



# COVID-19 in Bangladesh: measuring differences in individual precautionary behaviors among young adults

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## Abstract

**Aim** The novel coronavirus disease 2019 (COVID-19) is present in Bangladesh, and various control measures have been taken to flatten the epidemic curve. Due to the current demographic distribution in Bangladesh, young adults comprise almost one-third of the total population of the country. Therefore, their precautionary behavior is very important to ensure the success of preventive policies. This exploratory study examined the differences in the adoption of precautionary behaviors among young adults, and estimated and compared the predictors of precautionary behavior adoption among young adults living in the capital city Dhaka and a nearby district, Tangail.

**Subject and methods** A total of 350 respondents from each district participated in the study. ANOVA and two-sample t-tests were utilized to detect differences in precautionary behavior across demographic groups of young adults, and quantile regression modeling was used to find the predictors of adopting precautionary behaviors and to compare these predictors between the two districts.

**Results** Individuals who had a postgraduate education and had good mental health tended to show better precautionary behaviors in Dhaka. Female respondents from Tangail who had no psychological distress took precautionary behaviors more often than their male counterparts. However, no significant differences in the adoption of precautionary behaviors to prevent COVID-19 among young adults were found between the two districts. Better self-control ability, higher education and good mental health emerged as factors that significantly shaped the precautionary behaviors of young adults in this study.

**Conclusion** Having better knowledge did not ensure better adoption of precautionary behaviors among the participants. In effect, the government's strong intervention to keep people maintaining social distance and a strict lockdown in severely affected areas are probable immediate solutions.

**Keywords** COVID-19 · Precautionary behavior · Young adults · Self-control · Mental health · Health policy

## Background

Bangladesh confirmed the detection of its first three novel coronavirus disease 2019 (COVID-19)-positive cases on March 8, 2020, amid the global spread of COVID-19 (Paul 2020). Three days later, the World Health Organization (WHO) declared COVID-19 a pandemic because of its

unrelenting and rapid worldwide spread (Pogrebna and Kharlamov 2020). Bangladesh reported its first coronavirus death on March 18, 2020. The patient was a senior citizen aged almost 70 years with a history of various medical conditions (Reuters 2020). As of June 30, 2020, COVID-19 had reached 216 countries, areas or territories affecting 10,021,401 people, among which 499,913 had lost their lives (WHO 2020a, b, c). In that same time period, in Bangladesh, there were 145,483 confirmed cases of COVID-19 and 1847 confirmed deaths due to this pandemic (Institute of Epidemiology, Disease Control, and Research (IEDCR) 2020).

This disease has been infecting people at an exponentially increasing rate and can be transmitted by even asymptomatic or presymptomatic persons. These features have made COVID-19 harder to contain than the Middle East Respiratory Syndrome coronavirus (MERS-CoV) or Severe

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Acute Respiratory Syndrome (SARS-CoV) (Gates 2020). COVID-19 is highly contagious, with fever, dry cough, myalgia, fatigue, and dyspnea as its main clinical symptoms. At the severe stage of this disease, acute respiratory distress syndrome, uncontrolled metabolic acidosis, bleeding and coagulation dysfunction, and septic shock may occur (Chen et al. 2020; Zhong et al. 2020). The most vulnerable population for COVID-19 is older males with underlying diseases such as hypertension, type-2 diabetes, and cardiovascular disease (Chen et al. 2020; Huang et al. 2020). As the situation became critical and serious, the World Health Organization, in response, urged collective efforts of all countries to prevent the rapid spread of COVID-19 (WHO 2020a, b, c). Moreover, the WHO decided to improve clinical and community-level knowledge regarding COVID-19 while promoting optimized use of protective equipment for infection prevention and control in community settings (WHO 2020a, b, c). Lowering the predisposition of individual exposure is currently the only way to prevent COVID-19 because there is no vaccine (although several are being developed) or effective curative method to prevent this pandemic (Pogrebna and Kharlamov 2020). The approaches to reducing its transmission are mostly behavioral: handwashing; social distancing; coughing and sneezing etiquette (Haushofer and Metcalf 2020); and avoidance of touching the eyes, mouth, and nose. Several countries, including Bangladesh, declared a shutdown/lockdown to prevent the spread of COVID-19. Bangladesh deployed armed forces to ensure that people were maintaining social distancing and quarantine (ABC 2020; Daily Star 2020).

People's adherence to these control measures is central to their success, and this adherence heavily relies upon their knowledge, attitudes, and practices toward COVID-19. Moreover, less knowledge and poor attitudes toward contagious diseases can trigger panic emotions, in effect, making matters worse while attempting to prevent the disease from spreading (Ajilore et al. 2017; Person et al. 2004; Tachfouti et al. 2012; Tao 2003). In a study conducted very recently, it was found that Chinese women of relatively high socioeconomic class possessed good knowledge, optimistic attitudes, and performed proper COVID-19 prevention practices during the time when the disease was rising rapidly (Zhong et al. 2020). It is understandable that the people of China adopted intensive precautionary behaviors to prevent COVID-19 (Li et al. 2020a, b, c), and knowledge is a significant predictor of precautionary behavior adoption in general (Almutairi et al. 2015). Almost all the participants of this prior study were confident that COVID-19 would be finally controlled, and China would win against the virus. This confidence and positive attitude among the Chinese is nothing new, since the same pattern was exhibited during the SARS epidemic (Chen et al. 2020; Liu et al. 2004; Zhong et al. 2020; Zhou et al. 2004). Knowledge and perception of SARS were

significantly associated with precautionary behavior adoption (Varti et al. 2009), but the role of the public's precautionary behaviors in controlling epidemics such as SARS requires further investigation (Bell 2004).

