–449, Jun. 2021, doi: 10.1007/s10900-020-00879-9.

[37] M. G. Rabbani, O. Akter, M. Z. Hasan, N. Samad, S. S. Mahmood, and T. Joarder, "COVID-19 Knowledge, Attitudes, and Practices Among People in Bangladesh: Telephone-Based Cross-sectional Survey," *JMIR Formative Research*, vol. 5, no. 11, p. e28344, Nov. 2021, doi: 10.2196/28344.

[38] D. and H. Survey, "DHS Comparative Reports: DHS Wealth Index." [Online]. Available: https://dhsprogram.com/pubs/pdf/CR6/CR6.pdf

[39] M. Z. Ferdous, M. S. Islam, M. T. Sikder, A. S. M. Mosaddek, J. A. Zegarra-Valdivia, and D. Gozal, "Knowledge, attitude, and practice regarding COVID-19 outbreak in Bangladesh: An online-based cross-sectional study," *PLOS ONE*, vol. 15, no. 10, p. e0239254, Oct. 2020, doi: 10.1371/journal.pone.0239254.

[40] G. Berihun *et al.*, "Knowledge, attitude, and preventive practices towards COVID-19 among students of Ethiopian higher education institutions," *Journal of Multidisciplinary Healthcare*, vol. 14, pp. 2123–2136, 2021, doi: 10.2147/JMDH.S322495.

[41] A. Ikhlaq, H. Bint E Riaz, I. Bashir, and F. Ijaz, "Awareness and Attitude of Undergraduate Medical Students towards 2019-novel Corona virus," *Pakistan Journal of Medical Sciences*, vol. 36, no. COVID19-S4, May 2020, doi: 10.12669/pjms.36.COVID19-S4.2636.

[42] J. Prasad Singh, A. Sewda, and D. G. Shiv, "Assessing the Knowledge, Attitude and Practices of Students Regarding the COVID-19 Pandemic," *Journal of Health Management*, vol. 22, no. 2, pp. 281–290, 2020, doi: 10.1177/0972063420935669.

[43] A. P. Bautista, D. Balibrea, and D. G. Bleza, "Knowledge, attitude and practice toward the coronavirus disease (Covid-19) outbreak among selected employed people in the national capital region, philippines," *Asian Journal for Public Opinion Research*, vol. 8, no. 3, pp. 324–350, 2020, doi: 10.15206/ajpor.2020.8.3.324.

[44] N. Sahib Khalil, B. Al-Yuzbaki, and R. S. Tawfeeq, "COVID-19 knowledge, attitude and practice among medical undergraduate students in Baghdad City," *EurAsian Journal of BioSciences Eurasia J Biosci*, vol. 14, no. October, pp. 4179–4186, 2020.

[45] Z. Fatmi *et al.*, "Knowledge, attitudes and practices towards COVID-19 among Pakistani residents: information access and low literacy vulnerabilities," *Eastern Mediterranean Health Journal*, vol. 26, no. 12, pp. 1446–1455, Dec. 2020, doi: 10.26719/emhj.20.133.

[46] B. Kumar, S. D. Pinky, and A. M. Nurudden, "Knowledge, attitudes and practices towards COVID-19 guidelines among students in Bangladesh," *Social Sciences & Humanities Open*, vol. 4, no. 1, p. 100194, 2021, doi: 10.1016/j.ssaho.2021.100194.

[47] R. Nyeko, S. B. Amanya, M. Aleni, and F. Akello, "Unsatisfactory COVID-19-Related Knowledge, Attitudes and Practices among Undergraduate University Students in Uganda: An Online Cross-Sectional Survey," *Open Journal of Preventive Medicine*, vol. 11, no. 06, pp. 259–277, 2021, doi: 10.4236/ojpm.2021.116021.

[48] M. Saha, G. Saha, and M. Islam, "Knowledge, attitude, and practice of Bangladeshi residents during COVID-19 pandemic," *PLOS Global Public Health*, vol. 2, no. 5, p. e0000407, May 2022, doi: 10.1371/journal.pgph.0000407.

