Article

Knowledge, Attitudes, and Practices towards COVID-19 among Pregnant Women in Northern Bangladesh: A Community-Based Cross-Sectional Study

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Abstract

Background: COVID-19, caused by SARS-CoV-2, is still a global public health concern due to the absence of effective antiviral treatment against different strains. Studies have shown that pregnant women are more susceptible to COVID-19 due to altered physiology and immunological features. Therefore, this study was designed to investigate pregnant women's knowledge, attitudes, and practice (KAP) to prevent COVID-19 and determine the factors associated with KAP.

Methods: A community-based cross-sectional study was conducted among 425 pregnant women in Northern Bangladesh. The samples were obtained using a simple random sampling technique from April 5 to June 15, 2020. The data were collected by face-to-face survey with a structured and pre-tested questionnaire and analyzed using SPSS version 25. Bivariable and multivariable logistic regression analyses were performed, and *p*-values < 0.05 at 95% CI were considered statistically significant.

Results: Overall, the score of KAP among the respondents was 47.76%, 49.41%, and 56.24%, respectively. Participants' area of residence, educational status of the husband, and antenatal care (ANC) visit were

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significantly associated with the level of knowledge, whereas age, educational status of the husband, number of living children, and knowledge were significant predictors of attitude. The knowledge of COVID-19 was the only predictor associated with the practice.

Conclusion: Our study shows that almost half of the participants had poor knowledge, a negative attitude, and poor practices toward COVID-19. Additional health education programs by healthcare professionals and different media, coordinated and combined efforts of government and individuals' participation will be required to fight the spread of the infection.

Keywords: COVID-19; Knowledge; Practice; Pregnant women; Bangladesh

1. Introduction

The Novel Coronavirus disease (COVID-19) is an infectious disease caused by a new type of enveloped RNA coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1]. Since its first report in December 2019 in Wuhan, China, COVID-19 has rapidly evolved with worldwide exponential spread. As a result, the World Health Organization (WHO) declared COVID-19 a global pandemic on March 11, 2020 [2].

Since SARS-CoV-2 strains are constantly evolving, herd immunity has not yet developed, putting all populations at risk of infection. However, as pregnant women are more susceptible to severe infection by respiratory pathogens, they may be more susceptible to COVID-19 infection than the general population [3]. Additionally, because pregnant women undergo physiological changes and have characteristic immune responses, the possible risks from the cytokine storm by COVID-19 infection might be severe and fatal [4]. For example, a report from Brazil shows that from February 26, 2020, to June 18, 2020, there were 124 maternal deaths due to the pandemic [5]. Furthermore, several studies also reported that COVID-19 positive pregnant women had pre-existing co-morbidity such as diabetic mellitus, bacterial

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and viral co-infections, and obstetric complications, including premature rupture of membrane, placenta previa, preeclampsia, and postpartum haemorrhage [6]. Besides, the requirement for mechanical ventilation in COVID-19 positive pregnant mothers is higher than that for non-pregnant ones [7]. In addition, there is a strong association between COVID-19 and fetal and neonatal complications such as fetal distress, fetal tachycardia, low birth weight, neonatal asphyxia, and stillbirth [8]. Hence, with the ongoing pandemic of COVID-19, pregnant women and newborn babies should be considered at-risk populations in strategies centering on preventing COVID-19 infection.

A recent study conducted among pregnant women in Ghana found that 85% of the participants had good knowledge of COVID-19 but poor practice, as 63.4% were not practicing preventive measures [9]. Another study on pregnant women in India demonstrates that the majority of the pregnant women had satisfactory knowledge, positive attitudes, and good practices regarding COVID-19 [10]. However, two other studies from Ethiopia concluded that about half of the pregnant women had poor knowledge and inappropriate practice [11, 12]. The major determinants of knowledge about COVID-19 were women's age, residence, educational status, occupation, being civil servant, wanted pregnancy, and ANC follow-up, whereas age, educational status, residence, number of children, and knowledge were the major determinants of preventive practices [9-12]. In addition, age, the participant's husband's education, wanted pregnancy, and knowledge were the predictors of attitude [12].

Bangladesh is one of the Asian countries severely affected by the COVID-19 pandemic. This is partly due to Bangladesh's geographic location, as it shares three sides with India. Therefore, the catastrophic surge of delta variants in India also spread across the border [13]. Besides, the health care system of Bangladesh is not prepared for the pandemic since the country has never had experience dealing with epidemics such as SARS or MERS [14]. Nevertheless, since the COVID-19 outbreak, the government of Bangladesh has undertaken unparalleled measures to control the spread of the virus, including applying public health protocols, such as frequent hand washing, physical distancing,

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and lockdown measure [14]. Despite all efforts, Bangladesh reported 1,575,185 coronavirus cases and 27,970 deaths till November 26, 2021 [15]. Furthermore, although reports have been published on KAP in Bangladesh focusing general population, data on pregnant women's KAP remains scarce [14, 16, 17].

Unfortunately, rules implemented by the government created public distress and massive fear [18], especially among the unaffected population [19], driving them not to obey those. However, public compliance is crucial for such measures to be effective, which largely depends on their KAP towards COVID-19 [20, 21]. Therefore, our study investigated KAP towards COVID-19 and its associated factors among pregnant women in Northern Bangladesh. Data obtained from this study will facilitate healthcare professionals to provide appropriate counselling to reassure and clarify the uncertainties of pregnant women towards COVID-19 during the antenatal, intrapartum, and postpartum periods.

