Knowledge, attitudes, and practices towards measures for prevention of the spread of COVID-19: An online cross-sectional survey among Bangladeshi residents

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Abstract

Background

The novel coronavirus (SARS-CoV-2/ COVID-19) rapidly infects people across the world, leading to a massive public reaction. Peoples' knowledge, attitudes, and practices (KAP) towards measures for prevention of the spread of COVID-19 are the most important for the control and prevention of the pandemic infectious disease.

Objectives

This study aimed to assess the knowledge, attitude & practices (KAP) towards measures for prevention of the spread of COVID-19 among Bangladeshi residents during the COVID-19 pandemic.

Methods

An online survey of 1765 respondents was conducted through the social media networks of authors.

Results

The respondents were older than 18 years, with an average age of 24.88 years (SD: 6.30). Approximately 15% of our participants received online training. The mean knowledge score was 14.49 (SD: 1.8, ranging: 0-17), and the overall correct response rate on this knowledge test was 85%. About 67.2 % scored well (above the mean: 4.5, range: 1-5) regarding the practices. To avoid the infection, 96.6% wear mask outside the home, and 98.7% washed hand with soap when came back. COVID-19 knowledge score was significantly associated with a lower risk of (OR: 0.87, 95% CI: 0.79-0.92) of negative attitudes. Again, the awareness score was associated with a lower likelihood of (OR: 0.94, 95% CI: 0.87-0.98) of poor practices.

Conclusion

Online health education programs focusing on young people, housewife and people with less education may potentially improve the attitudes and practices to control the COVID-19 pandemic in long term in such a low resource setting.

Keywords: COVID-19, knowledge, attitude, practice, Bangladesh

Introduction

The novel coronavirus disease 19 (COVID-19) is a highly transmissible human respiratory disease infecting more than 10 millions peoples and causing approximately 501,000 deaths across the worldwide until 1st July 2020(WHO 2020a). COVID-19 is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that first appeared in Wuhan, China (Rothan and Byrareddy 2020). This zoonotic virus can be transmitted by droplets, fecal-oral route, and direct contact, and has an incubation period of 1 to 14 days (Schoeman and Fielding 2019; CDC 2020; Huynh and Nguyen 2020; Li et al. 2020; WHO 2020b), after which, it can cause flu-like symptoms and serious respiratory failure and death. The elderly and those with chssronic diseases are at a greater risk of more serious health outcomes (He et al. 2020; Team 2020). Contrary, individuals who test positive for COVID-19 can show no symptoms and may not be as contagious, limiting their ability to spread the virus (Sauer 2020). Due to these situations, the World Health Organization (WHO) declared COVID-19 as a public health emergency of international concern (PHEIC) (He et al. 2020; Team 2020; WHO 2020c) and a ‘global pandemic’ on 11th March 2020 (WHO 2020d).

On March 08, 2020, Bangladesh reported its first COVID-19 case (Agency 2020; THE BUSINESS STANDARD 2020; WHO 2020e). As part of efforts to contain the outbreak, on March 16th 2020 the Government of Bangladesh closed all educational institutions to contain the COVID-19 outbreak. The government also forbid all public gatherings, announced the closure of public and private offices,(WHO 2020f) and suspended travel from current countries who were showing the highest number of COVID-19 cases at the time; China, Iran, and Italy (Agency 2020). The response of the citizens to these government rules was largely unknown and undocumented, and ultimately depends on their attitude and perception of the seriousness of the problem (De La Vega et al. 2020). As of 1st July 2020, COVID 19 confirmed cases in Bangladesh increased to 1,45,484 including 1,874 deaths (IEDCR 2020). As there is no current cure or vaccine for the COVID-19 and medical treatments are limited to supportive care, (Bhagavathula et al. 2020; Huynh and Nguyen 2020) the WHO has placed an emphasis on prevention. This includes increasing the awareness of the disease and it’s consequences for health, promoting good personal hygiene practices, and suggesting a positive attitude towards diseased persons, all in an effort to contain the transmission of COVID-19 (WHO 2020g).

In the past, knowledge, attitudes, precautionary behaviors, and active social participation had positive effects on the control of the epidemics of SARS, Ebola, and H1N1 human influenza flu (Bell 2003; Vartti et al. 2009; Dorfan and Woody 2011; Yang and Chu 2018). Knowledge of infection pathways and relevant precautions to take is needed to control the pandemic. Previous studies (Brug et al. 2004; Choi and Yang 2010; Hussain et al. 2012) showed that the knowledge of infectious disease allows the individual to act to prevent infection. To achieve ultimate success against COVID-19 in Bangladesh, people’s awareness, healthy practices, and positive

commitment are necessary to help contain transmission of the virus, according to KAP theory (Tachfouti et al. 2012; Ajilore et al. 2017). To the best of our knowledge, no study has investigated the KAP towards COVID-19 in Bangladeshi residents. There is an urgent need to understand the public's awareness of COVID-19 at this critical moment to facilitate its outbreak management as efforts towards a vaccine remain underway. This study aimed to evaluate the knowledge, attitude and practices among the people of Bangladesh during the COVID-19 pandemic.

Methodology

Setting and participants

A prospective cross-sectional web-based survey was conducted from April 12th to April 18th, 2020, approximately one week after the lockdown of Bangladesh. Since a community-based national sampling survey was not feasible during this situation, we decided to collect the data online. The authors distributed the survey link in all divisions of Bangladesh via social media using snowball sampling. The authors assumed a 50% response of KAP, 5% level of significance, and 2.5% margin of error, the total sample size was 1,537 to achieve 80% power. During the data collection period, we found 1,765 participants. All individuals were included in the analysis. The survey targeted responses primarily from individuals 18 years and older. The study sample was drawn from 8 Bangladesh divisions (i.e., regions/states) each representing approximately 10.2-16.3% of the entire sample, except for one division (Sylhet division) (7.3%).

