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CONTENTS

Inequality in Access to COVID-19 Vaccines: Evidence from the Household Heads and Household Help from Dhaka City

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Abstract

Inequality in vaccination has been perceived as a research problem in the recent COVID-19 pandemic. This type of inequality has been investigated in the particular context of race, ethnicity, gender, regions in different parts of the world, with no study conducted so far in Bangladesh, an important South Asian country. We have conducted an online purposive random sampling of 311 household heads in April 2021 from Dhaka, Bangladesh, and their respective domestic or household help to examine the vaccination status across the socio-economic background, age, income, access to communication technology, and having a national identity card. Using univariate descriptive statistics, bivariate contingency table analysis, and multivariate logistic regression estimation, we find that in Dhaka, domestic or household workers above 40 years of age have mostly not taken COVID-19 vaccination at a 5% significance level. At the same time, their associated household heads are mostly vaccinated with two doses when they are above 40. Being a household head and having access to reliable communication technology are significant determinants of online registration and COVID-19 vaccination. The results have posed a question regarding the efficacy of the ongoing vaccination drive and the observed inequality or vaccine gap, primarily driven by class differences, whereas the government policy towards vaccination was intended to be universal across classes.

Introduction

Bangladesh's Vaccination Policy: Serum Institute

In a recent speech, the WHO Secretary-General expressed his distress regarding the vaccine gap between the rich and developing countries. He stated that nations such as Israel, UAE, and Saudi Arabia are globally considered to be the benchmark for universal vaccination, and hence their vaccination policies are being adopted by numerous countries. However, even after adopting these guidelines, several nations have failed to reap the benefit of a first-mover advantage. On the contrary, countries with effective administrative structures such as New Zealand, South Korea, and Jordan have used sensible strategies and achieved praiseworthy success against the virus.

The South Asian nation Bangladesh, with approximately 166 million people, is considered to be a lower-middle-income country. Unfortunately, the COVID-19 pandemic has severely affected its economy and sustainable development agendas. The government of Bangladesh was prudent enough to allow the private sector to negotiate with the Serum Institute of India to purchase Oxford vaccines, known as the Covishield[1], with advanced payment

(Kamruzzaman, 2021). On November 5, 2020, the Bangladesh government ordered 30 million doses for $4 per shot through Beximco Pharmaceuticals, and the effective mass vaccination started on February 7, 2021 (Kamruzzaman, 2021). It is to be noted that Bangladesh's health expenditure as a percent of GDP is the lowest in South Asia. As of 2018, the corresponding figures for the South Asian countries in descending order are Maldives (9.41%), Afghanistan (9.40%), Nepal (5.84%), Sri Lanka (3.76%), India (3.54%), Pakistan (3.20%), Bhutan (3.06%), and Bangladesh (2.34%) (World Bank, 2021).

Chronological History

According to the World Health Organization (WHO), as of May 31, 2021, the total cases of COVID-19 in Bangladesh was 798,830, of which 12,583 (1.56%) patients have died. The government followed limited testing facilities for the mass population. Nonetheless, the government was cautious enough to launch a freely available vaccination *en masse*, following the Extended Program of Immunization (EPI) success history. The government reserved 30 million doses from the Serum Institute, with advanced payment for 15 million doses. These were made freely available to all people via an online registration system, with limited rationing of age limit starting from 60, 50, and finally 40 years. The regulatory body also integrated foreign nationals residing in Bangladesh into the mass vaccination program from March 17, 2021. As of May 31, 2021, more than 9.90 million vaccines have been used in Bangladesh. Out of the total population of around 166 million people, only 4.17 million people are fully vaccinated, and an estimated 1.65 million have taken their first shot.
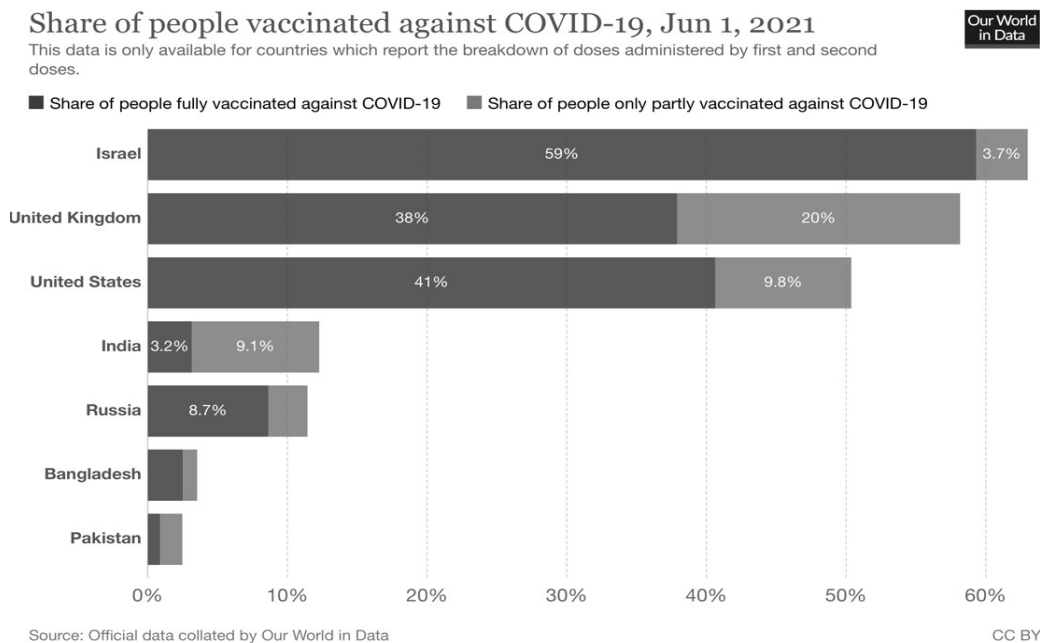