Peoples with better self-control possess more positive coping strategies (Li et al. 2016) and sustain more satisfaction in essential life domains (Duckworth and Seligman 2005; Moffitt et al. 2011). A high level of self-control has a greater positive association with healthy and virtuous outcomes, and effective adoption of healthy behavior requires volitional control or willpower (Hofmann et al. 2008). During the days of the COVID-19 pandemic, healthy behaviors mainly include frequent hand-washing, maintaining cough and sneeze etiquette, keeping social distance, and other steps required to stop its spread. Locations where citizens do not have the habit of washing their hands tend to be more exposed soon after the introduction of this virus (Pogrebna and Kharlamov 2020). Mental health has also been proved to be significantly correlated with the adoption of precautionary behavior (Yıldırım and Güler 2020 and healthy behavior (Tromp et al. 2005). Therefore, knowledge, attitude, self-control, mental health, as well as history of any psychological disorder can emerge as potential explanations of variation in precautionary behavior adoption in Bangladesh.

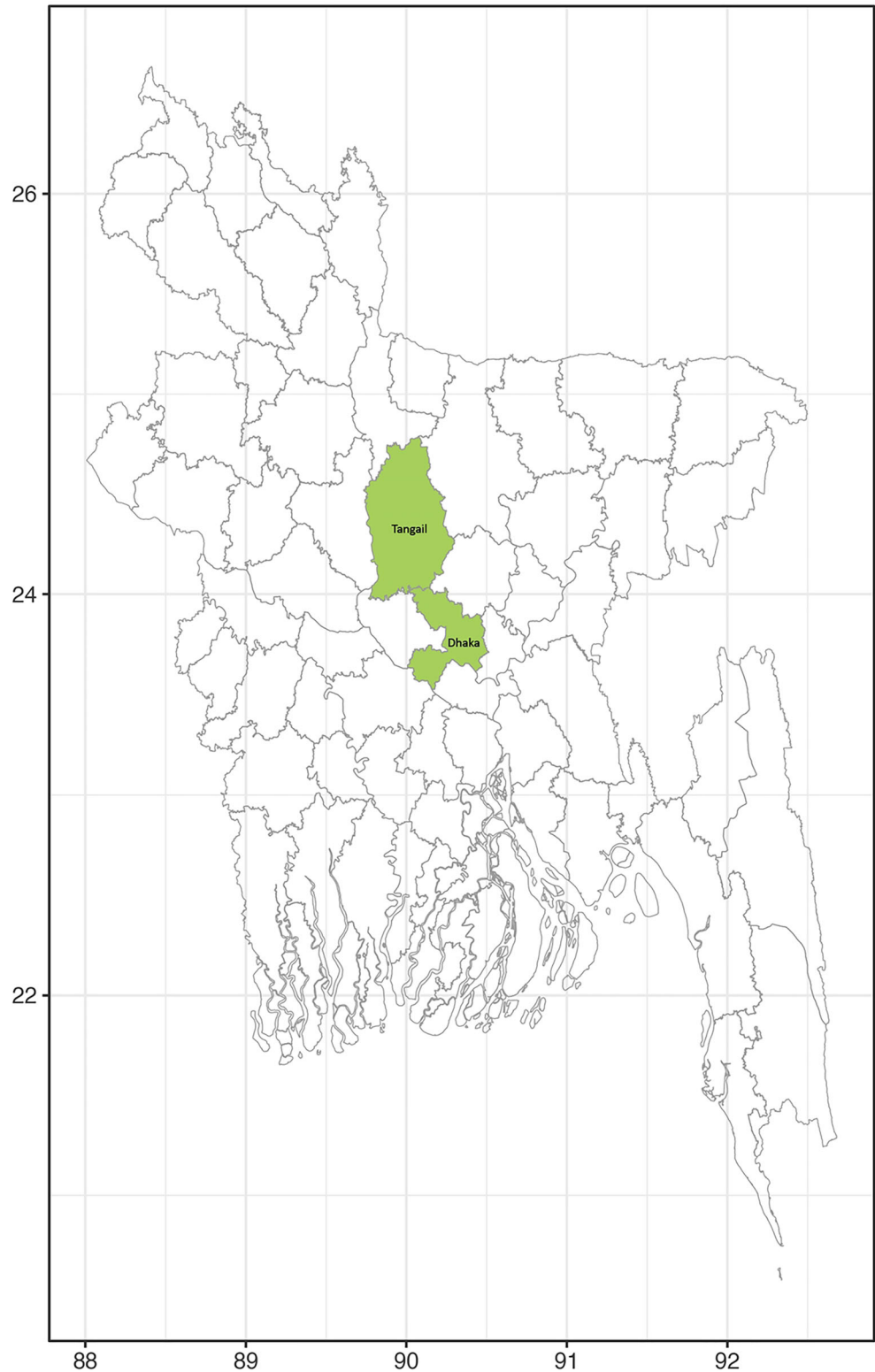
Demographic traits can significantly explain human behavior in response to the uprising of a pandemic. Never-married graduate or undergraduate males in China showed less knowledge of COVID-19, and they went to crowded places more often and wore masks less often than others during the rapid rise of the disease in mainland China (Zhong et al. 2020). Males who were less educated and older in age showed poor knowledge, negative attitudes, and poor preparedness skills for COVID-19 prevention and care (Srichan et al. 2020). Females with a better understanding of COVID-19 were more likely to adopt preventive measures than others (Kwok et al. 2020). Additionally, people with a history of chronic physical diseases underperformed precautionary behaviors to prevent themselves from being infected (Li et al. 2020a, b, c).