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2. Methods

2.1 Study design and setting

This community-based cross-sectional study investigated KAP about COVID-19 among pregnant women in Northern Bangladesh. A face-to-face survey was conducted to collect data on the study population from April 5 to June 15, 2020. Five sub-districts were selected randomly from each of the two northern districts, Lalmonirhat and Kurigram. Lalmonirhat Sadar, Kaliganj, Aditmari, Patgram, and Hatibandha from Lalmonirhat district and Kurigram Sadar, Phulbari, Nageshwari, Ulipur, and Rajarhat from Kurigram district. Both of these districts are under the Rangpur division, a northern border region of Bangladesh. For data collection, we visited community clinics (primary-level health facilities that the government has established along with the participation of local communities), union health and family welfare centers (UH & FHC), and non-governmental organization (NGO) hospitals/clinics in the study areas with strict precautionary measures during the pandemic.

2.2 Survey questionnaire and tools

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Data were collected via face-to-face interview techniques using a structured and pre-tested questionnaire. The questionnaire was first prepared in English, then translated to the local language, Bengali, for simplicity, and back to English for consistency. The questionnaire was adapted from WHO guidelines and relevant literature in different parts of the world and modified according to the local context. The questionnaires have six items (socio-demographic characteristics, reproductive health-related characteristics, knowledge-related characteristics, attitude-related characteristics, practice-related characteristics, and source of information regarding COVID-19). Pre-testing of the questionnaire was done on 10% of the total participants (43 pregnant women) in Lalmonirhat town near the study setting. During the pre-test, the questionnaire was assessed for its clarity, accuracy, comprehensiveness, readability, and optimal time for completing the interview. Modifications and corrections, including wording, logical sequence, and skip patterns, were immediately performed based on the results. Four diploma health professionals collected the data. Data collectors were trained for one day on the aim of the study, method of data collection, contents of the questionnaire, confidentiality, and informed consent before they started the actual data collection. The completeness and consistency of the collected data were cross-cheeked, cleaned, and compiled by supervisors and principal investigators regularly.

2.3 Sample size determination and sampling procedure

A sample size of 425 participants was determined by using the single proportion formula with the following assumptions: the proportion of KAP of preventive measures against COVID-19 is 50% since there is no related study in Bangladesh, confidence interval of (CI) 95%, margin of error (d) 5%, and considering none response rate of 10%. Pregnant women who had given informed consent to participate in the study and had antenatal care (ANC) follow-up

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for current pregnancies were included as the study population. In contrast, pregnant mothers who had mental problems, hearing difficulties, or were critically ill were excluded from the study.

2.4. Operational definitions

Level of knowledge, attitude, and practice were determined using 15 knowledge assessments, seven attitude assessments, and eight practice assessments questionnaires, respectively, and labelled as good and poor knowledge and practice based on mean score. Pregnant women who scored greater than or equal to the mean score of attitude questions of COVID-19 were considered as having a positive attitude. In contrast, those who scored less than the mean score was considered to have a negative attitude.

Good knowledge: Participants who scored greater than or equal to the mean score.

Poor knowledge: Participants who scored less than the mean score.

Positive attitude: Participants who scored greater than or equal to the mean score.

Negative attitude: Participants who scored less than the mean score.

Good practice: Participants who scored greater than or equal to the mean score.

Poor practice: Participants who scored less than the mean score.

2.5 Statistical Analysis

Statistical analysis software, IBM SPSS Statistics 25.0 and Microsoft Excel 16, were used to analyze the data. A simple descriptive analysis was carried out, and frequency, means, and percentages were used to present the descriptive results. The Manne-Whitney U test was used to compare the socio-demographic and obstetric health characteristics with two independent samples, and the Kruskal-Wallis test was used to compare three or more independent samples. In addition, multinomial logistic regression was used for prediction and estimating impact. The Hosmer-Lemeshow goodness of fit

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test was carried out to check the fitness of the model. All tests were done at 95% confidence intervals, and a two-sided significance value (*p-value*) <0.05 was considered statistically significant.

3. Results

3.1. Socio-demographic characteristics

A total of 425 pregnant women participated in this study, with a mean age of 30.37 (SD=5.12) years. The respondents predominantly resided in rural areas 235 (55.29%) and were Muslim (Islam followers) 357 (84%). Approximately half of the participants, 212 (49.88%) and 160 (37.65%) of the participant's husbands had minimum higher secondary (11-12) level education. (Table 1). Additionally, 287 (67.53%) of the respondents were homemakers, 78 (18.35%) employees in the private sector, 43 (10.12%) government employees, and 17 (4%) students, or job seekers. Mass media was the primary source of knowledge of the participants (31.06%), followed by health professionals (19.53%), friends and neighbors (13.18%), family members and relatives (12.24%), and government website (11.06%) (Figure 1).

Table 1. Pregnant women's' distribution by socio-demographic, obstetric and reproductive health related characteristics (N = 425).