Figure 1: Share of People Vaccinated against COVID-19 at a glance
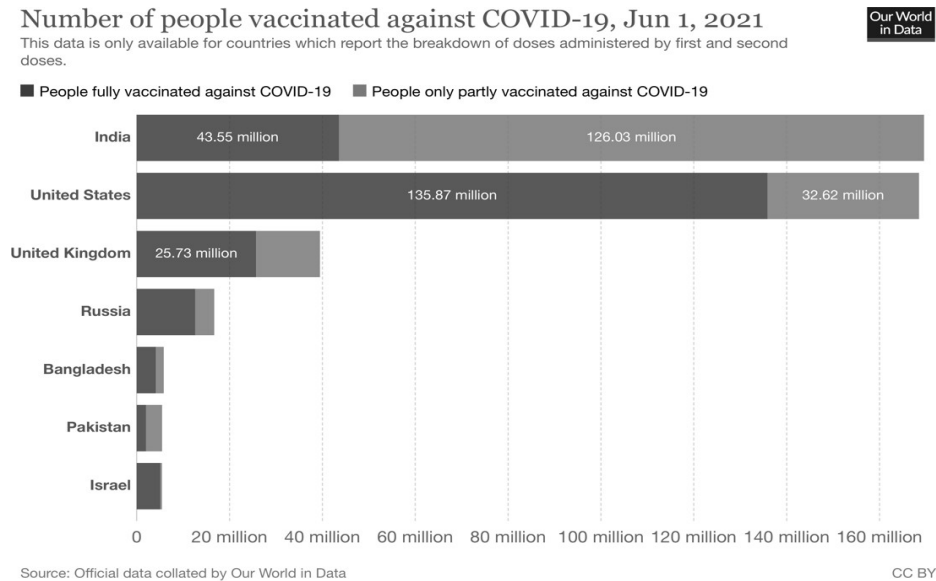Source: Our World in Data (2021)

Number of people vaccinated against COVID-19, Jun 1, 2021

This data is only available for countries which report the breakdown of doses administered by first and second doses.

■ People fully vaccinated against COVID-19   ■ People only partly vaccinated against COVID-19

India	43.55 million · 126.03 million
United States	135.87 million · 32.62 million
United Kingdom	25.73 million
Russia	
Bangladesh	
Pakistan	
Israel	

0   20 million 40 million 60 million 80 million 100 million 120 million 140 million 160 million

Source: Official data collated by Our World in Data   CC BY

Figure 2: Number of People Vaccinated against COVID-19 at a glance
Source: Our World in Data (2021)

Share of people who received at least one dose of COVID-19 vaccine

Share of the total population that received at least one vaccine dose. This may not equal the share that are fully vaccinated if the vaccine requires two doses.