Procedures

We developed an anonymous online questionnaire to gather data from respondents, developed using WHO course materials on emerging respiratory viruses, including COVID-19. The study tool was originally written in English and then translated into Bangla by an expert in both languages (WHO 2020b, h). Prior to data collection, the online questionnaire was piloted in a random sample of users group to identify any problems related to clarity and understanding. The online questionnaire included a short overview of the context, purpose, procedures, statements about the voluntary and confidential nature of participant responses, and additional notes to assist with completing the questionnaire. The study was performed following the Helsinki Declaration as revised in 2013. By clicking the link sent to the participants inbox, the user was automatically directed to the study overview and informed consent page. Consenting participants were required to complete demographic information prior to completing the questionnaire. The study was conducted following the Checklist for Reporting Results of Internet ESurveys (CHERRIES) guidelines.

Contents of the study tool

The survey instrument was 37-close ended questions, and took about 5-7 minutes to complete. The 37-item questionnaire was split into four sections, including participant demographics (11 items), knowledge about COVID-19 (17 items), attitudes towards COVID-19 (6 items), and practices related to COVID-19 (5 items). These questions were addressed with an additional "I don't know" option on a true/false foundation. 1 point was allocated for the correct answer and 0 points for the incorrect/unknown response. The overall score for knowledge ranged from 0 to 17; the score for attitude ranged from 0 to 6; and the score for practice ranged from 0 to 5. The Cronbach's alpha coefficient of the knowledge questionnaire, questionnaire toward attitude, and questionnaire related to practice was 0.80, 0.81, and 0.79, respectively indicating acceptable internal consistency (Taber 2018).

Statistical analysis

Descriptive analyses (frequency, percent, mean and standard deviation) were computed in all demographic variables, and for knowledge, attitude, and practices (KAP) towards COVID 19. A one way analysis of variance (ANOVA) and independent-sample t-test was employed for KAP across all demographical variables. Multiple linear regression assessed knowledge scores of COVID-19 to explore associated factors. Based on the adjusted R square and Mallows' C_p criterion, the regression model was selected as the final model. All assumptions were checked regarding linear regression after fitting the model. Binary and multinomial logistic regression model was applied for the practice and attitude domains, respectively, to explore associated factors. Odds ratio (OR) and 95% confidence interval (CI) were used to quantify the associations. All analyses were completed using the statistical package SPSS 20.0 and SAS 9.3. The level of significance was set at 5% for all analyses.

Results

Out of 1,765 respondents, all the participants were Bangladeshi citizens, 64% male, with an average age of 24.8 years (SD-6.30, range:18-72 years). Over half (54.9%) of the respondents were between 21-25 years of age groups. Unmarried persons made up over 75% of participants.

Among the online users, 99.2% knew the mode of transmission, 93.3% informed about clinical signs, and 92.5% agreed with 2-14 days incubation. Regarding minimizing the spread of the virus, 99.2% of respondents knew that hand hygiene, covering nose and mouth while coughing, avoiding contact with sick persons, and avoiding crowded places can reduce their risk of contracting COVID-19. Also, 99% of respondents knew that home quarantine is crucial to other's safety (**Table-1**).

The mean knowledge score was 14.49 (SD: 1.8, range: 0-17). This average score indicated that a substantial proportion of respondents was aware of the basic knowledge of COVID-19. The overall correct response rate on this knowledge test was 85% ($14.49/17 \times 100$). Knowledge mean scores were significantly different across all demographical variables except gender. Male (85.5%), aged between 26-30 years old (83.4%), masters educated persons (88.5%), health professionals (90.5%), city area peoples (86.3%), and trained respondents (90.0%) responded better among the respective categories (**Table-2**).

Multiple linear regression models were selected by using adjusted R-square (R_a^2) (0.62) and smallest Mallows Cp-criterion (13.70). Also, normality, independence, homoscedasticity, and linearity satisfied the model. Multiple linear regression analysis revealed that age ≤ 20 years (vs. >30 years), ≤ 30000 BD TK income (vs. >30000 BDTK), Hindu and others religion (vs. Muslim), secondary education, higher secondary and undergraduate (vs. masters), business and others (vs. employee) were associated with lower knowledge scores of COVID-19. On the other hand, male (vs. female), scientific features (vs. TV), and training (vs. no training) were associated with higher scores. There was an interaction effect between occupation business (vs. employee) and training (vs. no training) (**Table-3**).

Just over half (51.7%) of the participants have confidence that Bangladesh will win the battle against COVID-19. Similarly, 54.4% were worried that they and family members could get sick with COVID-19 at any time, and did not want any individuals in the community even after they recovered from illness. In addition, 94.1% of responders thought that social distancing is essential to stop the spread of the virus. All attitudes were significantly associated with different demographic variables. Only gender was not associated with attitudes. The mean knowledge score was significantly different for all attitudes towards COVID-19 (**Table-4**).

Characteristics of the participants were associated with the attitudes towards the COVID-19. On the contrary, people who received online training were less likely not to win the combat against COVID-19. Unemployed responders and homemakers were more likely to be unsure about the win over COVID-19. In the event of getting ill, older people (age >30) and television viewers were more likely to disagree about being sick than younger peoples (age ≤ 20) and individuals who used miscellaneous outlets for details. With respect to social distancing, who did not receive COVID-19 training were more likely to be unaware of controlling the COVID-19. Unmarried persons and television audiences (vs. other sources) were more disagreeable about not allowing people in the community following recovery from the virus. Untrained persons were more confused to allow the recovered persons in society (**Table 5**).

More than 11 % of respondents recently went outside the house. As protective measures, 96.6% wore masks outside, 98.7% washed hand with soap, and 82.8% changed clothing when they returned home. Recently, more than one-third of employed persons went outside, followed by individuals who were aged over 30 years old

(23.5%), and who were married (20.6 %), respectively. About 88% disinfected their hands after sneezing or coughing when they used their hand to cover their mouth. Only high school students comparatively ignored (67.6 %) the practices. All practices were significantly associated with different demographic variables. The mean knowledge scores were significantly different for the three practices like wearing mask when go outside, disinfect hand and changes clothes after returning from outside (P2, P3, and P4) (**Table-6**).

