

Vaccine Adherence and Behavioral Changes of Adults Regarding Prevention of COVID-19: A Community Survey Using the Theory of Planned Behavior

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Abstract

Considering the current context of the coronavirus 2019 (COVID-19) pandemic, people should equally comply with both vaccines and non-therapeutic health protective behaviors. This study investigated public adherence to vaccination, behavioral changes against COVID-19, and their determinants in Bangladesh during the pandemic. The study was conducted during May and June 2022 among 940 Bangladeshi adults selected by multi-stage sampling, and data were collected through face-to-face interviews using questionnaires. Significant determinants and their relationships were described through hierarchical regression and structural equation modeling (SEM) based on the theory of planned behavior (TPB). Nearly half of the subjects (48.2%) showed poor vaccine adherence and COVID-19 prevention practices. During the pandemic crisis, the majority of the respondents (86.7%) used face masks, but only 12.7% of the respondents used them regularly. Less than half (44.9%) received COVID-19 vaccines regularly. Along with some sociodemographic factors, knowledge ($p < .001$), attitude ($p < .01$), and intention ($p < .001$) regarding COVID-19 prevention were significant in predicting vaccine adherence and healthy practices in a hierarchical regression. Self-control was highly significant in SEM, showing the highest effect ($p < .001$). Policies based on the TPB model could be adopted to improve preventive behaviors against COVID-19.

Keywords

Behavioral change; COVID-19 prevention; vaccine adherence

Introduction

The coronavirus disease 2019 (COVID-19) spread like wildfire and brought unprecedented economic and health consequences to all nations. As per the World Health Organization (WHO) (2022a), as of the middle of June 2022, the cumulative number of reported cases exceeded 500 million, with around 6 million deaths globally. Bangladesh confirmed approximately 2 million COVID-19 cases and nearly 30,000 deaths from this deadliest pandemic (World Health Organization, 2022b). Prevention is considered the best possible way to control the devastating effects of the pandemic in the absence of effective vaccines and definitive treatment (Alam et al., 2021).

In the race to develop an effective vaccine against COVID-19 initiated by various research labs and pharmaceutical companies around the world soon after the start of the pandemic, many considered vaccination as the best strategy to prevent and control COVID-19. However, vaccines are not silver bullets, and the Centers for Disease Control and Prevention (CDC) recommended a combination of vaccination programs and health promotion measures to bring behavioral changes among people to control the pandemic (Smith, 2022). Bangladesh began its nationwide vaccination program on February 7, 2021, but there were reports of skepticism and mismanagement around the vaccination program (Islam et al., 2021). Moreover, gaps in understanding behavioral changes to combat the pandemic in the country were evident (Alam et al., 2021). Various cognitive factors influence community acceptance and adherence to health-protective behaviors. Perceived risks and threats have emerged in various studies (Weinstein, 1988). The theory of planned behavior (TPB) links belief to a behavior (Ajzen, 1991). The theory consists of three core components: attitude, subjective norms, and behavioral control, which together shape intention and practice. This study aimed to determine the structural relationship of variables based on a TPB theoretical framework in which attitude, motivation, and self-control influence preventive behavior through intention.

With the arrival of effective vaccines against COVID-19, countries worldwide took the initiative to vaccinate people, and Bangladesh was no exception. Considering the longer duration of both the national vaccination program and the widespread nature of the pandemic, it was necessary that people equally comply with both vaccine and non-therapeutic health protective behaviors against COVID-19. However, despite the sustaining pandemic and government initiatives, lower turnouts were reported during consecutive phases of the COVID-19 vaccination program in Bangladesh (Financial Express, 2022). This study investigated public adherence to vaccination and other healthy behaviors and their determinants in Bangladesh. The study offers the best opportunity to understand the factors influencing vaccine acceptance and behavioral changes in the new everyday context of the COVID-19 pandemic. The study can contribute substantially to the success of the massive government vaccination program and ensure preventive health practices among community residents to open the economy to the whole world.

Material and methods

A cross-sectional survey included 940 healthy Bangladeshi adults aged 18 years and above who were permanent residents of the area, had already taken at least a single dose of COVID-19 vaccine, and were willing to participate. A multi-stage sampling procedure was adopted. One urban and one rural area in the Dhaka and Chittagong divisions were selected randomly.

Terminal sampling was done from the voter lists of the respective selected areas. Respondents were approached for face-to-face interviews at their respective households during convenient times. A trained interviewer conducted the face-to-face interviews and recorded the responses on the questionnaire with prior signing of informed consent.