Infection in young adults may go undetected for a long period, which makes people less aware of the intensity of the situation (Dowd et al. 2020) and almost one-third of the Bangladeshi population is aged between 15 and 29 years (National Institute of Population Research and Training (NIPORT) 2016). The WHO has set six conditions prior to ending the lockdown. Among those, two conditions are directly related to taking proper preventive measures (Chappell 2020). As the lockdown in Bangladesh has been relaxed in moderate to less contagious areas, the practice of preventive behaviors among this population requires immense concentration, and performing proper precautionary behaviors is the only difference between those with the highest and lowest probability of getting COVID-19. The present study aimed to (i) determine the differences, if any,

in the adoption of precautionary behaviors among young adults living in the capital city Dhaka and a nearby district, Tangail, and (ii) estimate and compare the predictors of precautionary behavior adoption among the young adults living in these two districts.

Figure 1 displays the location map of our studied areas. Despite having a public university in its center and being only 83.5 km away from Dhaka, Tangail is considerably behind Dhaka in terms of vital health indicators and education (Bangladesh Bureau of Statistics (BBS) 2019), similar to all

**Fig. 1** Location map of the study areas in Bangladesh



other districts (excluding the city corporations outside of Dhaka) in Bangladesh. This allows respondents from Tangail to act as a proxy of respondents of other districts, which enables us to understand and compare the dynamics of precautionary behaviors among young adults living inside and outside of the capital city. Figure 1 displays the location map of our studied areas.

## Methods

### Design and sampling

The design of this study was cross-sectional in nature. Members of the Secondary and Intermediate Level Students' Welfare Association (SILSWA) of Dhaka and Tangail were the sampling frames for this study. SILSWA ([www.silswa.org](http://www.silswa.org)) is one of the largest student platforms in Bangladesh, with almost a million members across the country. Students from secondary to postgraduate levels are members of this association. This attribute of the association has made it a good representation of the young adults of the country. A simple random sampling strategy was adopted, and the sampling form was a questionnaire (Nooh et al. 2020). The minimum sample size was calculated using the formula  $n = z^2pq/d^2$ , where  $n$  = the desired sample size,  $z$  = the standard normal deviation (usually set at 1.96, which corresponds to 95% confidence interval level),  $p$  = the proportion in the target population estimated to have a particular characteristic (here  $p = 67\%$  from the pilot survey),  $q = 1 - p$  (proportion in the target population not having the particular characteristics) and  $d$  = the degree of accuracy required (usually set at the 0.05 level). Considering all these factors along with design effect = 1, the minimum sample size required for this study was 340 for each stratum, i.e., district. The background and aims of the study were stated on the first page of the questionnaire. Declarations of anonymity and data confidentiality were also explained. Participants 16 (Zhong et al. 2020) up to 29 years of age were included in the study given their willingness to participate. The final Dhaka and Tangail samples consisted of 350 participants each.

### Measures

#### Knowledge

Participants' knowledge about different features of COVID-19 was measured with a 12-item instrument that was developed by combining a questionnaire used in a previous study (Zhong et al. 2020) and guidelines for clinical and community management issued by the IEDCR (2020). Participants were asked to posit whether each statement was true or false. An additional "I don't know" option was also given in the

questionnaire. Specific statements were false to avoid bias. A binary scoring system was used: "1" for a correct answer and "0" for others (incorrect/unknown). Therefore, the range of the total knowledge score was from 0 to 12, where the higher the score, the better the knowledge about COVID-19. The Cronbach's alpha of this instrument was 0.64 for the Dhaka sample and 0.72 for the Tangail sample, indicating acceptable consistency (Hinton et al. 2014).

#### Attitudes

The 2-item instrument to measure attitudes toward COVID-19 was adopted from a previous study (Zhong et al. 2020). In the first question, participants were required to state their agreement on the final control of COVID-19. The scoring system was binary, indicating "1" for choosing the option "agree" and "0" for other options ("disagree"/"I do not know"). In the next question, respondents' confidence in winning the battle against COVID-19 was measured as a dichotomous outcome ("1" for yes and "0" for no). The Cronbach's alpha of this instrument was 0.85 for both the Dhaka sample and the Tangail sample, indicating very good consistency (Hinton et al. 2014).

#### Precautionary behaviors

The precautionary behaviors of the participants were measured with nine items developed by the authors as per the guidelines circulated by the IEDCR (2020). Participants were asked to express their frequency of performing several precautionary behaviors since the COVID-19 outbreak. Responses were collected on a five-point scale ranging from "0 = never" to "4 = very often" (Table 1).

The total score ranged from 0 to 36. A higher "precautionary score" indicated a better display of precautionary behavior. Cronbach's alpha was 0.68 for the Dhaka sample and 0.71 for the Tangail sample in this study, meaning acceptable internal consistency (Hinton et al. 2014).

#### Self-control

The 13-item Brief Self-Control Scale (Tangney et al. 2004) measured the participants' self-control on a five-point scale. Among the items, nine were reversed items. The scoring system used for nonreversed items ranged from "1 = not at all" to "5 = very much." The scores were reversed for reversed items. Better self-control ability was indicated by a higher score (Zhong et al. 2020). The Cronbach's alpha of this instrument was 0.73 for the Dhaka sample and 0.74 for the Tangail sample, indicating acceptable consistency (Hinton et al. 2014).