Table 7 shows practices towards COVID-19 and associated factors. Based on the average value of respondents (mean, 4.5), the practice score was classified as poor or low (≤ 4.5) versus high (> 4.5) score. Almost 67.2% scored high regarding the practices. The goodness of fit for the logistic regression model was (Chi-square=7.49 and P value=0.48) verified by Hosmer and Lemeshow goodness of fit test. Male (vs. female, OR: 3.22, $P < 0.001$), 26 to 30 age group (vs. above 30 years, OR: 1.32, $P = 0.03$), married person (vs. unmarried, OR: 1.58, $p = 0.01$), undergraduate students (vs. masters students, OR: 1.42, $P = 0.03$), non-employee and housewife (vs. employee, OR: 3.38 and 5.07, $P = 0.002$ and $P = 0.0007$), newspaper readers (vs. TV audiences, OR: 1.62, $P = 0.01$), and COVID-19 knowledge score (OR: 0.94, $P = 0.03$) were significantly associated with low practice scores.

Discussion

Bangladesh has entered into community transmission phases of the COVID-19 pandemic (Anwar et al. 2020). People in the community face several challenges during such periods. People should be well aware and practice accordingly to reduce the risk of being infected and transmitting the virus to others.. This study firstly explores the KAP of COVID-19 in this country. Most of our studied participants (85%) responded correctly on overall basic knowledge of the COVID-19 which was almost similar to China (90%) (Zhong et al. 2020), Iran (90% and 85% in two knowledge tests) [34], and the USA residents (80% knowledge scores) (Clements 2020). The little fluctuation may be due to the variation in characteristics of subjects like the highly educated sample (Zhong et al. 2020), and the inclusion of more health-related professionals [34]. For instance, we found a 90.5% correct response rate among health professionals, which was in accordance with the findings from Vietnamese health workers (Huynh and Nguyen 2020). Moreover, types of questions also affect the mean response rate of participants. The rate could be lower for more technical queries. This study showed the lowest correct response rates for K13 (COVID-19 is caused by a virus called SARS-CoV-2) (29.8%), which decreased the mean rates of correct answers for all queries. A study conducted in India revealed the responders had a moderate level of knowledge on infection, and adequate knowledge about its preventive aspects with the authors stating this is likely due to the government and media emphasizing more preventive measures (Roy et

al. 2020). However, the high ‘knowledge’ scores from our study might be due to the lag in the presence of the virus in Bangladesh. Specifically, COVID-19 was first identified near the end of 2019, and this study collected the data during the first two weeks of April 2020. Online users became more aware of the exposure of international media since the start of the outbreak. During the early period of the outbreak, a study about KAP towards COVID-19 among the bordered population of northern Thailand (Srichan et al. 2020) showed that 73.4% had poor knowledge of disease prevention and control.

The 36.4 to 56.9% population was optimistic that Bangladesh would win the fight against the COVID-19, where the percent of optimistic people in China (90.8%) and health workers in Vietnam (90%) was quite high (Huynh and Nguyen 2020; Zhong et al. 2020). Recently 5.5-35% of Bangladesh citizens from different demographic groups going outside, where nearly 96.4% of China residents avoided crowds during this COVID-19 pandemic (Zhong et al. 2020). Almost everyone (91-100%) wore masks when they went outside the home except the housewife, with similar results seen in the Chinese population (98%) (Zhong et al. 2020).

We found gender, family income, educational level, occupation, source of information were associated with the knowledge score towards COVID-19, which is similar to the findings from several studies [33-35]. Srichan et al. stated age, but not gender, was associated with knowledge in Thailand (Srichan et al. 2020). However, males (compared to females) were found with a higher knowledge score, which is in opposition to a study conducted in China (Zhong et al. 2020). This could be due to higher participation of males with high education levels in our study, with previous studies reporting, the association of education levels [33-35].

Only half (51.7%) of the participants had confidence about Bangladesh’s ability to overcome COVID-19, which was less than China (97.1%) (Zhong et al. 2020). This pessimistic response may be due to poor health care and quarantine facilities in Bangladesh. Further, Bangladeshi citizens' negative mindset may be related to inadequate health care services, low COVID-19 testing rate, and lower economic conditions. On the other hand, the optimistic attitude of the Chinese residents could be related to the unprecedented COVID-19 control measures such as traffic limits and shutdowns in critical areas and available medical workers and materials in highly impacted areas (Zhong et al. 2020).

Almost half of the respondents were afraid of getting the virus at any time. This fear could be due to the apparent failures regarding the successful management of the pandemic (e.g., lack of appropriate and widespread testing facilities, shortage of PPE etc.). In addition, Bangladesh citizens who were traveling abroad during the early stage of the pandemic neglected the home quarantine system and accelerated the outbreak. Also, the high density of the population makes it almost impossible to maintain social distancing in the food and medicine markets, which remained, and still remain, open during the shutdown period. Due to economic deprivation, many people in Bangladesh are being forced to go outside to get food. Around 80% of the health

workers in Vietnam were afraid of getting sick at any time, this could be due to their thought of more proximity of health care professionals to the patients and closeness of study setting to COVID-19 origin country China (Huynh and Nguyen 2020). More than half of our respondents denied accepting a previously-infected person back in the community. This may be due to high levels of fear of becoming infected. Roy et al. reported that fear and stigma was associated with the return of recovered COVID-19 patients into the mainstream society in India (Roy et al. 2020). Authorities are now simultaneously working on these social disparities. Adequate awareness may minimize the stigma and facilitate acceptance in the general population.

Most participants (94.1%) reported that social distancing is essential to stop the spreading of the virus. This could be due to the government and media emphasizing more on preventive measure (Roy et al. 2020). Besides, knowledge regarding the high infectivity and transmission possibilities via invisible respiratory droplets places a lot of importance on physical distancing (Zhong et al. 2020). These positive attitudes should be key measures for effective management of COVID-19, especially in highly-populated and low-health care-resourced countries like Bangladesh.