Data were collected through face-to-face interviews with a pretested questionnaire conducted during May and June 2022 with prior informed consent. The survey questionnaire was developed within the theoretical frame of the TPB consisting of attitude, subjective norms, intention, and practice (as outcomes), all of which were rated on 5-point Likert scales along with questions regarding sociodemographic characters and knowledge regarding COVID-19. Responses on attitude, motivation, self-control, and intention were recorded through a perceived degree of agreement with the statements, with a score of 4 for “strongly agree” and 0 for “strongly disagree.” Behavior was assessed through a 4-point Likert scale. Responses for behavior were recorded as the frequency of time (never [0], sometimes [1], often [2] and always [3]). Scoring levels were grouped with 60% and below considered poor, 61% to 80% considered fair, and above 80% considered good.

A seven-part questionnaire was developed using the major determinants of the TPB model relevant to the prevention of COVID-19 (sociodemographic characteristics, information, attitude, motivation, self-control, intention, and COVID-19 preventive practices. Behavior was assessed in four dimensions (vaccine uptake, face mask use, handwashing frequency, and compliance with other health rules). The content validity of the questionnaire was checked, after which the instrument was finalized and translated into the Bengali language based on the opinions and recommendations of four public health experts. Alpha coefficients ranged from .80 to .91. Trained data collectors used the Bengali version of the questionnaire for data collection.

Descriptive analysis, two-stage hierarchical regression, and structural equation modeling were used to describe adults’ preventive health practices and the causal relationships of their predictors. Hierarchical regression was performed to predict significant predictors, and a causal model of preventive behaviors against COVID-19 was also tested and justified through structural equation modeling (SEM). The Statistical Package for the Social Sciences (SPSS) Version 20 and Analysis of Moment Structures (AMOS) software were used for analysis. The significance level for statistical analysis was set at $p < .05$ at a confidence interval (CI) of 95%.

The study was conducted with a research grant from the Directorate General of Health Services (DGHS) of Bangladesh. Ethical approval for this study was gained from the Ethical Review Committee of Dhaka Medical College (Ref: ERC-DMC/ECC/2022/113).

Results

The study included adults (≥ 18 years) of both genders. Less than one-third of the respondents (26.1%) were in the age group of ≤ 25 years, and around half (49.5%) were between 26 and 35 years old. The mean age of the respondents was 32.6 (± 6.7) years. Nearly two-thirds (61.7%) of the sampled population were males, and the remainder were females. Most (88.3%) of the selected respondents were Muslim, and the rest were Hindu. Around half (46.3%) had monthly family incomes exceeding 20,000 BDT, and more than one-third of the respondents (37.2%) had family incomes between 10,001 and 20,000 BDT. The average monthly family

income was 22,700 BDT. The minimum monthly family income of the respondents was 5,000, and the maximum was 120,000 BDT (Table 1).

Table 1: Distribution of Sociodemographic Characteristics of the Respondents ($n = 940$)

Sociodemographic Characteristics	Number	Percentage
Age of Respondents (years)		
≤ 25	245	26.1
26–35	465	49.5
≥ 36	230	24.4
Gender		
Female	360	38.3
Male	580	61.7
Religion		
Hindu	110	11.7
Islam	830	88.3
Monthly Family Income (BDT)		
≤ 10,000	155	16.5
10,001–20,000	350	37.2
> 20,000	435	46.3
Educational Level of Respondents		
Illiterate	55	5.9
Primary	218	23.2
Junior School Certificate	382	40.6
Secondary School Certificate and Above	285	30.3
Family Type		
Nuclear	430	45.7
Extended	510	54.3

Note: 1 USD ≈ 110.3 BDT

Only about 6% of the respondents were illiterate or without any formal education, whereas the remainder were literate with primary (23.2%), lower secondary school (40.6%), and upper secondary school level educations (30.3%). The literacy rate was higher among males. Among the respondents, around 12% were farmers, nearly 13% were day laborers, and almost 30% were homemakers. Less than 10% were students, more than 12% were factory workers, and nearly 15% were involved in public- or private-sector jobs. Less than half of the respondents (45.7%) lived in nuclear families. The majority received information about COVID-19 from television, newspapers, and digital media. Around 12% had COVID-19 patients among their family members or relatives.

Vaccine adherence, practices to prevent COVID-19, and their predictors in the hypothetical model were the latent variables assessed by using scales of different items. The total score of all the latent variables was categorized into three groups: good (> 80%), fair (61–80%), and poor (≤ 60%). Vaccine adherence and practices to prevent COVID-19 were assessed by five items on three dimensions. About half (48.2%) of the respondents scored poor preventive behaviors, and the remaining were in fair and good categories in nearly equal proportions. Most reported avoiding handshaking or close bodily contact but were reluctant about social gatherings and distancing during the pandemic. Similarly, the majority was unwilling to use face masks regularly. After vaccination, the respondents were more relaxed following the health rules during the Omicron wave (Table 2).