Variables	N	Percent (%)
Age, mean, (SD), Year		30.37 (5.12)
Resident		
Rural	235	55.29%
Urban	190	44.71%
Religion		
Muslim	357	84.00%
Hindu	68	16.00%
Education		
No formal education	16	3.76%
Secondary (6-10) and lower	80	18.82%
Intermediate (11-12)	212	49.88%
Bachelor	23	5.41%
Higher Education (Above bachelor)	94	22.12%

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Occupation		
Housewife	287	67.53%
Employee at private sector	78	18.35%
Gov. employee	43	10.12%
Student/Job finder	17	4.00%
Education of Husband		
Secondary (6-10) and lower	103	24.24%
Intermediate (11-12)	160	37.65%
Bachelor	23	5.41%
Higher Education (Above bachelor)	139	32.71%
Occupation of Husband		
Gov. employee	49	11.53%
Employee at private sector	337	79.29%
Businessman	18	4.24%
Day Labor	21	4.94%
Gravidity		
Primi	276	64.94%
Multi	149	35.06%
Parity		
Nuliparous	249	58.59%
Primipara	85	20.00%
Multipara	91	21.41%
Number of living children		
None	290	68.24%
One	107	25.18%
Greater than or equal 2	28	6.59%
Condition of pregnancy		
Unwanted	54	12.71%
Wanted	359	84.47%
Mistimed	12	2.82%
ANC visit		
No	171	40.24%
Yes	254	59.76%

3.2. Reproductive and obstetric health characteristics

This study results showed that about 276 (64.94%) and 162 (40%) participants were primigravida's and nulliparas, respectively. In addition, more than three-fourths of the respondents had no prior history of miscarriage (90.4%, n=384) or abortion (96.9%, n=412), or stillbirth (92.2%, n=392). About 359 (84.47%) respondents reported current pregnancy as

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wanted and planned. Moreover, 254 (59.76%) participants had been to ANC follow-up for the pregnancy during the study period. Of the participants, 68.24% (n=290) had no living children, 25.18% (n=107) had one, and 6.59% (n=28) had greater than or equal to 2 children (Table 1).

3.3. Knowledge of pregnant women towards COVID-19

According to the study, about 46.59% (n=198) of the participants were aware of the COVID-19 pandemic (Table 2). Furthermore, more than half of the participants (66.82%, n=284) acknowledged that they knew the COVID-19 disease was caused by a virus. Moreover, about half of the study respondents answered that the disease transmits *via* respiratory droplets of infected individuals (49.18%, n=209), and this transmission can be prevented by staying indoors, frequent handwashing, and wearing a face mask (51.53%, n=219). However, more than half of the respondents (53.18%, n=226) reported that they did not know that individuals with coronavirus disease can still spread the disease to others without developing signs and symptoms.

Table 2. Distribution of participants' KAP towards COVID-19 (N = 425).

Knowledge items	**Yes (%)**	**No (%)**
Aware of ongoing COVID-19 outbreak	46.59	53.41
COVID-19 is disease caused by virus	66.82	33.18
The COVID-19 spreads via respiratory droplets of infected individuals	49.18	50.82
COVID-19 can spread through touching face, mouth, and eyes by infected hands	49.65	50.35
Symptoms appear after 2-14 days	48.00	52.00
The whole population is susceptible to COVID-19	44.71	55.29
The major clinical symptoms of COVID-19 are headache, fever, fatigue, dry cough, and difficulty in breathing	41.88	58.12
COVID-19 can affect human and other animals	44.00	56.00
COVID-19 is airborne	44.71	55.29
Staying indoors washing hands frequently and using face mask can prevent transmission of COVID-19	51.53	48.47
Worst on people with chronic disease	50.12	49.88
Worst on older people	53.41	46.59
Without developing signs and symptoms, individuals with corona virus disease can spread COVID-19 to others	46.82	53.18
Pregnant women are at higher risk than others if infected with COVID-19?	45.88	54.12

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Vaccine available		43.06%	56.94%
Attitude items	**Disagree (%)**	**Neutral (%)**	**Agree (%)**
COVID-19 is a deadly disease	44.71	10.59	44.71
People with any age can infected with COVID-19	39.53	11.76	48.71
Pregnant women are more susceptible of getting COVID-19 compared to non-pregnant women	40.71	13.88	45.41
COVID-19 makes you reduce or discontinue your routine prenatal care	42.12	12.00	45.88
Your new-born can be infected with COVID-19	46.12	7.76	46.12
It can be treated at home	44.71	6.59	48.71
Social distancing and face mask can play an important role in COVID-19 prevention	45.65	3.29	51.06
Practice items		**Yes (%)**	**No (%)**
Are you obeying government restriction on COVID-19?		47.29	52.71
Have you stop going crowded place during the COVID-19 pandemic?		49.88	50.12
Do you wash hands frequently using water and soaps?		49.18	50.82
Do you maintain 2 m distance others?		44.00	56.00
Do you avoid touching eyes, nose, and mouth with unwashed hands?		46.12	53.88
Do you wear face mask in public?		47.53	52.47
Do you cover mouth and nose during coughing or sneezing?		55.06	44.94
Do you maintain a healthy lifestyle during COVID-19 outbreak?		43.29	56.71

For the disease symptoms, more than half of the respondents reported that they did not know the major symptoms (Headache, fever, fatigue, dry cough, and difficulty in breathing) of COVID-19 (58.12%, n=247). More than half of the respondents also reported that they were not aware of vaccine availability (56.94%, n=242), nor did they know that pregnant women were at higher risk than others if infected with COVID-19 (54.12%, n=230). Again, more than half of the respondents did not know that the whole population was susceptible to COVID-19 (55.29%, n=235), and the symptoms appeared after 2-14 days (52%, n=221). In addition, participant's knowledge scores significantly differed across residence places, education levels of the participants, occupation of the participants, educational level of participant's husbands, and ANC visits (p <0.05) (Table 3), and only 47.76% of the participants had good knowledge about COVID-19 (Figure 2).