Our study found considerably positive practices towards COVID-19, which was supported by previous research in China (Zhong et al. 2020), and towards SARS in China (JIAO et al. 2005; Zhong et al. 2020). Most of the people took preventive measures against this infectious disease, such as refraining from public gatherings, wearing masks while going out and disinfecting their hands upon coming back from outside or public excursions. People following these preventive practices may be due to the swift preventive and controlling measures taken by the local government, such as prohibiting public gathering closing all educational institutions, and eventually locking down the whole country (WHO 2020f). In addition, following preventive practices could be a result of people's higher levels of knowledge about the infective nature of COVID-19. The present findings still showed that recently 11.27% of people went to crowded places, which is very much higher than in China (3.6%) (Zhong et al. 2020), and when outside, 3.4% of people did not wear masks. This discrepancy from other countries such as China may be due to the socio-economic conditions of both settings. Poor economic structures may force certain individuals to go outside as they have no other option to be physically separated from one another. This study also reported 12.2% did not sanitize their hands after sneezing or coughing, or did not cover their mouth. Moreover, our study findings revealed that 1.3% and 17.2% did not disinfect their hand with soap and change clothes after returning from the outside, respectively. These unfavorable and poor practices were mainly related to males 26 to 30 years of age, married persons, unemployed persons, housewives, undergraduate students, those taking newspaper as a source of information, trained persons, and poor COVID-19 knowledge. This study found that males were more likely to have a lower score of practices towards COVID-19 as compared to females, which is similar to a previous study conducted

in China (Zhong et al. 2020). Earlier studies on age and gender variations of risk-taking behaviors reported male and late adolescents are more likely to involve in risk-taking behaviors (Pawlowski et al. 2008; Cobey et al. 2013; Duell et al. 2018). This might be a plausible explanation of poor practices towards COVID-19 among males in this study. The study showed a higher risk of developing poor practices towards this infection among 26-30 age group (vs. >30 years) and married (vs. unmarried), which might be due to their responsibilities on family members, children, and peers. Undergraduate students were more susceptible to lower practices towards COVID-19 than masters' students; however these risky practices might be due to their younger age. The higher odds of developing poor practices were found to be associated with the occupation of unemployment and housewife (vs. employment). As housewives might be more unaware, and unemployed individuals need to go outside as a means of livelihood, which might be resulting in these lower levels of practices. The risk of having a low score of practices was found to be higher among people who got information on COVID-19 from newspaper than television. As television is an effective learning and reliable medium for all kinds of information which might be resulting knowledge into behaviors. It is worth mentioning that higher knowledge scores on COVID-19 were found to be significantly associated with a higher likelihood of positive practices towards the COVID-19 epidemic in this study area.

To be noted, this study only includes the highly qualified participants in this setting as over three-fourth of our responders had at least graduated from university. These results may only represent the higher-educated young adult individuals of Bangladesh. So, they cannot be generalized to the whole population. Given their poor economic and educational profiles of general people of this population, and previous findings of poor knowledge and attitudes toward disease prevention in a similar setting (Srichan et al. 2020), a community-based study may represent more accurate results for this area. Finally, we did not explore the causality of going outside for some specific groups (which may have been necessary) which could affect the quarantine campaign for the prevention of COVID-19.

Conclusion

Our study revealed that higher knowledge score regarding COVID-19 was significantly associated with a higher likelihood of having a positive attitude and good practices during the COVID-19 pandemic. The attitudes of the participants are moderate, but appropriate and hygienic practices are lacking to control the outbreak, despite a reasonable understanding of COVID-19. Peoples of Bangladesh are very reluctant to follow government instructions such as improvement of personal hygiene and avoiding unnecessary movement. Considering the current COVID-19 situation, where the number of COVID-19 cases and deaths are increasing day by day, the government should extend and strengthen lockdown to reduce the unnecessary movements of people. Another issue is the potential stigma of the integration of recovered COVID-19 patients

into the mainstream of society. Nearly one-third of all respondents and more than forty per cent of young and low-educated participants disagreed with allowing recovering patients to rejoin their communities. This implicates a higher level of fear among the community about the COVID-19 outbreak. The government should actively prevent the stigmatization and discrimination against recovered COVID-19 patients. Mass awareness campaigns that target specific demographic groups as housewives, youth, and people with less education may also change the attitudes and practices toward the COVID-19. This study provides early evidence of this issue, and we believe these results have important theoretical and practical consequences in understanding the knowledge, attitude, and practices of the public during the COVID-19 pandemic in Bangladesh. This study provides early evidence on this issue, and we believe these results have important theoretical and practical consequences in understanding the knowledge, attitude, and practices of the public during the pandemic situation in this setting and design of effective prevention strategies & policies.

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Table 1: Questionnaire of knowledge, attitudes, and practices towards COVID-19

Questions	Options
Knowledge (Correct rate, n (%) of the total sample)	
K1. COVID-19 is transmitted through sneezing, coughing and with contact of affected people. (99.2%)	True, False, I don't Know
K2. Headache, fever, cough, sore throat, and flu are symptoms of COVID-19. (93.3%)	True, False, I don't Know
K3. COVID-19 symptoms appear in 2-14 days. (92.5%)	True, False, I don't Know
K4. COVID-19 can lead to pneumonia, respiratory failure, and death. (93.9%)	True, False, I don't Know
K5. Supportive care is the current treatment for COVID-19. (76.7%)	True, False, I don't Know
K6. Hand hygiene, covering nose and mouth while coughing, and avoiding sick contacts can help in the prevention of COVID-19 transmission. (99.2%)	True, False, I don't Know
K7. A Flu vaccination is sufficient for preventing COVID-19. (71.6%)	True, False, I don't Know
K8. Eating well-cooked and safely handled meat would result in COVID-19infection. (74.4%)	True, False, I don't Know
K9. Sick patients should share their recent travel history with healthcare providers. (93.5%)	True, False, I don't Know
K10. Disinfect equipment, surfaces? and working areas in markets at least once a day. (93.3%)	True, False, I don't Know
K11. It is not necessary for children and young adults to take measures to prevent the COVID-19 infection -. (86.4%)	True, False, I don't Know
K12. To prevent the COVID-19 infection, individuals should avoid going to crowded places. (99.2%)	True, False, I don't Know
K13. COVID-19 is caused by a virus called SARS-CoV-2. (29.8%)	True, False, I don't Know
K14. Are antibiotics effective in preventing or treating COVID-19? (55.5%)	Yes, No, I don't Know
K15. COVID-19 is a contagious disease. (91.8%)	True, False, I don't Know
K16. Hand should be washed with soap for at least 20 seconds. (98.9%)	True, False, I don't Know
K17. Do u know home quarantine is crucial to save others from COVID-19? (99.5%)	Yes, No, I don't Know
Attitudes	
A1. Do you have confidence that Bangladesh can win the battle against the COVID-19 virus?	Yes, No, Don't know
A2. Do you think that you and your family may get sick with COVID-19	Yes, No, Don't know
A3. Do you think social distancing is essential to stop the spread of the virus?	Yes, No, Don't know
A4. Would you allow infected individuals into your community after they've recovered from COVID-19, as you did previously?	Yes, No, Don't know
Practices	
P1. In recent days, have you gone to any crowded place?	Yes, No
P2. In recent days, have you worn a mask when leaving home?	Yes, No
P3. Do you disinfect your hand with soap upon returning from public places?	Yes, No
P4. Do you change your clothes when you come back from public places?	Yes, No
P5. Do you disinfect your hand after sneezing or coughing into your hand	Yes, No