Table 2: Categories of Preventive Health Practices Against COVID-19 and Their Behavioral Predictors

Variable	Scores			$\bar{x} \pm SD$	Cronbach's Alpha (α)
	Poor ($\leq 60\%$)	Fair (61–80%)	Good ($> 80\%$)		
Preventive Behavior	48.2	26.4	25.4	5.5(2.2)	0.82
Information	35.4	23.5	41.1	5.7(1.6)	0.80
Attitude	40.6	29.1	30.3	37.5(4.7)	0.91
Motivation	48.0	32.5	19.5	40.9(4.8)	0.85
Self-control	29.8	50.6	19.6	36.7(4.4)	0.87
Intention	29.1	42.4	28.5	28.0(3.9)	0.90

Note: \bar{x} = Mean, SD = Standard deviation

Two-stage hierarchical regression was done initially to determine significant factors related to vaccine adherence and healthy behaviors of adults to prevent COVID-19.

Table 3: Hierarchical Regression Analysis for Significant Factors Predicting Vaccine Adherence and Healthy Practices to Prevent COVID-19

Variable	Model 1			Model 2		
	B	$SE(B)$	β	B	$SE(B)$	β
Constant	3.52	0.33		-3.26	0.60	
Age	-0.03	0.01	-0.15***	-0.01	0.01	-0.05
Gender	0.11	0.12	0.02	-0.09	0.11	-0.02
Family Income	6.9×10^{-5}	0.00	0.36***	3.7×10^{-5}	0.00	0.19***
Educational Status	1.83	0.17	0.33***	0.33	0.16	0.06*
Marital Status	0.17	0.21	0.03	0.19	0.17	0.03
Region	0.16	0.12	0.04	0.10	0.10	0.02
Information				0.48	0.05	0.34***
Attitude				0.04	0.02	0.09**
Motivation				0.01	0.01	0.01
Self-control				0.02	0.02	0.03
Intention				0.11	0.02	0.19***
R^2	0.36			0.55		
F for R^2 change	88.5***			79.8***		

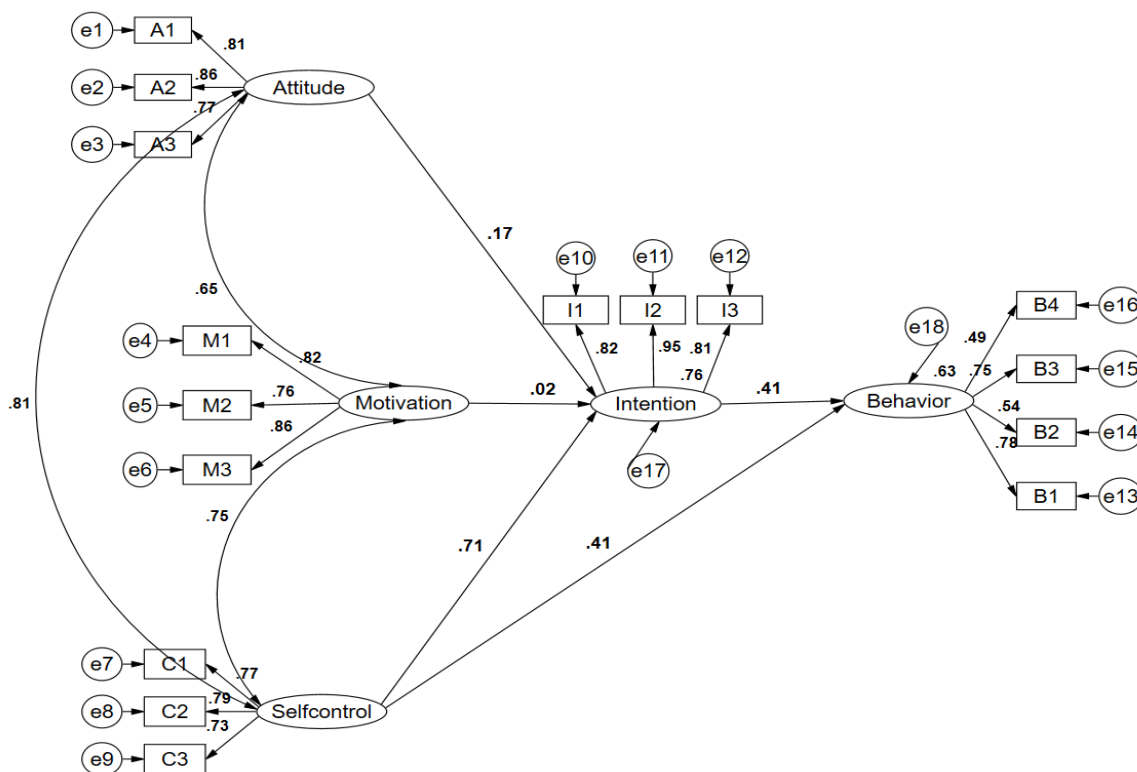
Note: The reference group for education was up to primary level education, and the regional variation in rural areas was the reference group. For gender variation, females were the reference group, and the unmarried group was the reference for marital status. One asterisk (*) denotes significance ($p < .05$), two asterisks (**) imply high significance ($p < .01$), and three asterisks (***) signify very high significance ($p < .001$).