**Table 1** Questionnaire items for measuring precautionary behaviors of the participants

No.	Items
1	Are you washing your hands frequently with soap and water or hand sanitizer?
2	In recent days, have you maintained cough etiquette? (Cough etiquette: When coughing and sneezing, cover mouth and nose with flexed elbow or tissue – discard tissue immediately into a closed bin and clean your hands with soap and water or hand sanitizer)
3	In recent days, have you avoided touching eyes, nose, and mouth as far as possible?
4	In recent days, have you avoided close contact with healthy persons if you have respiratory symptoms such as fever, cough, sore throat, breathing difficulty?
5	Do you know human to human transmission has been confirmed?
6	In recent days, I have traveled to an outbreak area.
7	In recent days, I have cooked fish and meat well before eating.
8	In recent days, I have gone to at least one crowded place.
9	In recent days, I have worn a mask when leaving home.

## Mental health

Symptoms of common mental health problems were measured with a 12-item General Health Questionnaire (GHQ-12) (Goldberg 1972) because its reliability and validity have already been proven in community settings in different cultural contexts (Lindencrona et al. 2008). In our study, we used a 0–0–1–1 scoring system that generated a score ranging from 0 to 12. A higher score indicated poorer mental health. As a safe benchmark, the mean score was used as a potential threshold (Goldberg et al. 1998). The Cronbach's alpha of this instrument was 0.74 for both the Dhaka sample and the Tangail sample, indicating good internal consistency (Hinton et al. 2014).

## Demographics

Information on fundamental demographic traits such as sex (male, female), educational qualification (higher secondary, graduate, and postgraduate), and history of chronic/psychological disorder (yes, no) was collected.

## Data analyses and model evaluation

### Descriptive analyses

Descriptive analyses to explore the differences in adoption of precautionary behaviors among different stratified demographic groups in terms of age, education, sex, marital status, mental health, and history of chronic/mental disorder were performed using ANOVA and two-sample t-test, as appropriate.

### Estimation technique

Multivariate analyses were performed using the quantile regression model. Knowledge, attitude, mental health, self-

control, and demographic variables acted as independent variables. Classical regression models cannot be extended beyond central locations, and quantile regression can analyze the entire conditional distribution. This appealing property has made quantile regression more popular among economists, econometricians, and biostatisticians (Machado and Mata 2005; Wei et al. 2006). Therefore, the quantile regression model was utilized since this method provides a comprehensive representation of possible causal relationships between variables (Liu and Bottai 2009).

## Results

The descriptive statistics of the mean precautionary score of the respondents of Dhaka obtained under different covariates are given in Table 2.

To examine whether the mean precautionary score changed with the level of covariates, a two-sample t-test and analysis of variance (ANOVA) were conducted. For the residents of Dhaka, the mean precautionary score varied across all covariates except sex and history of psychological disorder. The mean score varied significantly ( $p = 0.008$ ) with the level of education among the respondents of Dhaka. It was found that the mean precautionary score was highest (26.2; SD = 3.2) for the people who had completed their postgraduate education, whereas this mean score was 24.4 (SD = 4.5) for those that completed graduate level education. The mean precautionary score was lowest (23.7; SD = 4.6) for those who had only a Higher Secondary Certificate (HSC) degree. Psychologically distressed people had lower mean (23.6; SD = 4.5) precautionary scores than those who were not distressed (Mean = 25.1; SD = 4.4). This result was found to be statistically significant at the 1% level of significance.

Table 3 shows that the mean precautionary score varied across all covariates except educational level and history of

**Table 2** Sample distribution of Dhaka participants and mean adoption of precautionary behavior by demographic factors

Characteristics	Sample % (n)	Adoption of precautionary behaviors		<i>p</i> value
		Mean	SD <sup>a</sup>	
Total	100 (350)	24.4	4.5	
Sex				
Female	49% (170)	24.3	4.3	0.61
Male	51% (180)	24.5	4.6	
Education				
Higher secondary	30% (105)	23.7	4.6	0.008
Graduate	58% (202)	24.4	4.5	
Postgraduate	12% (43)	26.2	3.2	
Psychologically distressed				
Not distressed	55% (194)	25.1	4.4	0.001
Distressed	45% (156)	23.6	4.5	
History of psychological disorder				
Absent	86% (301)	24.5	4.5	0.779
Present	14% (49)	24.3	4.4	

<sup>a</sup> SD = standard deviation

psychological disorder among the residents of Tangail. The mean precautionary score of the young adults of Tangail differed significantly ( $p = 0.007$ ) by sex. Females (mean = 25.3; SD = 5.1) proved to be more cautious than males (mean = 23.8; SD = 5.4). Psychologically distressed participants had lower mean precautionary scores (23.7; SD = 5.8) than those who were not psychologically distressed (mean = 25.1; SD = 4.8).

**Table 3** Sample distribution of the Tangail participants and mean adoption of precautionary behaviors by demographic factors

Characteristics	Sample % (n)	Adoption of precautionary behaviors		<i>p</i> value
		Mean	SD <sup>a</sup>	
Total	100 (350)	24.5	5.3	
Sex				
Female	47% (166)	25.3	5.1	0.007
Male	53% (184)	23.8	5.4	
Education				
Higher secondary	32% (113)	24.7	5.8	0.524
Graduate	58% (203)	24.3	5.1	
Postgraduate	10% (34)	25.4	4.7	
Psychologically distressed				
Not distressed	58% (202)	25.1	4.8	0.019
Distressed	42% (148)	23.7	5.8	
History of psychological disorder				
Absent	85% (296)	24.7	5.1	0.29
Present	15% (54)	23.7	6.3	

<sup>a</sup> SD = standard deviation

Table 4 shows that the mean precautionary score (24.4) of participants who were living Dhaka insignificantly differed from the mean precautionary score (24.5) of those who were living in Tangail. However, the score of the precautionary behaviors of the study participants from Tangail district had higher standard deviation (5.3 vs 4.5) compared to those who were from Dhaka.