Table 2: Distribution of respondents and ‘Knowledge’ scores of COVID-19 across demographics in Bangladesh, 2020. (N=1,765)

Parameters	Categories	Frequency (%)	Knowledge score (mean $\pm$ SD)	t/F	P value
Gender	Male	1129 (64)	14.54 $\pm$ 1.84	1.79	0.074
	Female	636 (36)	14.38 $\pm$ 1.82		
Age	≤ 20	288 (16.3)	13.81 $\pm$ 2.12	8.33	< 0.001
	21-25	969 (54.9)	14.63 $\pm$ 1.55		
	26-30	338 (19.2)	14.82 $\pm$ 1.77		
	Above 30	170 (9.6)	14.18 $\pm$ 2.51		
Monthly income(Tk)	$\leq 30,000$	940 (53.3)	14.38 $\pm$ 1.79	2.71	0.007
	> 30,000	825 (46.7)	14.61 $\pm$ 1.88		
Religion	Muslim	1380 (78.2)	14.53 $\pm$ 1.84	1.89	0.031
	Hindu	373 (21.1)	14.38 $\pm$ 1.77		
	Others	12 (0.7)	12.75 $\pm$ 2.73		
Marital status	Married	384(21.8)	14.45 $\pm$ 2.13		
	Unmarried	1381(78.2)	14.50 $\pm$ 1.74		
Education status	Below secondary	6 (0.3)	9.67 $\pm$ 5.82	23.46	< 0.001
	High School	62(3.5)	11.97 $\pm$ 2.52		
	College	223(12.6)	13.90 $\pm$ 2.14		
	Honours	999(56.6)	14.54 $\pm$ 1.61		
	Masters or Higher	475 (26.9)	15.04 $\pm$ 1.46		
Occupation	Student	937 (53.1)	14.41 $\pm$ 1.75	5.40	< 0.001
	Health Professional	118 (6.7)	15.39 $\pm$ 1.17		
	Employee	352 (19.9)	14.81 $\pm$ 1.7		
	Business	40 (2.3)	13.75 $\pm$ 2.46		
	Unemployed	184 (10.4)	14.55 $\pm$ 1.82		
	Housewife	68 (3.9)	13.00 $\pm$ 2.81		
	Others	66 (3.7)	14.00 $\pm$ 1.79		
Residence	Rural	497 (28.2)	14.23 $\pm$ 2.13	3.34	< 0.001
	Semi-urban	621 (35.2)	14.49 $\pm$ 1.74		
	Urban	647 (36.7)	14.68 $\pm$ 1.65		
Source of information	Facebook	894 (50.7)	14.48 $\pm$ 1.70	6.84	< 0.001
	TV	625 (35.4)	14.48 $\pm$ 1.83		
	Newspaper	98 (5.6)	14.65 $\pm$ 2.05		
	Scientific features	58 (3.3)	15.40 $\pm$ 1.12		
	Others	90 (5.1)	13.79 $\pm$ 2.81		
Received training	Yes	260 (14.7)	15.30 $\pm$ 1.28	7.92	< 0.001
	No	1505 (85.3)	14.34 $\pm$ 1.88		

Table 3: Characteristics of respondents associated with COVID-19 ‘Knowledge’ score

Parameters	Estimate	Standard error	t	P value
Intercept	14.903	0.109	18715.1	<.0001
Gender (male vs. female)	0.169	0.086	3.85	0.049
Age (≤ 20 vs. > 30)	-0.405	0.115	12.30	0.001
Income ($\leq 30,000$ <i>vs</i> $> 30,000$)	-0.173	0.080	4.67	0.031
Religion (Hindu vs. Muslim)	-0.195	0.098	3.94	0.047
Religion (others vs. Muslim)	-1.357	0.487	7.78	0.005
Education (high school vs. masters)	-2.907	0.222	170.73	<.0001
Education (college vs. masters)	-0.831	0.143	33.89	<.0001
Education (honors vs. masters)	-0.375	0.097	15.11	0.0001
Occupation (health professionals vs. employee)	0.569	0.165	11.89	0.001
Occupation (business vs. employee)	-1.205	0.293	16.87	<.0001
Occupation (others vs. employee)	-0.436	0.214	4.14	0.042
Source (scientific features vs. TV)	0.577	0.227	6.46	0.0111
Training (yes vs. no)	0.566	0.120	22.29	<.0001
Occupation (business)*training (yes)	1.749	0.749	5.45	0.019

Table 4: Distribution of participants based on ‘Attitudes’ towards COVID-19 by demographic variables