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Regression analysis revealed factors associated with the knowledge of the participants and found that participants who lived in a rural area (vs. urban, AOR: 0.59, 95% CI = 0.38-0.92, $p<0.05$) had lower odds of having knowledge about COVID-19. Participant's husband having secondary and lower levels of education (vs. master's and above, AOR: 0.18, 95% CI = 0.07-0.43, $p<0.001$), intermediate level of education (vs. master's and above, AOR: 0.32, 95% CI = 0.14-0.71, $p<0.01$), bachelor's degree (vs. master's and above, AOR: 0.10, 95% CI = 0.03-0.35, $p<0.001$) had lower odds of knowledge regarding COVID-19. In addition, participants whose number of ANC visits was more than 3 times (vs. less than or equal to 3 times, AOR: 0.62, 95% CI = 0.39-0.98, $p<0.05$) had lower odds of knowledge regarding COVID-19 (Table 4).

Table 3: Differences in participants mean score of COVID-19 related to KAP (N = 425).

Categories	**N (%)**	**Knowledge**		**Attitude**		**Practice**	
		(Mean ± SD)	***p* Value**	**(Mean ± SD)**	***p* Value**	**(Mean ± SD)**	***p* Value**
Age							
15 to 24 Year	55 (12.9)	(7.24 ± 2.2)	0.669	(7.20 ± 2.8)	0.919	(3.67 ± 1.5)	0.565
25 to 34	306 (72.0)	(7.33 ± 2.4)		(7.27 ± 3.1)		(3.82 ± 1.8)	
Above or equal 35	64 (15.1)	(6.98 ± 2.4)		(7.33 ± 3.0)		(3.97 ± 1.6)	
Resident							
Rural	235 (55.3)	(6.97 ± 2.3)	**0.005**	(7.15 ± 2.9)	0.414	(3.84 ± 1.6)	0.774
Urban	190 (44.7)	(7.63 ± 2.4)		(7.42 ± 3.2)		(3.81 ± 1.8)	
Religion							
Muslim	357 (84.0)	(7.20 ± 2.4)	0.156	(7.11 ± 3.0)	**0.007**	(3.71 ± 1.7)	**<0.001**
Hindu	68 (16.0)	(7.60 ± 2.4)		(8.13 ± 2.9)		(4.43 ± 1.6)	
Education							
No formal education	16 (3.8)	(6.44 ± 2.3)	**<0.001**	(7.00 ± 3.0)	**<0.001**	(3.50 ± 1.7)	**<0.001**
Secondary (6-10) and lower	80 (18.8)	(6.60 ± 2.1)		(6.39 ± 2.7)		(3.31 ± 1.4)	
Intermediate (11-12)	212 (49.9)	(6.93 ± 2.3)		(6.57 ± 2.8)		(3.55 ± 1.6)	
Bachelor	23 (5.4)	(8.78 ± 2.0)		(9.61 ± 2.6)		(4.65 ± 1.7)	
Higher Education (Above bachelor)	94 (22.1)	(8.35 ± 2.5)		(9.09 ± 2.8)		(4.73 ± 1.9)	
Occupation							
Housewife	287 (67.5)	(7.10 ± 2.3)	**<0.001**	(6.96 ± 3.0)	**<0.001**	(3.63 ± 1.6)	**<0.001**

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Employee at private sector	78 (18.4)	(7.12 ± 2.5)		(7.33 ± 3.2)		(3.87 ± 1.9)	
Gov. employee	43 (10.1)	(7.91 ± 2.2)		(8.23 ± 2.4)		(4.53 ± 1.6)	
Other	17 (4.0)	(9.06 ± 2.5)		(9.76 ± 2.6)		(5.06 ± 1.7)	
Education of Husband							
Secondary (6-10) and lower	103 (24.2)	(6.38 ± 2.0)	**<0.001**	(6.29 ± 2.5)	**<0.001**	(3.28 ± 1.4)	**<0.001**
Intermediate (11-12)	160 (37.6)	(6.88 ± 2.3)		(6.49 ± 2.7)		(3.53 ± 1.5)	
Bachelor	23 (5.4)	(6.22 ± 1.7)		(6.04 ± 3.5)		(3.39 ± 1.8)	
Higher Education (Above bachelor)	139 (32.7)	(8.54 ± 2.4)		(9.10 ± 2.8)		(4.63 ± 1.8)	
Occupation of Husband							
Gov. employee	49 (11.5)	(7.67 ± 2.7)	0.355	(8.08 ± 3.5)	0.293	(4.27 ± 1.7)	0.293
Employee at private sector	337 (79.3)	(7.25 ± 2.4)		(7.18 ± 3.0)		(3.78 ± 1.7)	
Businessman	18 (4.2)	(6.44 ± 1.8)		(6.94 ± 2.5)		(3.67 ± 1.3)	
Student/Job finder	21 (4.9)	(7.29 ± 2.2)		(7.10 ± 2.3)		(3.57 ± 1.5)	
Gravidity							
Primi	276 (64.9)	(7.20 ± 2.4)	0.419	(7.21 ± 3.1)	0.603	(3.74 ± 1.7)	0.148
Multi	149 (35.1)	(7.39 ± 2.4)		(7.38 ± 2.8)		(3.97 ± 1.6)	
Parity							
Nuliparous	249 (58.6)	(7.18 ± 2.3)	0.948	(7.27 ± 3.2)	0.785	(3.76 ± 1.8)	0.607
Primipara	85 (20.0)	(7.44 ± 2.5)		(7.19 ± 2.8)		(3.96 ± 1.6)	
Multipara	91 (21.4)	(7.33 ± 2.5)		(7.34 ± 2.8)		(3.87 ± 1.6)	
Number of living children							
None	290 (68.2)	(7.14 ± 2.3)	0.836	(7.15 ± 3.1)	0.223	(3.76 ± 1.7)	0.242
One	107 (25.2)	(7.54 ± 2.6)		(7.67 ± 2.8)		(3.88 ± 1.6)	
Grater than or equal 2	28 (6.6)	(7.46 ± 2.3)		(7.00 ± 2.8)		(4.25 ± 1.8)	
Condition of pregnancy							
Unwanted	54 (12.7)	(7.44 ± 2.2)	0.731	(7.63 ± 2.9)	0.385	(4.15 ± 1.6)	0.337
Wanted	359 (84.5)	(7.23 ± 2.4)		(7.19 ± 3.1)		(3.78 ± 1.7)	
Mistimed	12 (2.8)	(7.50 ± 1.9)		(8.17 ± 2.7)		(3.67 ± 1.2)	
ANC visit							
No	171 (40.2)	(7.02 ± 2.4)	**0.049**	(7.14 ± 3.1)	0.376	(3.68 ± 1.7)	0.141
Yes	254 (59.8)	(7.43 ± 2.4)		(7.36 ± 3.0)		(3.92 ± 1.7)	
Total	425 (100.0)	(7.26 ± 2.4)		(7.27 ± 3.0)		(3.82 ± 1.7)	