Figure 2 shows the histogram of the precautionary scores for the Dhaka sample. The precautionary scores of the Dhaka-residents were more concentrated between 22.2 and 28.8 and the histogram was negatively skewed. From Fig. 3, it can be seen that a similar negative skewness was present in the histogram of precautionary scores for the Tangail sample and the Tangail residents' scores were more frequent between 20.8 and 28.6. Figure 4 displays the histogram of precautionary scores for the full sample and the histogram was negatively skewed. To supplement the graphical findings, the value of skewness of the precautionary scores for Dhaka, Tangail, and the full sample was calculated, which were  $-0.53$ ,  $-0.82$ , and  $-0.71$ , respectively.

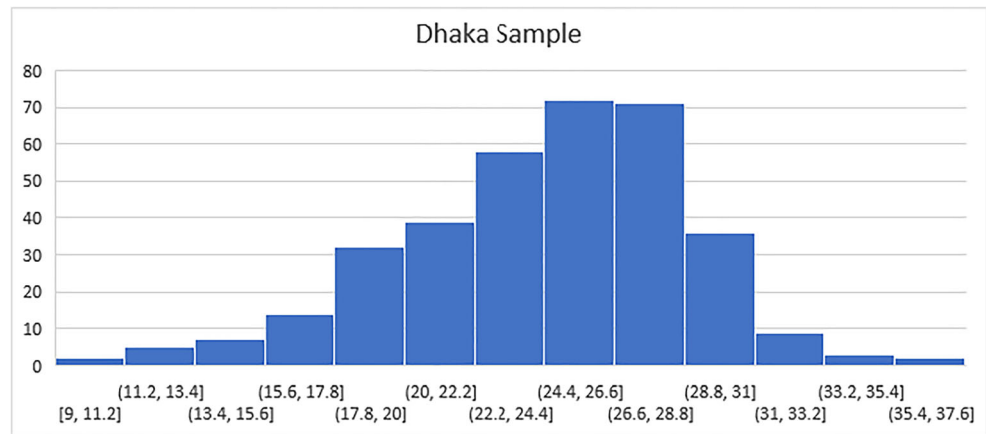
Before fitting the regression model using the precautionary score as the dependent variable, it was essential to check whether the precautionary score data contained outliers. A box plot of the precautionary score is given in Fig. 4, and it is depicted from the figure that some observations of the precautionary score were detected as outliers for the sample of Dhaka, Tangail, and the combined sample. Therefore, a linear regression model was not appropriate to examine the effects of covariates on the precautionary score for this scenario.

Thus, to determine the adjusted contribution of the related variables on the precautionary score of people, a quantile regression model was fitted on the 50th quantile. From Fig. 5, it is evident that the value of the mean absolute error of our predicted values is lowest at the 50th quantile. Therefore, the median quantile regression model performs better in these scenarios to predict the precautionary score. Regression coefficients, standard errors, and  $p$  values are reported in Table 5. Model 1 is pertinent for the samples drawn from Dhaka; Model 2 is for the sample drawn from Tangail. Model 3 is the full sample quantile regression model combining samples from both districts in a single model (Fig. 6).

**Table 4** Differences in precautionary behaviors among people at the district level

District	Sample % (n)	Adoption of precautionary behaviors		<i>p</i> value
		Mean	SD	
Dhaka	50% (350)	24.4	4.5	0.769
Tangail	50% (350)	24.5	5.3	
Total	100 (700)	24.48	4.9	

**Fig. 2** Histogram of precautionary score for Dhaka sample



As shown in Table 5, the self-control score was found to have a significant positive association with the precautionary score at the 50th quantile point in all three models [coefficient = 0.14, 0.26, 0.2, respectively]. Postgraduate participants were estimated to be more cautious compared to their counterparts in model 1 and model 3 [coefficient = 2.42,  $p < 0.001$ ; coefficient = 2.30,  $p < 0.001$ , respectively]. The precautionary score for psychologically distressed people was significantly lower [at the 10% level of significance; coefficient = -0.9,  $p = 0.065$ ] than the score for those who were not distressed in model 1. In summary, it can be concluded from the models that postgraduate participants with higher self-control and better mental health had developed better precautionary behaviors to prevent COVID-19.

### Discussion

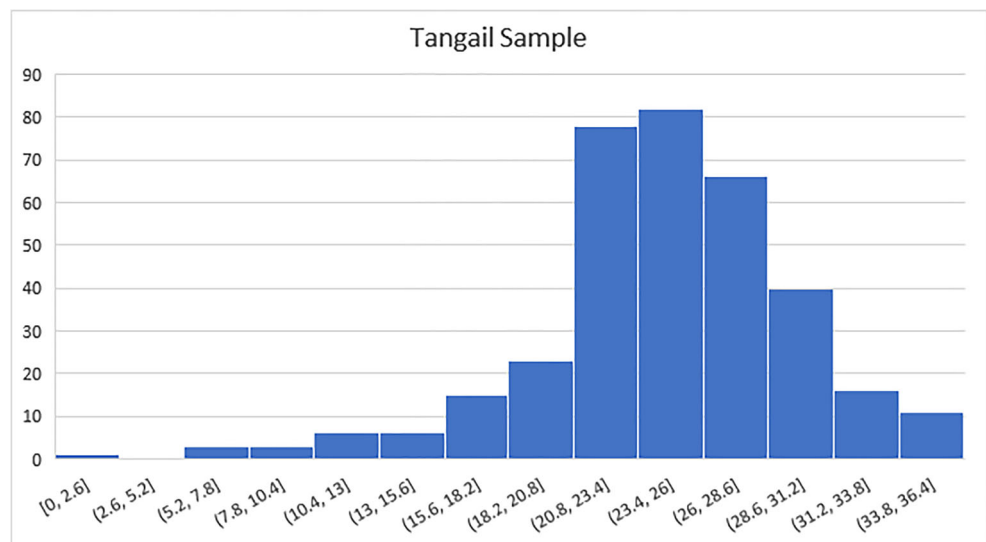
The primary goal of this research was to measure the magnitude of adoption of precautionary behavior to prevent COVID-19 across different groups of young adults living in

Dhaka and Tangail, Bangladesh. Furthermore, this study investigated the factors responsible for shaping their precautionary behaviors. In general, participants from Dhaka and Tangail showed moderate precautionary behavior during the rising period of COVID-19 in Bangladesh.