In the first model, age, family income, and educational level ($p < .001$) showed significance in predicting the healthy behaviors of adults to prevent COVID-19. Following up in the second model, only family income ($p < .001$) and educational status ($p < .05$) persisted as significant predictors from the first model. Moreover, information, attitude, and intention were also found to be significant in predicting the healthy behaviors of adults to prevent COVID-19 in the second model (Table 3). Although self-control was not significant in the hierarchical model, it was found highly significant in the causal relationship model, influencing the outcomes in both direct and indirect ways.

The causal model was explained through SEM with the latent variables to describe the relationships theoretically more rationally by using the TPB model. The model was framed

with five causal relationships among five latent variables with 16 indicators. Attitude, motivation, and self-control were in the first block as exogenous to determine the significance of vaccine adherence and health practices of the third block through the second block of intention (Figure 1). The causal model was reasonably fit [$\chi^2 = 550.72$, GFI = 0.93, CFI = 0.95, NFI = 0.94, RMSEA = 0.05, SRMR = 0.04] to describe the structural relationships. In the causal model, attitude showed positive significant effects on intention ($p < .01$), and β in the structural relationships of attitude with intention was 0.17. Self-control ($\beta = 0.71$, $p < .001$) with intention was also highly significant. The vaccine adherence and healthy behaviors of adults to prevent COVID-19 were significantly influenced by intention ($\beta = 0.41$, $p < .001$). All the indicators of the latent variables showed their significance ($p < .001$) in the causal model. Self-control showed the highest effect on COVID-19 prevention behavior in SEM. All the predictors could correctly explain 62.7% of the variance of COVID-19 prevention behavior in the adjusted model.

Figure 1: Causal Model of the COVID-19 Prevention Behaviors Based on TPB



Note: Idea about preventive practices (A1), idea about Covid vaccine (A2), idea about stigma (A3), family influence (M1), community influence (M2), organizational influence (M3), confidence about vaccine uptake and preventive practices (C1), confidence about regularity or timeliness (C2), confidence about decision-making (C3); readiness for preventive practices (I1), readiness to receive vaccine (I2), readiness for maintenance (I3), receipt of vaccine (B1), use of face masks (B2), hand washing (B3), compliance with other health rules (B4). A1, A2, A3 are indicators for attitude; M1, M2, M3 are indicators for motivation; C1, C2, C3 are indicators for self-control; I1, I2, I3 are indicators for intention and B1, B2, B3 and B4 are indicators for preventive behavior.

Discussion

Emphasis has been given to vaccine adherence and behavioral changes in the new everyday context of the COVID-19 pandemic. Considerable confusion, hesitancy, and concern have arisen concerning the side effects of vaccines, mistrust of the health system, and preference for natural immunity in the receipt of COVID-19 vaccines. Although using face masks is not that difficult, the preventive health rules were not commonly followed in the cultural context of this study.

Vaccine hesitancy is not a new issue in the scientific arena, and some studies have already been done to assess or postulate the vaccine hesitance toward COVID-19 vaccines. In the United Kingdom, vaccine hesitancy has been reported to be 35% by a recent survey (Murphy et al., 2021). A systematic review reported differences in COVID-19 vaccine acceptance, and high acceptance was found in Malaysia, Indonesia, and China. In contrast, poor acceptance was found in Italy, Russia, the United States, and France (Sallam, 2021). Moreover, in a multi-country survey, various factors (educational status, age, occupation, etc.) were associated with vaccine acceptance in different countries (Lazarus et al., 2021). In a similar study by Kanozia and Arya (2021), false information, lack of trust in the health system, and religion were associated with vaccine hesitancy.