Note: SD = Standard deviation

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3.4. Attitude of pregnant women towards COVID-19

The responses to each question regarding the attitude of pregnant women toward COVID-19 are depicted in Table 2. About 45.41% of study respondents agreed that they wanted to reduce or discontinue their prenatal care visits due to COVID-19. Also, about 46.12% of the participants agreed that they feared their new-born might get infected with COVID-19. The response rates of 'Agree' were higher for the questions concerning COVID-19 being preventable by practicing social distancing and wearing a facemask (51.06%), and it is treatable at home (48.71%). A statistically significant association was found between attitude and sociodemographic variables such as religion, education level of the participant, occupation of the participant, and education level of the participant's husband ($p<0.05$) (Table 3), and only 49.41% of the participants had a positive attitude towards COVID-19 (Figure 2).

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Participants in the age group 25-34 years (vs. ≥35 years, AOR: 0.38, 95% CI = 0.16-0.91, p<0.05) were less likely to have a positive attitude towards COVID-19. Participant's husband has a secondary and lower level of education (vs. master's and above, AOR: 0.23, 95% CI = 0.09-0.63, p<0.01), intermediate level of education (vs. master's and above, AOR: 0.32, 95% CI = 0.13-0.80, p<0.05), were less likely to have a positive attitude towards COVID-19. Moreover, participants who had only one child (vs. greater than or equal to 2, AOR: 4.87, 95% CI = 1.28-18.51, p<0.05) were more likely to have a positive attitude toward COVID-19. Participants having poor knowledge of COVID-19 (vs. good knowledge, AOR: 0.12, 95% CI = 0.07-0.20, p<0.001) were more likely to have a positive attitude towards COVID-19 (Table 4).

3.5. Practice of pregnant women towards COVID-19

The responses for each practice question are presented in Table 2. About half of the study participants responded that they did not avoid crowded places during the COVID-19 pandemic (50.12%, n=213) nor practiced frequent handwashing with water and soaps (50.82%, n=216). In addition, more than half of the study participants reported that they did not maintain a 2-meter distance from others (56%, n=238) and did not wear a face mask in public (52.47%, n=223). Participant's mean practice score was significantly different in terms of religion, education level of the participant's, occupation of the participant's and education level of the participant's husband (p<0.05) (Table 3), and 56.24% of the participants had good practice towards COVID-19 (Figure 2). Participants having poor knowledge of COVID-19 (vs. good knowledge, AOR: 0.11, 95% CI = 0.07-0.19), p<0.001) were less likely to have good practices towards COVID-19 (Table 4).

Table 4: Multivariable analysis of factors affecting KAP towards COVID-19

Variables	**Knowledge**	**Attitude**	**Practice**
	AOR (95% CI)	**AOR (95% CI)**	**AOR (95% CI)**
Age			
15-24	2.34 (0.81-6.76)	0.43 (0.13-1.41)	0.58 (0.19-1.81)