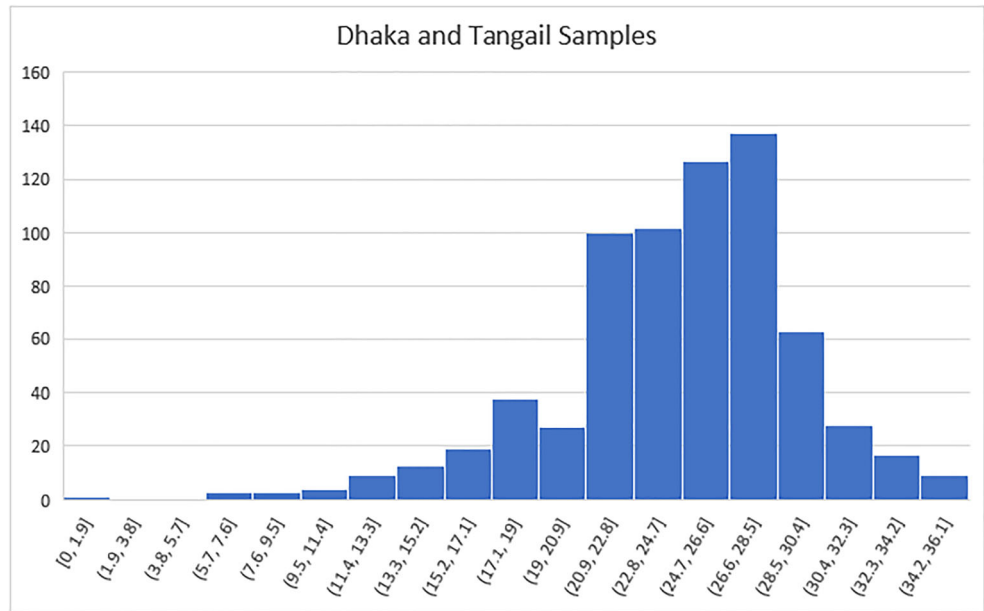
Results from the descriptive analyses indicate that the mean precautionary score varies significantly with the status of mental health of the participants. The mean precautionary behavior varies significantly with the variations in the level of education in Dhaka. In Tangail, females behave in a more cautious way than males to prevent COVID-19. Among the variables selected for modeling, self-control was significantly associated with the adoption of precautionary behaviors in all three models. Education had a significant positive relationship with precautionary behavior in two models, and mental health became a significant predictor in one model. Knowledge, attitude, sex, and history of psychological disorder/chronic disease were not found to be effective predictors of precautionary behaviors.

People with good mental health, i.e., less psychological distress, tended to adopt more preventive measures in the

**Fig. 3** Histogram of precautionary score for Tangail sample



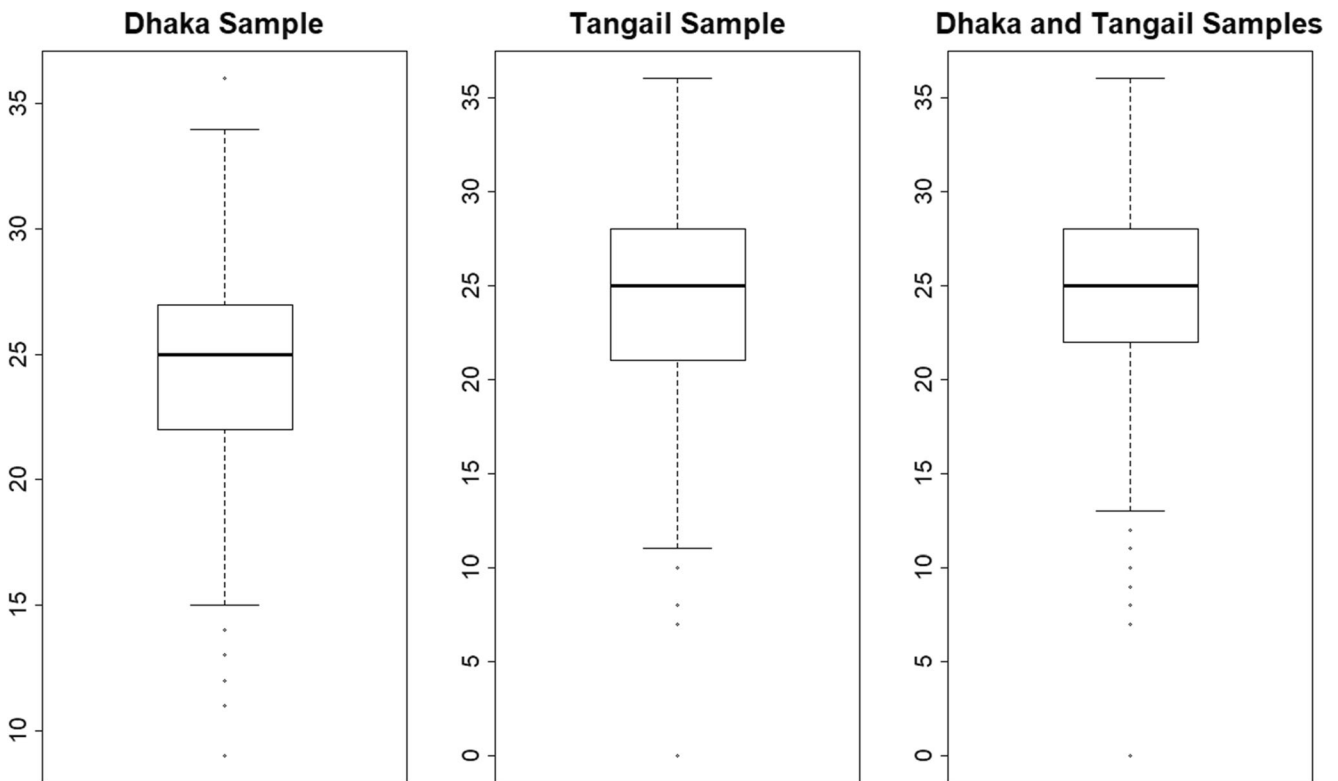
**Fig. 4** Histogram of precautionary score for Dhaka and Tangail samples