Characteristics	Attitudes, n (%) or mean (SD)											
	A1			A2			A3			A4		
	Agree	Disagree	Don't know	Agree	Disagree	Don't know	Agree	Disagree	Don't know	Agree	Disagree	Don't know
Gender												
Male	577 (51.1)	328 (29.1)	224 (19.8)	609(53.9)	189(16.7)	331(29.3)	1063(94.2)	32(2.8)	34(3.0)	612(54.2)	379(33.6)	138(12.2)
Female	336 (52.8)	168 (26.4)	132 (20.8)	351(36.6)	109(17.1)	176(27.7)	597(93.9)	26(4.1)	13(2.0)	349(54.9)	211(33.2)	76(11.9)
Age Groups (Years)												
≤ 20 years	171(59.2)	49(17.0)	69(23.9)	130(45.0)	60(20.8)	99(34.3)* *	268(92.7)	11(3.8)	10(3.5)	130(45.0)	117(40.5)	42(14.5)* **
21-25 years	490(50.6)	297(30.7)	181(18.7)	550(56.8)	150(15.5)	268(27.7)	912(94.2)	38(3.9)	18(1.9)	559(57.7)	300(31.0)	109(11.3)
26-30 years	162(47.9)	116(34.3)	60(17.8)	190(56.2)	64(18.9)	84(24.9)	324(95.9)	5(1.5)	9(2.7)	190(56.2)	121(35.8)	27(8.0)
> 30 years	90(52.9)	34(20.0)	46(27.1)	90(52.9)	24(14.1)	56(32.9)	156(91.8)	4(2.4)	10(5.9)	82(48.2)	52(30.6)	36(21.2)
Family Income (monthly)												
≤ 30000 BDT	492(52.3)	261(27.8)	187(19.9)	514(54.7)	171(18.2)	255(27.1)	892(94.9)	34(3.6)	14(1.5)*	486(51.7)	341(33.3)	113(12.0)
> 30000 BDT	421(51.0)	235(28.5)	169(20.5)	446(54.1)	127(15.4)	252(30.5)	768(93.1)	24(2.9)	33(4.0)	475(57.6)	249(30.2)	101(12.2)
Religion												
Muslim	687(49.8)	396(28.7)	297(21.5) **	779(56.4)	215(15.6)	386(28.0) *	1297(94.0)	44(3.2)	39(2.8)*	759(55.0)	455(33.0)	166(12.0)
Hindu	221(59.2)	97(26.1)	55(14.7)	174(46.6)	83(22.3)	116(31.1)	353(94.6)	14(3.8)	6(1.6)	193(51.7)	132(35.4)	48(12.9)
Others ^a	5(41.7)	3(25.0)	4(33.3)	7(58.3)	0(0)	5(41.7)	10(83.3)	0(0)	2(16.7)	9(75.0)	3(25.0)	0(0)
Marital Status												
Married	194(50.5)	97(25.3)	93(24.2)	199(51.8)	69(18.0)	116(30.2)	363(94.5)	7(1.8)	14(3.6)	192(50.0)	148(38.5)	44(11.5)
Unmarried	719(52.1)	399(28.9)	263(19.0)	761(55.1)	229(16.6)	391(28.3)	1297(93.9)	51(3.7)	33(2.4)	769(55.7)	442(32.0)	170(12.3)
Education												
High school	31(45.6)	13(19.1)	24(35.3) **	31(45.6)	4(5.9)	33(48.5)* *	53(77.9)	7(10.3)	8(11.8)* **	29(42.6)	30(44.1)	9(13.2)**
College	123(55.2)	44(19.7)	56(25.1)	113(50.7)	42(18.8)	68(30.5)	217(97.3)	3(1.3)	3(1.3)	106(47.5)	8(35.9)	37(16.6)
Honors	491(49.1)	307(30.7)	201(20.1)	541(54.2)	167(16.7)	291(29.1)	940(94.1)	36(3.6)	23(2.3)	535(53.6)	357(35.7)	107(10.7)
Masters or higher	268(56.4)	132(27.8)	75(15.8)	275(57.9)	85(17.9)	115(24.2)	450(94.7)	12(2.5)	13(2.7)	291(61.3)	123(25.9)	61(12.8)
Occupation												
Student	513(54.7)	250(26.7)	174(18.6) ***	502(53.6)	162(17.3)	273(29.1) ***	878(93.7)	34(3.6)	25(2.7)*	495(52.8)	312(33.3)	130(13.9) ***
Health Professionals	66(55.9)	30(25.4)	22(18.6)	76(64.4)	20(16.9)	22(18.6)	116(98.3)	0(0)	2(1.7)	84(71.2)	28(23.7)	6(5.1)
Employed (not health)	180(51.1)	112(31.8)	60(17.0)	180(51.1)	58(16.5)	114(32.4)	338(96.0)	6(1.7)	8(2.3)	204(58.0)	118(33.5)	30(8.5)
Business	20(50.0)	12(30.0)	8(20)	22(55.0)	10(25.0)	8(20.0)	40(100)	0(0)	0(0)	14(35.0)	20(50.0)	6(15)
Unemployed	84(45.7)	62(33.7)	38(20.7)	118(64.1)	26(14.1)	40(21.7)	166(90.2)	14(7.6)	4(2.2)	104(56.5)	58(31.5)	22(12.0)
Housewife	26(38.2)	12(17.6)	30(44.1)	38(55.9)	12(17.6)	18(26.5)	60(88.2)	2(2.9)	6(8.8)	28(41.2)	26(38.2)	14(20.6)
Others ^b	24(36.4)	18(27.2)	24(36.4)	24(36.4)	10(3.4)	32(48.5)	62(93.9)	2(3.0)	2(3.0)	32(48.5)	28(42.4)	6(9.1)
Current Residence												
Village	265(53.3)	125(25.2)	107(21.5)	257(51.7)	91(18.3)	149(30.0)	465(93.6)	18(3.6)	14(2.8)	250(50.3)	183(36.8)	64(12.9)*
Town (Upazilla/Thana)	334(53.8)	157(25.3)	130(20.9)	348(56.0)	97(15.6)	176(28.3)	589(94.8)	14(2.3)	18(2.9)	329(53.0)	214(34.5)	78(12.6)
City (Division/District)	314(48.5)	214(33.1)	119(18.4)	355(54.9)	110(17.0)	182(28.1)	606(93.7)	26(4.0)	15(2.3)	382(59.0)	193(29.8)	72(11.1)
Main Information source												
Facebook	441(49.3)	267(29.9)	186(20.8) *	468(52.3)	152(17.0)	274(30.6) **	851(95.2)	33(3.7)	10(1.1)* **	481(53.8)	305(34.1)	108(12.1)
Television	353(56.5)	137(21.9)	135(21.6)	349(55.8)	99(15.8)	177(28.3)	589(94.2)	22(3.5)	14(2.2)	347(55.5)	202(32.3)	76(12.2)