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25-34	1.13 (0.52-2.49)	**0.38 (0.16-0.91)***	0.68 (0.30-1.57)
≥35	Ref.	Ref.	Ref.
Resident			
Rural	**0.59 (0.38-0.92)** *	1.15 (0.69-1.90)	1.41 (0.87-2.28)
Urban	Ref.	Ref.	Ref.
Religion			
Muslim	1.07 (0.55-2.07)	1.31 (0.61-2.82)	0.65 (0.32-1.33)
Hindu	Ref.	Ref.	Ref.
Education			
No formal education	0.30 (0.07-1.35)	0.84 (0.17-4.29)	0.52 (0.12-2.34)
Secondary (6-10) and lower	0.55 (0.19-1.56)	0.77 (0.24-2.49)	0.68 (0.22-2.09)
Intermediate (11-12)	0.65 (0.26-1.61)	0.56 (0.20-1.58)	0.70 (0.26-1.86)
Bachelor	1.46 (0.40-5.32)	1.43 (0.35-5.93)	1.31 (0.35-4.90)
Higher Education (Above bachelor)	Ref.	Ref.	Ref.
Occupation			
Housewife	0.50 (0.11-2.42)	1.02 (0.19-5.40)	0.59 (0.10-3.34)
Employee at private sector	0.28 (0.06-1.36)	0.81 (0.15-4.31)	0.56 (0.10-3.22)
Gov. employee	0.72 (0.14-3.82)	1.22 (0.21-7.17)	0.98 (0.15-6.28)
Student/Job finder	Ref.	Ref.	Ref.
Education of Husband			
Secondary (6-10) and lower	**0.18 (0.07-0.43)** ***	**0.23 (0.09-0.63)****	1.08 (0.41-2.87)
Intermediate (11-12)	**0.32 (0.14-0.71)** **	**0.32 (0.13-0.80)***	1.30 (0.52-3.24)
Bachelor	**0.10 (0.03-0.35)** ***	0.38 (0.10-1.41)	2.07 (0.58-7.40)
Higher Education (Above bachelor)	Ref.	Ref.	Ref.
Occupation of Husband			
Gov. employee	0.85 (0.24-3.00)	1.28 (0.31-5.27)	3.16 (0.84-11.91)
Employee at private sector	1.05 (0.35-3.20)	1.19 (0.34-4.16)	1.58 (0.50-4.97)
Businessman	0.73 (0.16-3.30)	1.67 (0.34-8.15)	3.94 (0.81-19.14)
Daily labourer	Ref.	Ref.	Ref.
Gravidity			
Primi	1.33 (0.47-3.72)	1.66 (0.54-5.10)	0.89 (0.32-2.46)
Multi	Ref.	Ref.	Ref.
Parity			
Nuliparous	1.55 (0.53-4.55)	1.50 (0.46-4.83)	1.02 (0.33-3.12)
Primipara	1.83 (0.80-4.16)	1.01 (0.41-2.51)	1.66 (0.70-3.98)
Multipara	Ref.	Ref.	Ref.
Number of living children			
None	0.48 (0.10-2.23)	1.83 (0.33-10.11)	0.51 (0.11-2.40)
One	1.10 (0.35-3.40)	**4.87 (1.28-18.51)***	0.57 (0.17-1.89)

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Greater than or equal 2	Ref.	Ref.	Ref.
Condition of pregnancy			
Unwanted	0.59 (0.13-2.55)	0.64 (0.12-3.39)	1.90 (0.42-8.57)
Wanted	0.72 (0.18-2.95)	0.53 (0.11-2.60)	2.63 (0.64-10.77)
Mistimed	Ref.	Ref.	Ref.
ANC visit			
No	**0.62 (0.39-0.98)** *	1.28 (0.77-2.14)	0.98 (0.60-1.58)
Yes	Ref.	Ref.	Ref.
Knowledge			
Poor knowledge	-	**0.12 (0.07-0.20)*****	**0.11 (0.07-0.19)*****
Good knowledge	-	Ref.	Ref.

Note: *p < 0.05; **p < 0.01; ***p < 0.001, AOR = Adjusted Odds Ratio, CI = Confidence interval

4. Discussion

This is the first study in Bangladesh investigating the KAP towards COVID-19 among pregnant women in Northern Bangladesh during the COVID-19 pandemic.

Our research revealed that almost half (46.6%) of the participants had heard about the coronavirus pandemic, comparatively lower than studies conducted in Ethiopia and Bangladesh [11, 22]. The most credible source of information about COVID-19 for the participants was the mass media (31.1%). This finding is in line with other studies done in Ethiopia and Kenya [11, 12, 23]. This result highlighted the importance of mass media in preventing COVID-19, especially when people are in lockdown. According to our findings, 41.9% of the participants think headache, fever, fatigue, dry cough, and difficulty in breathing were the major clinical symptoms of COVID-19, which is slightly lower compared with recent studies [11, 12]. The differences in the results could be explained by the area, context, and survey timing across the countries.

Our study also noted that the participants' knowledge regarding COVID-19 was higher (47.8%) than in a study in Egypt (16.4%) [24] and similar to studies conducted in Ethiopia [11, 12] and South Africa [25]. Nevertheless, it was lower than the findings from other studies conducted in Ghana (85.6%) [9] and India (60%) [10]. The difference, perhaps, is because

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of the variations in sociodemographic characteristics, study setting, healthcare system, and health education programs of the countries to raise awareness concerning the disease.

Overall, half of the respondents (49.4%) showed a positive attitude towards COVID-19 was similar to a study conducted in Ethiopia [12], lower than a study conducted in India [10], and higher than a study done in South Africa [25]. The present finding is also lower than studies from Bangladesh [14], Iran [26], and Malaysia [27]. The reasons for these discrepancies might be caused by sociodemographic characteristics, study setting, and study participants. In agreement with the present study, Yassa et al. [28] reported that less than half of the pregnant women do not think that they are more susceptible to getting COVID-19, and their new-born can be infected with COVID-19 compared to non-pregnant women. More importantly, about 45.7% of pregnant women disagreed that social distancing and face masks can play an important role in COVID-19 prevention. The negative attitudes of pregnant women towards COVID-19 could be possible because of the regulatory measures such as lockdowns, social distancing, and use of face masks in public places from the beginning of the confirmed cases in Bangladesh. This negative attitude might mitigate the efforts made by the governments to decrease the spread of COVID-19.