studied areas. The tendency of being less concerned about maintaining a healthy lifestyle among psychologically distressed persons is not surprising (Honda et al. 2005). Female participants in Tangail with a better mental state were more cautious than males, which supports previous findings that men are more expected to exhibit risk-taking behavioral patterns (Duell et al. 2018; Pawlowski et al. 2008). Postgraduate participants in Dhaka reported the

adoption of more precautions than the other participants. A postgraduate person seemingly possesses better knowledge and understanding of what to do in this sort of never-seen situation, which is why it was well anticipated that a postgraduate resident of Bangladesh would be more precautionous than others.

Good self-control is obviously relevant to health outcomes, particularly in situations where the ability to restrain or initiate



**Fig. 5** Boxplot for precautionary score



**Table 5** Quantile regression model for precautionary behavior adoption

Variables	Model 1 (Dhaka sample)		Model 2 (Tangail sample)		Model 3 (Full sample)	
	Coefficient (SE <sup>a</sup> )	<i>p</i> value	Coefficient (SE)	<i>p</i> value	Coefficient (SE)	<i>p</i> value
Intercept	16.4 (2.02)	<0.001***	11.89 (1.95)	<0.001***	14.4 (1.22)	<0.001***
Knowledge	0.19 (0.15)	0.23	0.12 (0.12)	0.316	0.08 (0.08)	0.333
Attitude	0.0 (0.24)	1.0	0.08 (0.31)	0.786	0.15 (0.18)	0.392
Self-control	0.14 (0.02)	<0.001***	0.26 (0.03)	<0.001***	0.2 (0.02)	<0.001***
Psychological distress	-0.9 (0.49)	0.065*	-0.25 (0.5)	0.61	-0.32 (0.33)	0.336
Sex (Ref: male)	-	-	-	-	-	-
Female	0.04 (0.48)	0.921	-0.6 (0.48)	0.212	-0.06 (0.33)	0.858
Education (Ref: Higher secondary)	-	-	-	-	-	-
Graduate	0.85 (0.55)	0.119	0.28 (0.55)	0.604	0.63 (0.4)	0.117
Postgraduate	2.42 (0.57)	<0.001***	1.41 (0.96)	0.142	2.3 (0.53)	<0.001***
History of psychological disorder/chronic disease	-0.47 (0.66)	0.474	-0.26 (0.74)	0.724	-0.01 (0.41)	0.978
District (Ref: Dhaka)	-	-	-	-	-	-
Tangail	-	-	-	-	0.02 (0.3)	0.939