Israel
United Kingdom
United Arab Emirates
United States

India
Russia

Bangladesh
Pakistan

Dec 15, 2020   Jan 15, 2021   Feb 24, 2021   Apr 5, 2021   Jun 1, 2021

Source: Official data collated by Our World in Data   CC BY
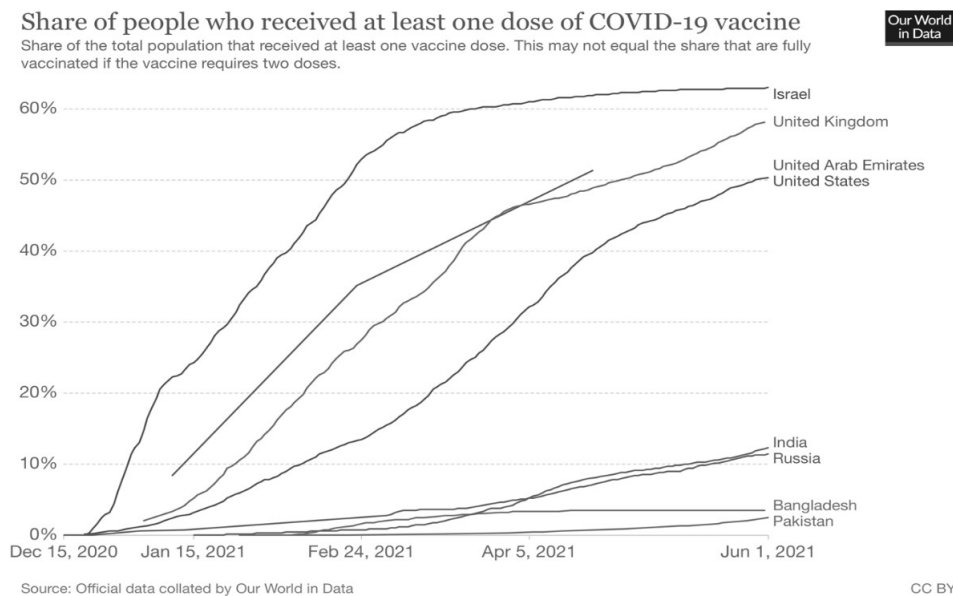
Figure 3: The dynamics of the share of people who received at least one dose
Source: Our World in Data (2021)

From the figures above, it can be seen that Israel has effectively vaccinated 59% of its entire population by May 31, 2021. The United Kingdom and the United States of America have fully immunized around 40% of their population (Our World in Data, 2021). It can also be seen that 43.56 million Indians are fully immunized, and 126.03 million are partially protected against COVID-19 (Our World in Data, 2021). On the other hand, Bangladesh and Pakistan are lagging behind their neighbor India in these numbers. Only 2.25% of 166 million people are fully vaccinated in Bangladesh, which is somewhat alarming.

The puzzles of the rich-poor divide for mass vaccination

Agence France-Presse (AFP) has reported that the vaccine gap between underprivileged and privileged countries is snowballing, and there is no general solution available to mitigate this disparity. Many developed countries have started providing vaccination to their youth, while several developing countries have started their first dose of immunization for people above 40 years old. According to the World Health Organization, vaccination has been provided to more than 600 million people worldwide. Nevertheless, many underdeveloped countries in Africa have not received their first supply of COVID-19 vaccines. The WHO Director-General, Tedros Adhamon Ghebreysus, has said that the COVID-19 vaccination is a blessing for affluent countries; however, it is a curse for emerging countries. It introduces another means of increasing inequality between rich and developing countries (UN News, 2021).

Nonetheless, the global community has not considered the internal vaccine gap within countries, manifested by unequal access to the so-called mass vaccination available to the general public. We have seen that even in countries like the UK and the US, racial minorities, including African Americans have a higher death rate than most of the population, even though most countries provide the vaccines freely. Why is this happening?

Research Objective

In Bangladesh, the affluent can easily afford more than one household help to support household chores. These workers are hired on a part-time or full-time basis. Dhaka city, the sixth largest megacity in the world, has undergone massive urbanization, and the migration of the young population from the countryside to Dhaka has led to many of them being hired as domestic help. Those who employ these migrants are mostly vaccinated, while the employees who prepare meals and provide cleaning, cooking, and other services are outside the fold of those who are vaccinated. The irony is that these domestic workers regularly contact their employers, putting them at risk. Is there any reason for this vaccine gap within the city? Income, wealth, education, class, or consciousness level disparity probably put this household help in a disadvantageous position to get proper access to digital facilities, thereby preventing them from registering for the vaccine.