Based on our study findings, 56.2% of the participants had a good level of practice in preventing COVID-19. The finding was higher than a study from Ghana [9] and lower than studies from India [10] and South Africa [25]. However, the study also found that the commonly practiced preventive measures such as wearing a face mask (47.5%), frequent washing of hands with water and soap (49.2%), and maintaining a 2m distance (44%) were adopted only by less than half of the participants, which was lower than a recent study from Ethiopia [11]. The possible explanation for the low level of adherence to preventive practices could be inadequate face masks, unavailability of soap for handwashing, and high cost or unavailability of hand sanitizer in the study area. In addition, the responses by the participants also exhibited ignorance about the severity of the disease, reluctance to use face masks, and avoid the crowd. This explains

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the reason behind less compliance by the participants in following precautionary measures specified by the government and maintaining social distancing and other preventive measures.

Similar to the findings of the present study, two other studies on pregnant women revealed that individuals living in urban areas had more knowledge about COVID-19 [9, 28]. This is not surprising because urban areas have good infrastructure, such as internet connectivity and other media facilities, compared to their rural counterparts. According to our study, participants' husbands with a higher level of education were found to have more knowledge about COVID-19, whereas other studies found such associations [11, 12]. This could be justified by the fact that husbands' higher level of education leads their wives to access more information technologies with easier access to health information which further helps to educate their wives with basic knowledge of COVID-19. According to the current finding, women who had ANC follow-up during their current pregnancy had a good level of COVID-19 knowledge. The result was supported by a study conducted in Ethiopia [11]. The probable reason might be that participants with ANC follow-up obtained information, main manifestation, and prevention strategies about COVID-19 while visiting healthcare providers for routine obstetric care.

Our study also determines factors associated with pregnant women's attitudes. Increased age of pregnant women was positively associated with a positive attitude. Recent research conducted in Pakistan concurs with our study results. [29]. The finding might be because the higher the age, the longer the experience dealing with the COVID-19 emergency, showing confidence and optimism. The participants with higher education had a significantly higher positive attitude than participants with lower education. This might be because the educated husband has better access to information via different sources such as newspapers, the Internet, Facebook, and telegram. Moreover, educated individuals also can comprehend the information easily that they receive and follow them. Furthermore, as the educational level of the husband increases, they can learn more accurate information promptly and share more critical topics clearly with their

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wife. Additionally, an educated husband may better understand complications and outcomes associated with the outbreak, thereby positively influencing his wife's attitude. Lastly, the pregnant women with good knowledge also showed a good attitude toward COVID-19. This is consistent with a study performed in Ethiopia [12] and Pakistan [29]. The underlying reason might be that good knowledge clears confusion and raises awareness leading to a positive attitude toward COVID-19.

Regarding the practice of pregnant women, it is worth mentioning that higher COVID-19 knowledge scores were found to be associated with a lower likelihood of poor practices towards COVID-19 in this study. Studies from Ethiopia [11] and China [30] are consistent with this study findings. This might be because in-depth knowledge about COVID-19 may improve the perception and awareness of the disastrous consequences and, thus, helpful for maintaining good practices to control COVID-19 infection.

This study has several limitations. Due to the scarcity of studies explicitly dedicated to pregnant women, the researchers attempted to refer to other related studies to discuss the results. This may limit the generalizability of the study results. Social desirability and selection bias may also influence the results, as they might deter participants from providing accurate information. Also, due to the cross-sectional nature of our study, causal inference cannot be drawn. In the current study, we used only a limited number of questions to assess knowledge, attitude, and practice. Therefore, additional assessments using all aspects of KAP towards COVID-19 would be needed to determine the actual extent of KAP in the general population. However, the findings from our study are useful and are the first to measure the level of KAP of pregnant women towards COVID-19 in Bangladesh.

5. Conclusion

In conclusion, our study revealed that about half of the participants had poor knowledge, negative attitudes, and poor practices for preventing COVID-19. In addition, women's age, residence, husband's educational level, number of living

children, and ANC visits were significant predictors of KAP. As per findings, the authors recommend that the government and other policymakers increase health education and counselling pregnant women regarding the spread, transmission, and preventive measures to fight against deadly COVID-19. Furthermore, since access to electronic media is limited in rural areas, media campaigns should be extended to rural areas. Finally, efforts should increase access to water, sanitation, and hygiene practices with the free supply of face masks, soap, and hand sanitizers.

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Ethics Statement: The study was conducted in accordance with the guidelines of the Helsinki Declaration, 1975. The research protocol was evaluated and approved by the Research Ethical Committee (REC) of the Department of Biochemistry and Food Analysis, Patuakhali Science and Technology University, Bangladesh (Approval Number: BFA: 10/01/2020:02). Each of the surveyed individuals was aware of the purpose of the study, data confidentiality, further manoeuvre of the collected data, and the right to withdraw from the study at any time.

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Conflict of interests: The authors declare that they have no conflict of interest.

Consent to participate: All participants gave their consent prior to the survey's start.