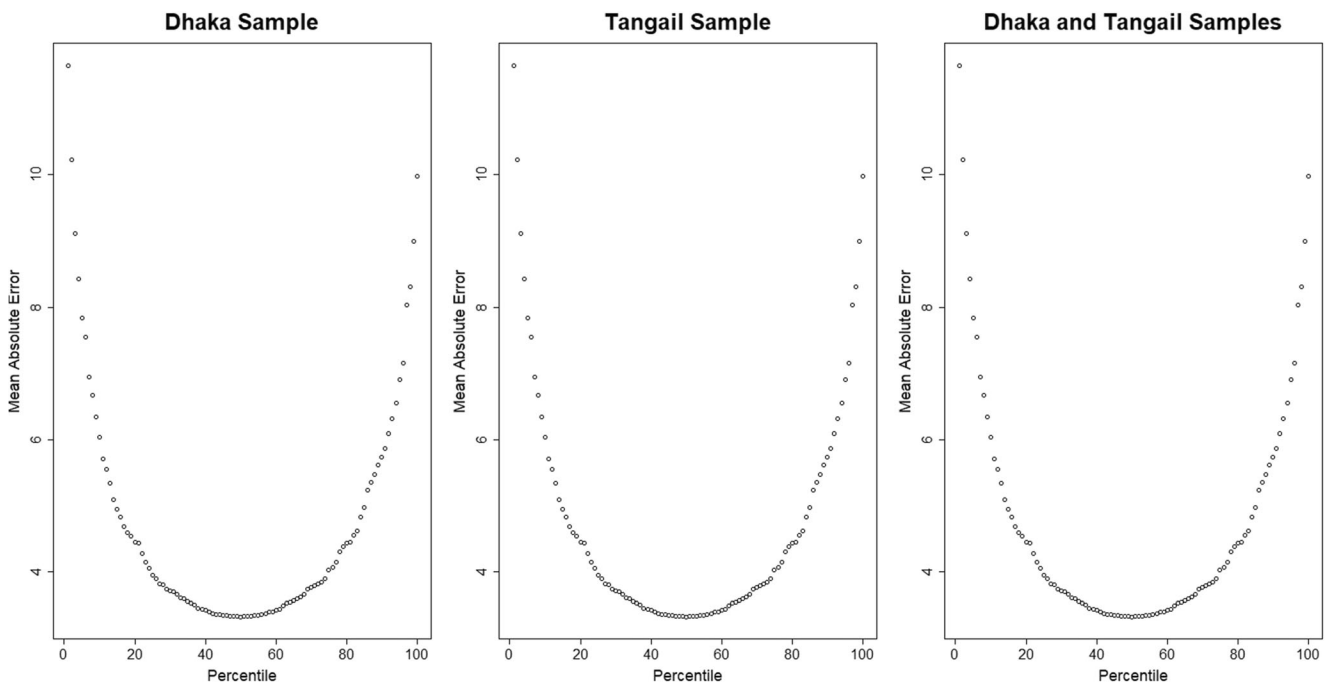
<sup>a</sup> SE = standard error

\**p* < 0.1

\*\*\**p* < 0.01

action is significantly related to the ability to handle difficulties arising from problematic situations (Li et al. 2020a, b, c; Wills et al. 2008). This concept is reflected clearly in this study, as self-control was observed to be a significant predictor of precautionary behaviors in young adults in Dhaka and Tangail. Self-control positively induces a person to do what is right for themselves. Keeping a social distance, using

protective equipment appropriately, maintaining cough etiquette, and quarantining oneself even if minimal symptoms are present are similar to fighting a war during this pandemic era. A proper precautionary step taken by one person can save the lives of many. A person with better self-control is, therefore, a better fighter against COVID-19 because they are more likely to adopt precautionary behaviors.



**Fig. 6** Mean absolute error (MAE) at different quantiles

Good knowledge about the high infectivity of COVID-19 makes people take a high level of precautions to prevent themselves from being contaminated (Zhong et al. 2020). Similarly, Li et al. (2020a, b, c) found that knowledge of the participants regarding COVID-19 was positively related to their precautionary behavior adoption. It was assumed that a person with more knowledge of COVID-19 may realize the importance of protective measures against this pandemic and do so accordingly in Tangail. Interestingly, this relationship did not hold. Knowledge was not a factor that influences the adoption of precautionary behaviors in the studied areas. Since knowledge is gained through information, invariance of knowledge among citizens made knowledge an insignificant predictor of precautionary behaviors. This might be a probable indication of an equal opportunity to access the information or acquire knowledge from various sources among the residents of Dhaka and Tangail.

Maintaining a proper attitude toward emergency situations is therefore very necessary. An optimistic attitude toward disease can result in the success of control measures such as traffic limits and location lockdowns (Zhong et al. 2020). During the SARS outbreak, optimistic thinkers more often avoided crowded or public places but portrayed poor adoption of health behaviors, such as less use of disinfectants and washing their hands infrequently. On the other hand, those who were more concerned about SARS reported better adoption of health behaviors and less avoidance (Lee-Baggley et al. 2004). Surprisingly, attitude did not appear to be a significant predictor of precautionary behavior in any of the samples in this study.

This study gives the evidence that self-control, mental health, and education can have significant impacts on adoption of precautionary behavior among young adults. Unlike the previous evidence across the world, a better knowledge of and a positive attitude toward the disease cannot ensure them to be more cautious of stopping the spread of COVID-19. These findings can be helpful for policymakers in several ways. Publicizing scientific information about COVID-19 as thoroughly as possible can enhance the development of the public's healthy behaviors (Zhong et al. 2020). The circulation of false information, rumors, and unauthentic news from different social networking sites and online news portals obviously misguides people and, in effect, promotes the loss of self-control. These factors can result in unanticipated fatal outcomes and the government's special attention is needed on this. Moreover, formulating proper policies aiming at improving the mental health status of young adults is also a call of the time.

## Limitations

Even though the findings of this early study can bear several implications, both theoretically and empirically, it could not

overcome some limitations. The study covered only educated young adult participants and could not incorporate the responses from elderly people living in remote areas. Rural people and older people are more likely to have inappropriate precautionary behaviors, and they need special research efforts. Analyses of a more representative sample drawn from all over Bangladesh can show more vigorous findings.

## Conclusion

The results from descriptive statistics showed that young adults of Dhaka and Tangail show moderate precautionary behavior to prevent COVID-19 and the mean precautionary score is different across gender, presence of psychological distress, and level of education. Moreover, from the econometric estimations of different models, self-control and education emerged as the significant predictors of better precautionary behavior. Knowledge of and attitude toward COVID-19 failed to influence the adoption of precautionary behavior to avoid the COVID-19 contamination. Because having better knowledge and a proper attitude cannot ensure the adoption of more precautionary behaviors among the people, the government's strong intervention to keep people maintaining social distance from each other is imminent. A strict lockdown in severely affected areas is useful in reducing the transmission rate of COVID-19.

**Authors' contribution** Asif Imtiaz contributed to the study conception and design. Material preparation, data collection and analysis were performed by Asif Imtiaz, and Noor Muhammad Khan. The first draft of the manuscript was written by Asif Imtiaz and Noor Muhammad Khan. Md. Akram Hossain approved the final version to be published. All authors read and approved the final manuscript.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they do not have any conflict of interest.

**Ethical approval** The study was approved by the research ethics committee of the Center for Project Management and Information Systems (PMIS), University of Dhaka. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

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