[49] D. Gebretsadik, S. Gebremichael, and M. A. Belete, "Knowledge, Attitude and Practice Toward COVID-19 Pandemic Among Population Visiting Dessie Health Center for COVID-19 Screening, Northeast Ethiopia," *Infection and Drug Resistance*, vol. Volume 14, pp. 905–915, Mar. 2021, doi: 10.2147/IDR.S297047.

[50] B. A. Kassie, A. Adane, Y. T. Tilahun, E. A. Kassahun, A. S. Ayele, and A. K. Belew, "Knowledge and attitude towards COVID-19 and associated factors among health care providers in Northwest Ethiopia," *PLOS ONE*, vol. 15, no. 8, p. e0238415, Aug. 2020, doi: 10.1371/journal.pone.0238415.

[51] M. Endriyas *et al.*, "Knowledge and attitude towards COVID-19 and its prevention in selected ten towns of SNNP Region, Ethiopia: Cross-sectional survey," *PLOS ONE*, vol. 16, no. 8, p. e0255884, Aug. 2021, doi: 10.1371/journal.pone.0255884.

BIOGRAPHIES OF AUTHORS

Md. Shahjahan 🆔 📇 SC ↻ has more than 25 years of experience on teaching, planning, and coordinating training courses at graduate and post graduate institutes. Inaddition to all academic responsibilities, he is conducting research activities covering the issues of public health, population, reproductive health and family planning along with reviewing Project proposals, monitoring, evaluating the researchactivities, and managing and analyzing various complex datasets for scientific and technical reporting. Prof. Shahjahan has performed manykey responsibilities in different organizations in various capacities and gained substantial knowledge on classroom teaching andsupervising student's dissertation. He can be contacted at e-mail: drshahjahan@daffodilvarsity.edu.bd.

M. Mazharul Islam 🆔 📇 SC ↻ is working in the department of Statistics at Sultan Qaboos University (SQU) in Sultanate of Oman. Before joining SQU, he has been a Professor of Statistics at University of Dhaka, Bangladesh. On top of teaching Statistics over the last 38 years of teaching life, Prof. Islam carried out a sizable number of applied research projects and provided consultancy services to different international organizations including ADB, UNFPA, USAID, EU, CIDA, UNESCO, UNICEF, WHO, UNAIDS, ICDDR'B and a host of national and international NGOs.He has published over one hundred peer-reviewed scientific articles in major journals on the subjects of statistics, health, population and social sciences. He can be contacted at e-mail: mislam@squ.edu.om.

Md. Kamrul Hossain 🆔 📇 SC ↻ is affiliated to Department of General Educational Development, Daffodil International University, where he is currently working as Associate Professor and Head of the Department. Dr. Hossain has authored and co-authored several national and international publications and also working as a reviewer for reputed journals. He is having an active association with different societies and academies around the world. He can be contacted email: kamrul.ged@diu.edu.bd.

Md. Ruhul Amin 🆔 📇 SC ↻ is working as Director BMRC, Mohakhali, Dhaka After completing of MD(EM) degree from BSMMU, he was posted at Sir Salimullah Medical College and at Dhaka Medical College as Head of the Department of Endocrinology.He has 11 publications in national and international journals.Ethical guidelines for conducting research on human subjects, SOP for health strategy, the establishment of the digital library, IRB formation, manpower development for research, and many other activities for the development of a research culture are going on in the BMRC under his leadership. He can be contacted email: capruhulamin@gmail.com.

Mostafa Kamal 🆔 📇 SC ↻ is working as Dean, Academic Affair in Daffodil International University, Dhaka, Bangladesh. Prof. Kamal has published more than 30 articles in national and international indexed journal. His expertise area of teaching is Real Estate Finance, Finance, Management & Micro Credit. Prof. Kamal has keen interest of research in the area of Academic Institutions, Real Estate & Housing Finance, Management, Micro Credit, Academic Curriculum & Conflict Management. He is founder of BIRD, a national level NGO in Bangladesh. He can be contacted email: m.kamal@daffodilvarsity.edu.bd.