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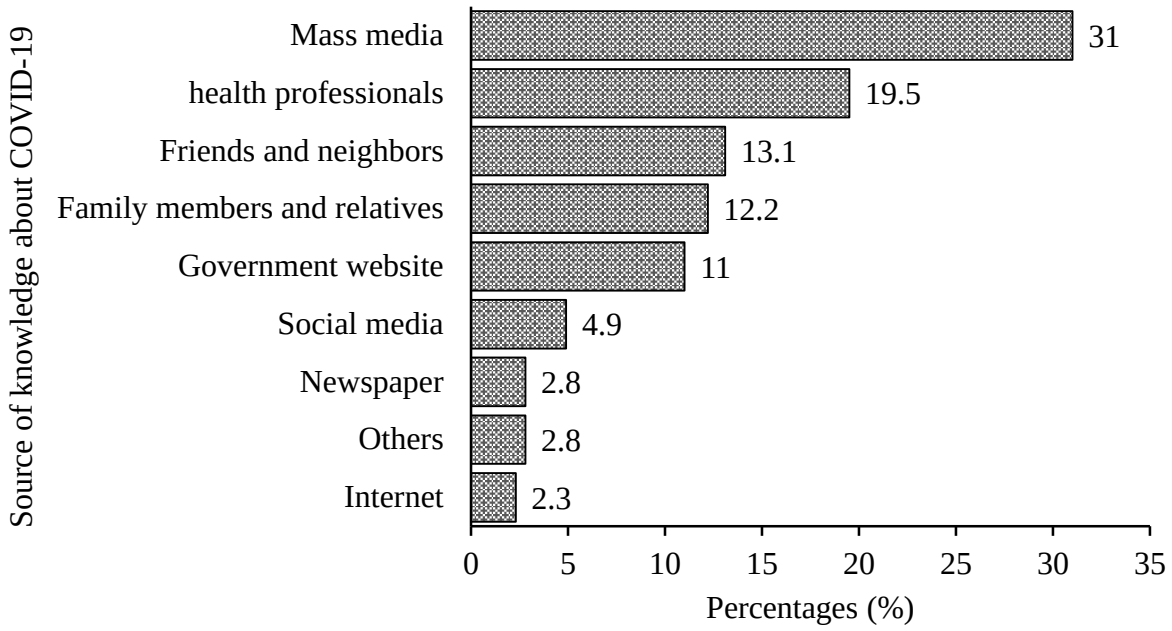
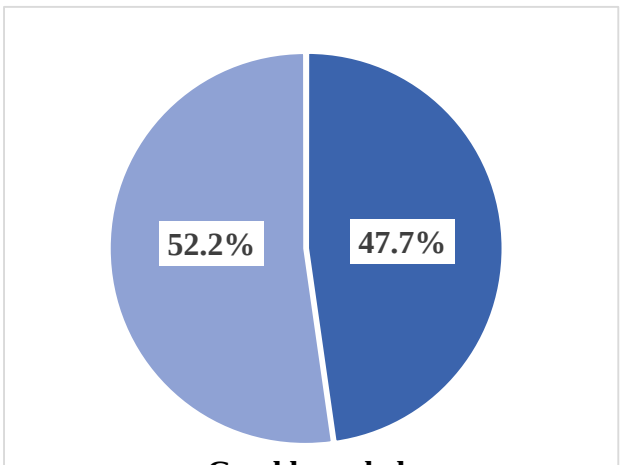
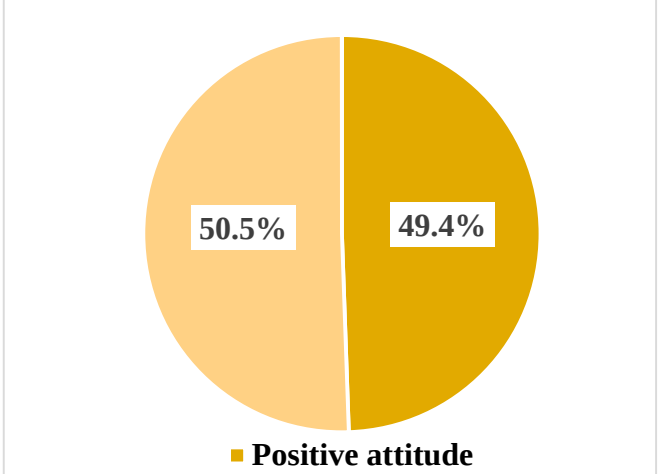


Figure 1. Sources of knowledge regarding COVID-19 among the participants





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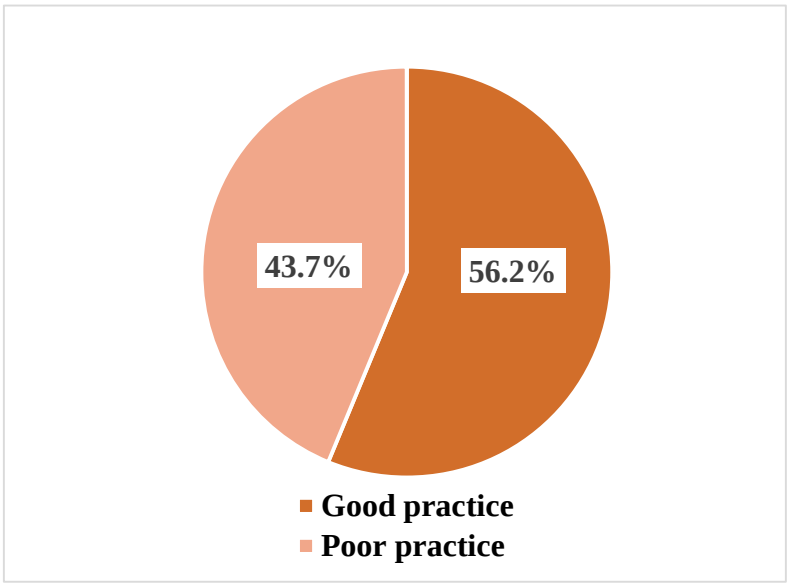

Figure 2. Level of