In this study, a similar scenario was observed in Bangladesh. Initially, there was confusion about the use of face masks, and only a few people adhered to this practice, but the use of face masks gradually increased with the rise of COVID-19 cases. Social distancing is totally against the rural culture of South Asian countries. It was only observed as the law during the lockdowns while enforcement agency members were in the field. Rural culture is always in favor of social gatherings. Vaccine hesitancy in the initial days of vaccine introduction was a common scenario among respondents from lower socioeconomic groups. Vaccines were tagged as Chinese, Indian, or Western propaganda, water injections, etc., and people were uncertain about the effectiveness of the vaccines.

Rural people were unfamiliar with the online registration system, and the age bar was another major issue in the initial days of vaccination. Despite low knowledge and confidence levels, vaccine demand increased drastically among the lower socioeconomic groups over time and during the more vulnerable second wave of COVID-19. Moreover, vaccine demand was higher during the peaks of pandemic waves, with longer queues in the vaccination centers. As the severity of cases drastically decreased during the Omicron wave, the vaccination centers were reported to be empty. As the vaccines were new, people were concerned about side effects. Most people favored vaccination to combat the pandemic, despite hesitancy on the vaccine issue from rural and urban areas. Studies in developed countries also found variations in vaccine hesitancy and vaccination rates in different COVID waves (Fridman et al., 2021; Wang et al., 2021).

Handwashing with soap is not a common scenario or routine practice in rural areas, even among urban communities (Ro, 2020). However, handwashing with soap and water was emphasized during the pandemic. The current study's findings describe the poor handwashing culture of Bangladeshi communities, especially in rural areas. People were also not worried about washing for 20 seconds or using soap during hand washing, but the frequency and rate of hand washing increased after the crisis. The availability of handwashing facilities in public places remained a concern. The United Nations Children's Fund (UNICEF)

(2020) also suggested the critical importance of hand washing in the fight against COVID-19 when 3 billion people were deprived of proper hand sanitization facilities with soap and water at home.

Although the use of face masks became mandatory in gatherings everywhere in the world, the larger portion of the population in Bangladesh was reluctant to wear masks to control the spread of coronavirus (Financial Express, 2020). Authorities in Bangladesh soon shut schools in the middle of March, immediately after confirming the rising cases of COVID-19, banned public gatherings, and imposed lockdowns. Many took the government's sudden closure declaration as an opportunity to vacation and visit village homes, and some were not afraid to go for tourism. The lockdowns were urgent then, and the Bangladesh government had no better option to save its people (Smith, 2020). Although most respondents reported using face masks during the pandemic crisis, most used them irregularly, and most were unaware of their proper use or quality. The urban-rural disparity was prominent in using face masks among the respondents. However, case detection was comparatively much higher in urban areas due to higher population density and connection with the outer world, especially in the capital of Bangladesh.

Rural people were more relaxed initially, believing that COVID-19 might be more infectious only in over-crowded urban areas. One survey found the Munshiganj district to be in the bottom ten for a higher percentage of not using face masks (Tithila, 2020). Although health workers at the peripheral level and community clinics played a vital role in community awareness regarding COVID-19 prevention, behavioral changes were challenging, especially in rural areas (Alam et al., 2021). With some inherent limitations, such as multi-stage sampling and cross-sectional surveys, this study successfully explained COVID-19 vaccine adherence and preventive health practices with their determinants. Less than half of the respondents had good knowledge, and the majority in this study showed poor attitudes toward COVID-19 prevention, consistent with an online survey in Bangladesh (Paul et al., 2020). Similar behavioral determinants were also found significant in a recent Norwegian study (Wolff, 2021). The study tried to use major determinants from the TPB model to describe preventive behaviors. As a cross-sectional study, the research had inherent limitations in explaining associations. There were chances of recall bias, and the study sites were limited in determining regional variation.

Conclusion and recommendations

It can be concluded that the preventive behaviors adopted by Bangladeshi adults to combat COVID-19 were not optimum. Vaccine uptake by the people varied with the perceived severity of COVID-19 waves. People did not strictly follow the health regulations regarding the use of masks and social distancing. Maintaining the consistency of healthy practices among people during the pandemic was a challenge for the government and law enforcers. Not only individual issues but community and organizational limitations were responsible for poor health practices and vaccine adherence. All the key components of the TPB model were found to be significant in predicting the healthy behaviors of adults to prevent COVID-19. The study also found a significant socioeconomic disparity in COVID-19 prevention behavior, vaccine adherence among adults, and its predictors. Apart from individual factors, various organizational and health system factors influenced vaccine acceptance. This study provides a holistic scenario of this burning issue for policymakers to enable them to design relevant social campaigns.

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