Newspaper	51(52.0)	40(40.8)	7(7.1)	59(60.2)	10(10.2)	29(29.6)	91(92.9)	2(2.0)	5(5.1)	62(63.3)	24(24.5)	12(12.2)
Scientific features	29(50.0)	28(48.3)	1(1.7)	42(72.4)	12(20.7)	4(6.9)	49(84.5)	1(1.7)	8(13.8)	37(63.8)	15(25.9)	6(10.3)
Others [#]	39(43.3)	24(26.7)	27(30.0)	42(46.7)	25(27.8)	23(25.6)	80(88.9)	0(0)	10(11.1)	34(37.8)	44(48.9)	12(13.3)
Receive Training/ Online Course												
Yes	174(66.9)	47(18.1)	39(15.0)* **	131(50.4)	45(17.3)	84(32.3)	254(15.3)	2(.8)	4(1.5)*	151(58.1)	73(28.1)	36(1.8)
No	739(49.1)	449(29.8)	317(21.1)	829(55.1)	253(16.8)	423(28.1)	1406(93.4)	56(3.7)	43(2.9)	810(83.8)	517(34.4)	178(11.8)
COVID-19 Knowledge score	14.5(1.7)	14.8(1.6)	13.9(2.4) ***	14.6(1.7)	14.8(1.6)	14.1(2.1) ***	14.5(1.7)	14.1(2.2)	13(3.5) ***	14.7(1.8)	14.4(1.7)	13.8(2.2) ***
^a Others include Buddhist, Christian, etc ^b Others include farmer, shopkeeper, etc [#] Others include radio, health professionals, pharmacist, friends, etc ***P<0.001, **P<0.01, *P<0.05												

Table 5: Association of demographic variables with ‘Attitudes’ towards COVID-19

Parameters	OR (95% CI)	P value
A1: disagree with the win the battle against the COVID-19 (vs. agree)		
Age (26-30 vs. > 30)	1.69 (1.003, 2.86)	0.001
Education (Bachelors vs. masters)	1.70 (1.24, 2.34)	0.023
Source (Scientific features vs. TV)	3.03 (1.65, 5.54)	0.029
Training (yes vs. no)	0.37 (0.25, 0.53)	<.0001
Total knowledge Score	0.87 (0.79, 0.92)	0.0004
A1: unknown with win the battle against the COVID-19 (vs. agree)		
Religion (Hindu vs. Muslim)	0.59 (0.42, 0.84)	0.013
Occupation (non-employee vs. employee)	2.49 (1.17, 5.29)	0.030
Occupation (housewife vs. employee)	3.20 (1.64, 6.23)	0.004
Source (scientific features vs. TV)	0.10 (0.01, 0.74)	0.036
Training (yes vs. no)	0.65 (0.44, 0.97)	0.024
Total knowledge Score	0.92 (0.86, 0.99)	0.016
A2: disagree with getting sick (vs. agree)		
Age (≤ 20 vs. >30)	2.87 (1.34, 6.17)	0.002
Source (others vs. TV)	2.47 (1.38, 4.42)	0.002
A2: unknown about getting sick (vs. agree)		
Occupation (non-employee vs. employee)	0.51 (0.32, 0.82)	0.206
Source (scientific features vs. TV)	0.20 (0.07, 0.57)	0.002
Training (yes vs. no)	1.67 (1.21, 2.31)	0.002
Total knowledge Score	0.90 (0.84, 0.96)	0.001
A3: disagree with social distancing to control COVID-19 (vs. agree)		
Education (secondary vs. masters)	3.75 (1.17, 12.01)	0.002
Training (yes vs. no)	0.21 (0.05, 0.87)	0.032
A3: unknown about social distancing to control COVID-19 (vs. agree)		
Family income (≤ 30000 vs. > 30000)	0.33 (0.17, 0.63)	0.0008
Total knowledge Score	0.76 (0.66, 0.88)	0.0002
A4: disagree allowed individual after recovery (vs. agree)		
Family income (≤ 30000 vs. > 30000)	1.28 (1.03, 1.58)	0.026
Marital status (married vs. unmarried)	1.61 (1.14, 2.28)	0.007
source (others vs. TV)	1.95 (1.17, 3.24)	0.007
A4: unknown about allowed individual after recovery (vs. agree)		
Age (21-25 vs. >30)	0.20 (0.09, 0.42)	0.002
Occupation (student vs. employee)	3.02 (1.60, 5.70)	0.007
Training (yes vs. no)	1.55 (1.01, 2.38)	0.044
Total knowledge Score	0.78 (0.72, 0.85)	<.0001

Table 6: Distribution of respondents according to ‘Practices’ related to COVID-19 by demographic variables