The main objective of this study is to examine the reasons for this vaccine gap by conducting a sample survey of people living across different parts of the city. With this end in view, the second section of this paper presents a brief literature review of the vaccine gap, the third section includes an outline of the methodology used in this paper, the fourth section provides a broad overview about data, and the following three sections present estimated results followed by a concluding section that has policy suggestions.

Literature Review

The literature on non-medical COVID-19 research can be broadly classified into three groups: causes of transmission, causes of death or mortality, and the socio-economic impact of COVID-19. In the first group, several potential reasons for transmission were identified. The determinants include testing, environmental or ecological factors, the effectiveness of the government, cultural factors such as wearing a mask or keeping physical distance, and handwashing (Goswami, Ali, and Islam, 2020; Ehlert, 2021). The factors seen as contributing to a higher death rate are: preconditions of asthma, cancer, liver or other non-communicable diseases, lack of vaccination, age, gender, and racial minority status (Gebhard, Regitz-Zagrosek, Neuhauser, Morgan, and Klein, 2020; Kang and Jung 2020; Perone, 2021).

India, a highly populated country, is dealing with an inadequate rural healthcare system (Kumar, Nayar, and Koya, 2020). Similarly, it is difficult for Bangladesh to distribute vaccination equitably among low- and high-income households due to its limited rural healthcare system. The COVID-19 pandemic has also disrupted production and transportation throughout the world. Consequently, the food chain system of many countries has been highly affected, and lower-income citizens have been exposed to job lay-offs (Singh, Kumar, Panchal, and Tiwari, 2021). Unemployment often leads to the consumption of less nutritious foods, which may deteriorate the immune system, increasing the probability of getting infected by COVID-19. A vaccine produced by a US federal program is being proposed to be delivered at Dollar General, a retail outlet targeted to low-income groups so that they may have easier accessibility. This might reduce the gap of vaccination between high and low low-income households. (Chevalier, Schwartz, Su, and Williams, 2021)

Research on immunization of children from various diseases in Bangladesh discusses numerous factors creating a disparity among households of different income levels. Generally, 86% of children in Bangladesh are wholly vaccinated for different flu viruses. However, urban children can access facilities with more medical advancements than children from rural areas. As a result, many unimmunized children are being seen in less-educated and low-income households in underdeveloped regions in Senegal (Sarker, Akram, Ali, Chowdhury, and Sultana, 2019). In addition, these groups lack knowledge regarding health issues and therefore do not make the best decisions related to their wellbeing.

In the US, the concept of accepting vaccination varies among regions due to differences in culture, religion, and political beliefs. Cynical political beliefs among African Americans make them less willing to take vaccinations (Woko, Siegel, and Hornik, 2020). Some surveys on COVID-19 vaccinations have found that most respondents are willing to receive vaccinations if the government verifies the reliability of the vaccines (Lazarus et al., 2021). However, a prevalent issue in the US across different states is that racial minorities are not receiving vaccinations at rates that are in keeping with their representation in the population (Thoumi, Tewarson, and Johnson 2021).

A health survey shows that Bangladesh has successfully distributed remedies for tetanus to different rural areas through building clinics, arranging roadshows, and educating low-income households. The Bangladesh government has effectively immunized the youth by covering BCG, DPT 1, DPT 2, DPT 3, Polio 1, Polio 2, and Polio 3 vaccinations (Jamil, Bhuiya, Streatfeild, and Chakrabarty, 1999). Several active small firms in Bangladesh are developing income smoothing behaviors to minimize this gap (Habib, 2005). However, the income gap between rich and poor hinders the Bangladesh government's sustainability (Boulton, Carlson, Power, and Wagner, 2018). Consequently, Bangladesh needs improvement in socio-economic factors to reduce the vaccine disparity among different classes of people.

A large body of the vaccine gap literature deals with other epidemics, the rich-poor divide, the digital divide, and the developed vs. developing country divide. The literature discusses income disparity among different races, cultures, ethnic groups, and economies. Evidence of income disparity has been found by numerous studies that have conducted cross-country analysis. However, research is lacking on intra-country vaccine disparity. This paper fills this gap by examining the vaccine disparity among different classes of people using primary data from Dhaka, Bangladesh.