Mohammad Saiful Islam ⓘ 🔗 SC 🔵 earned his MBBS from Sir Salimullah Medical College, Dhaka in 2000 and completed MPH in 2011 from University of Dhaka. Dr. Islam has worked at graduate and postgraduate institutions for more than 20 years and experience developing, organizing, and instructing courses on research methodology. In addition to his duties, he has performing research on topics related to public health, policy planning, monitoring with the evaluating the research activities, and preparing project proposals for execution. Dr. Islam carried out numerous important tasks in a variety of capacities for numerous distinct institutes while also learning a great deal. He can be contacted email: drsaifulislam@gmail.com.

APPENDIX

Table 5. Distribution of attitudes and odds of positive attitudes about COVID-19

Characteristics	Attitudes towards COVID-19			Adjusted odds ratio (AOR) of positive attitudes towards COVID-19 with 95% CI		
	Positive	Negative	p-value	AOR	95% CI	p-value
Total sample	78.6	21.4				
Age			0.024			
< 20	81.4	18.6		1.13	0.92 - 2.78	0.098
20-24	80.4	19.6		1.08	0.89 - 1.79	0.118
25-29	76.0	24.0		1.02	0.81 - 1.68	0.287
30+ (ref.)	75.8	24.2		1.00		
Gender			0.033			
Male	81.3	18.7		1.58	1.20 - 2.98	0.039
Female (ref.)	76.9	23.1		1.00		
Marital status			0.834			
Single	79.1	20.9		1.01	0.85 - 2.16	0.364
Married (ref.)	76.8	23.2		1.00		
Place of permanent residence			0.018			
Dhaka	80.6	19.4		1.36	1.12 - 2.31	0.016
Outside Dhaka (ref.)	76.0	24.0		1.00		
Level of education			0.038			
Primary (ref.)	70.3	29.7		1.00		
Secondary	74.2	25.8		1.08	0.37 - 2.12	0.414
Higher Secondary	77.1	22.9		1.86	1.09 - 2.59	0.023
Graduate or above	81.2	18.8		2.56	1.87 - 3.85	0.008
Occupation			0.048			
Student	78.9	21.1		1.36	1.10 - 2.66	0.047
Health worker	82.7	17.3		2.83	1.19 - 3.23	0.011
Service holder	76.2	23.8		1.18	0.78 - 2.65	0.114
Business	74.8	25.2		1.02	0.89 - 3.12	0.110
Others (ref.)	72.3	27.7		1.00		
Monthly HH income (in OR)			0.342			
Up to 15,000	76.3	23.7		0.76	0.58 - 1.72	0.277
15,001-30,000	78.4	21.6		0.89	0.63 - 1.85	0.293
Above 30,000 (ref.)	78.8	21.2		1.00		
Wealth Index			0.048			
Poorest (ref.)	73.1	26.9		1.00		
Poorer	74.6	25.4		1.02	0.77 - 1.83	0.876
Middle	76.8	23.2		1.04	0.78 - 2.03	0.486
Wealthier	78.9	21.1		1.44	0.82 - 2.13	0.120
Wealthiest	80.2	19.8		1.96	0.98 - 2.33	0.098
Test for COVID-19			0.578			
Not tested	76.7	23.3		0.85	0.78 - 1.98	0.725
Tested Negative	80.2	19.8		1.08	0.66 - 2.19	0.452
Tested positive (ref.)	78.8	21.2		1.00		
Health status			0.782			
Good	77.3	22.7		0.87	0.56 - 1.98	0.785
Moderate	82.4	17.6		1.03	0.78 - 2.18	0.461
Bad (ref.)	80.1	19.9		1.00		
Knowledge about COVID-19			0.003			
Good	84.2	15.8		3.13	1.24 - 4.76	<0.001
Poor (ref.)	76.8	23.2		1.00		