Characteristics	Practices, n (%) or mean (SD)									
	P1		P2		P3		P4		P5	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Gender										
Male	164(14.5)	965(85.5)***	1093(96.8)	36(3.2)	1108(98.1)	21(1.9)**	870(77.1)	259(22.9)***	975(86.4)	154(13.6)*
Female	35(5.5)	601(94.1)	612(96.2)	24(3.8)	634(99.7)	2(0.3)	591(92.2)	45(7.1)	574(90.3)	62(9.7)
Age Groups (Years)										
≤ 20 years	23(8.0)	226(92.0)***	273(94.5)	16(5.5)**	284(98.3)	5(1.7)	247(85.5)	42(14.5)	249(86.2)	40(13.8)
21-25 years	63(6.5)	905(93.5)	940(97.1)	28(2.9)	953(98.5)	15(1.5)	791(81.7)	177(18.3)	850(87.8)	118(12.2)
26-30 years	73(21.6)	265(78.5)	334(98.8)	4(1.2)	337(99.7)	190(3)	279(82.5)	59(17.5)	296(87.6)	42(12.4)
> 30 years	40(23.5)	130(76.5)	158(92.9)	12(7.1)	168(98.8)	2(1.2)	144(84.7)	26(15.5)	154(90.6)	16(9.4)
Family Income (monthly)										
≤ 30000 BDT	105(11.2)	835(88.8)	904(96.2)	36(3.8)	929(98.8)	11(1.2)	777(82.7)	163(17.3)	827(88.0)	113(12.0)
> 30000 BDT	949(11.4)	731(88.6)	801(97.1)	24(2.9)	813(98.5)	12(1.5)	684(82.9)	1419(17.1)	722(87.5)	103(12.5)
Religion										
Muslim	165(12.0)	1215(88)	1331(96.4)	49(3.6)	1364(98.8)	16(1.2)	1110(80.4)	270(19.6)***	1185(85.5)	195(14.1)***
Hindu	33(8.8)	340(91.2)	362(97.1)	11(2.9)	366(98.1)	7(1.9)	340(91.2)	33(8.8)	354(94.9)	19(5.1)
Others ^a	1(8.3)	11(91.7)	12(100)	0(0)	12(100)	0(0)	11(91.7)	1(8.3)	10(83.3)	2(16.7)
Marital Status										
Married	79(20.6)	305(79.4)***	368(95.8)	16(4.2)	378(98.4)	6(1.6)	315(82.0)	69(18.0)	337(87.8)	4(12.2)
Unmarried	120(8.7)	1267(91.3)	1337(96.8)	44(3.2)	1364(98.8)	17(1.2)	1146(83)	235(17.0)	1212(87.8)	169(12.2)
Education										
High school	10(17.7)	58(85.3)**	62(91.2)	6(8.8)***	66(97.1)	2(2.4)***	41(60.3)	27(39.7)***	46(67.6)	22(32.4)***
College	22(9.9)	201(90.1)	210(94.2)	13(5.80)	222(99.6)	1(0.4)	183(82.1)	40(17.9)	195(87.4)	28(12.6)
Honors	96(9.6)	903(90.4)	963(96.4)	36(3.6)	980(98.1)	19(1.9)	8129(81.3)	187(18.7)	877(87.4)	122(12.2)
Masters or higher	71(14.9)	404(85.1)	470(98.9)	5(1.1)	474(99.8)	1(0.20)	425(89.5)	50(10.5)	431(90.7)	44(9.3)
Occupation										
Student	65(6.9)	872(93.1)***	899(95.9)	38(4.1)***	924(98.6)	13(1.4)**	767(81.9)	170(18.8)***	825(88.0)	112(12.0)***
Health Professionals	8(6.8)	110(93.2)	118(100)	0(0)	118(100)	0(0)	110(93.2)	8(18.1)	104(88.1)	14(11.9)
Employed (not health)	70(19.9)	282(80.1)	348(98.9)	4(1.1)	352(100)	0(0)	320(90.9)	32(9.1)	330(93.8)	22(6.3)
Business	14(35.0)	26(65.0)	40(100)	0(0)	38(95)	2(5.0)	28(70)	12(30.0)	36(90.0)	4(10.0)
Unemployed	26(14.1)	158(85.9)	180(97.8)	4(2.2)	180(97.8)	4(2.2)	128(69.6)	56(30.4)	140(76.1)	44(23.9)
Housewife	10(14.7)	58(85.3)	56(82.4)	12(17.6)	66(97.1)	2(2.9)	48(70.6)	20(29.4)	54(79.4)	14(20.6)
Others ^b	6(9.1)	60(90.9)	64(97.0)	2(3.0)	64(97.0)	2(3.0)	60(90.9)	6(9.1)	60(90.9)	6(9.1)
Current Residence										
Village	63(12.7)	434(87.3)	470(94.6)	27(5.4)**	479(96.2)	19(3.8)***	374(75.3)	123(24.7)***	411(82.7)	86(17.3)***
Town(Upazilla/Thana)	63(10.1)	558(89.9)	605(97.4)	16(2.4)	621(100)	0(0)	527(84.9)	94(15.1)	568(91.5)	53(8.5)
City(Division/District)	73(11.3)	574(88.7)	630(97.4)	17(2.6)	643(99.4)	4(0.6)	560(86.6)	87(13.4)	570(88.1)	77(11.9)
Main Information source										
Facebook	85(9.5)	809(90.6)*	865(96.8)	29(3.2)*	879(98.3)	15(1.7)	734(82.1)	160(17.9)	786(87.9)	108(12.1)

Television	79(12.6)	546(87.4)	608(97.3)	17(3.2)	619(99.0)	6(1)	525(84.0)	100(16.0)	557(89.1)	68(10.9)
Newspaper	19(19.4)	79(80.6)	94(95.9)	4(4.1)	96(98.0)	2(2)	81(82.7)	179(17.3)	81(82.7)	17(17.3)
Scientific features	6(10.3)	52(79.7)	56(96.6)	2(3.4)	58(100)	0(0)	50(86.2)	8(13.8)	52(89.7)	6(10.30)
Others [#]	10(11.1)	80(88.9)	82(91.1)	8(8.9)	90(100)	0(0)	71(78.9)	19(21.1)	73(81.1)	17(18.9)
Receive Training/ Online Course										
Yes	33(12.7)	227(87.3)*	259(99.6)	1(0.4)**	259(99.6)	1(0.4)**	233(89.6)	27(10.4)**	247(95.0)	13(5.0)**
No	166(11.0)	1339(89)	1446(96.1)	59(3.9)	1483(98.5)	22(1.5)	1228(81.6)	277(18.4)	1302(86.5)	203(13.5)
COVID-19 Knowledge score	14.5(1.8)	14.4(1.8)	14.5(1.8)	13.4(3.1) ***	14.5(1.8)	13.7(1.9) *	14.6(1.7)	13.9(2.4) ***	14.5(1.8)	14.3(2.3)
^a Others include Buddhist, Christian, etc ^b Others include farmer, shopkeeper, etc [#] Others include radio, health professionals, pharmacist, friends, etc ***P<0.001, **P<0.01, *P<0.05										

Table 7: Association of demographic variables with COVID-19 related ‘practices’ on COVID-19

Parameters	OR (95% CI)	P value
Gender (male vs. female)	3.22 (2.46, 4.21)	<.0001
Age (26-30 vs. > 30)	1.32 (1.25, 1.92)	0.027
Marital status (married vs. unmarried)	1.58 (1.11, 2.25)	0.010
Education (bachelors vs. masters)	1.42 (1.05, 1.92)	0.031
Occupation (non-employee vs. employee)	3.38 (2.20, 5.20)	0.002
Occupation (housewife vs. employee)	5.067 (2.64,9.72)	0.001
Source (newspaper vs. TV)	1.62 (1.03, 2.56)	0.009
Training (yes vs. no)	0.593 (0.42, 0.83)	0.002
Total knowledge score	0.94 (0.87-0.98)	0.003