Methodology

This study examines the magnitude and the determinants of the COVID-19 vaccine gap in Dhaka, Bangladesh. A purposive random sample of 311 household heads and their corresponding household help was conducted in April 2021. Respondents were asked 41 questions about possible factors that may have contributed to vaccine disparity. The nature of the questions is primarily categorical, and some are purely ordered responses. In addition, information about household heads and their family members was collected, and such information was also gathered from the domestic workers. The data was collected mainly from the households of undergraduate and graduate students at North South University (NSU), Dhaka, in Spring 2021.

NSU is the second-largest university in Bangladesh and the leading private university among 107 private universities. The advantage of selecting NSU is that it has a representative student population from all parts of Bangladesh living in Dhaka. Currently, NSU has 20,000 students from different parts of Bangladesh, and the majority of them reside in Dhaka, having come here for their education. It is to be noted that NSU is successfully conducting online classes for all programs during the COVID-19 pandemic. All students participate in classwork remotely, and teachers connect with students via Google Classroom.

The survey respondents are classified according to their profession, residential area, income level, age, awareness level, and the number of electronic devices owned; the household workers are also classified in another cluster based on their income level, education, cell phone ownership, accessibility to electronic devices and internet, and awareness level. This study examines the determinants of vaccine disparity by using a Logit model because the dependent variable is the probability of being vaccinated or not.

Survey Population

The survey population consists of residents of Dhaka city who had part-time or full-time household help during the survey period. Household heads or household workers aged below 40 years were excluded from the final estimation, as based on the directives of the Bangladesh government, this age group did not qualify to receive vaccinations till April 30, 2021.

Sampling Method

A purposive random sampling method has been used, allowing the researchers to select samples for an online survey. Dhaka is the largest megacity of Bangladesh, and it is the sixth most densely populated city globally, with 8.9 million residents. Dhaka has been selected for this study, as this cosmopolitan city is home to migrants from all parts of the country, and hence the number of COVID-19 cases and death rates are the highest here of any region in the country.

Considering the widespread infection, transmission, and mutation of the new variants of COVID-19, face-to-face interviews with the respondents were avoided. Instead, an online platform from NSU was used. The online survey was conducted using Google Forms, and the link to the form was circulated among teachers and students of NSU. Given the standard of living of most NSU students, it was assumed that their households could afford to hire one or more domestic workers, either full-time or part-time.

Part-time household help generally lives close to the residence where they work, preferably within walking distance. They primarily work in the residence of their household head for a couple of hours a day, making it difficult for researchers to collect data from these part-time workers personally. An online questionnaire was circulated to students via Google Classroom, and they were asked to fill out the form by collecting responses from part-time and full-time workers in their households. The students were asked to submit the answers via the online platform, and the data was stored for 15 days, from April 16 to April 30, 2021. Students who relocated their residence from Dhaka to other parts of the country during the pandemic were excluded from the sample. Families that did not use any household help service during the data collection period were also excluded.

Survey Constraints

Many respondents hesitated to share their residential address and cell number with the researchers. Also, this study does not have any external financial support, and hence no financial incentives could be provided to the respondents to fill out the form. The authors had to request the respondents repeatedly to participate in the survey. Moreover, many domestic workers were below 40 years of age, and hence they do not qualify for vaccination. The data collection process was solely based on online responses from household heads/students, while direct responses from household help were not available due to the nature of the survey. Some students were busy during the spring semester's final stage and did not have sufficient time to fill out the questionnaire. The authors had to rely heavily on course teachers to encourage their students to participate in the survey. The prolonged absence of some students from Dhaka implied that they were taking online classes from rural areas and could not participate in the study due to location constraints. Some families were not comfortable using household help services during COVID-19, so these families were excluded from the survey.

Data

Sample Size

The survey respondents were mainly from 26 areas of Dhaka city. The sample consists of 311 households who have used household help during the period. The family information of the household head is captured, but that of the domestic workers' family is not fully captured; information about only the household help was captured.

Area Covered and Time Frame

The data was collected from the Dhaka North and the Dhaka South City Corporation Area and surrounding areas. During the data collection period in April 2021, many respondents had just received the first dose of the vaccine, and a few were fully vaccinated. Since then, the government had temporarily discontinued administering the first dose due to an apparent supply shortage from the Serum Institute, India (Kamruzzaman, 2021).

Univariate and Bivariate Results

Table 1: Vaccinated vs. Not Vaccinated

Individuals	Vaccinated	Not Vaccinated	Total
Household members above 40	360 (67.54%)	173 (32.46%)	533
Household members below 40	52 (6.15%)	794 (93.85%)	846
Household help above 40	5 (9.80%)	46 (90.20%)	51
Total	417	1,013	1,430

Source: Calculated from the survey.
Note: Figures in the parentheses represent the percentage of respondents in that respondent type.

The survey yielded data for 311 households and their domestic help. The aggregate number of household members is 1,379, out of which 533 individuals are above 40 years old. Among the 311 household workers, 51 were above 40 years old. Table 1 shows that 67.54% of the household members above 40 years of age were vaccinated. However, only five household workers[2] above 40 years of age received the COVID-19 vaccination, showing a significant class disparity. It should be noted that the age eligibility criterion for vaccination (above 40) does not apply to frontline workers, health officials, bankers, funeral service workers, and other categories. Also, some households used their connections to get their younger members vaccinated, which explains the 6.15% vaccination rate for household members who are younger than 40.

A Chi-Square Test for Vaccinated vs. Not Vaccinated (above 40 years of age) was conducted. The test result suggested that the null hypothesis of no class discrepancy can be rejected at the 1% significance level, suggesting a significant discrepancy exists because of class difference. As can be seen from Table 2, there are significant differences between the actual frequencies of household members and household help vs. their expected frequencies if the rows and columns were independent (i.e., there was no discrepancy due to class difference). The highly significant test statistic suggests that the row and column independence can be firmly rejected.

Table 2: Chi-Square Test for Vaccinated vs. Not Vaccinated (Above 40 Years of Age)

	Vaccinated	**Not Vaccinated**
Household Members	360 (333.13)	173 (199.88)
Household Help	5 (31.88)	46 (19.13)
Total	365	219
H_0: Vaccination status and respondents' type are not associated		
H_a: Vaccination status and respondents' type are associated	Test Statistic: 66.207 ***	
Decision:	Reject the null hypothesis at the 1% significance level.	

Source: Calculated from the survey. *** Significant at 1% level.
Note: Figures outside the parentheses represent the actual frequencies, and figures in the parentheses represent the expected frequencies if the rows and columns were independent.

In Bangladesh, individuals have to undergo an online registration process to get enlisted for the COVID-19 vaccination. Access to the online registration service requires a device, such as a mobile phone, computer, and internet. Therefore, our model uses access to a mobile phone or internet as a vital independent variable.

From Table 3, we can see that 100% of the household heads (above 40 years old) have access to mobile phones or the internet. On the other hand, 64.71% of the household help (above 40 years old) have access to mobile phones or the internet. A Chi-Square Test for "Have access to mobile phone or internet" vs. "Do not have access to mobile phone or internet" was conducted. The test result suggested that the null hypothesis of no class discrepancy can be rejected at the 1% significance level. As shown in Table 4, there are significant differences between the actual frequencies vs. the expected frequencies if the rows and columns were independent. The highly significant test statistic suggests that the row and column independence (which would establish no discrepancy due to class difference) can be firmly rejected.

Table 3: Access to Mobile Phone or Internet

Individuals	**Access to the mobile phone, laptop, computer, or internet**	**No access to the mobile phone, laptop, computer, or internet**	**Total**
Household head above 40	294 (100%)	0 (0%)	294
Household help above 40	33 (64.71%)	18 (35.29%)	51
Total	327	18	345

Source: Calculated from the survey.
Note: Figures in the parentheses represent the percentage of respondents in that respondent type.

Table 4: Chi-Square Test for "Have access to mobile phone or internet" vs. "Do not have access to mobile phone or internet" (Above 40 Years of Age)

	Have access	Do not have access
Household Head	294 (278.66)	0 (15.34)
Household Help	33 (48.34)	18 (2.66)
Total	327	18

H_0: Access to mobile phone or internet and respondents' type is not associated	
	Test Statistic: 109.477 ***
H_a: Access to mobile phone or internet and respondents' type are associated	

Decision	Reject the null hypothesis at the 1% significance level.

Source: Calculated from the survey. *** Significant at 1% level.
Note: Figures outside the parentheses represent the actual frequencies, and figures in the parentheses represent the expected frequencies if the rows and columns were independent.

The online registration process in Bangladesh requires a NID card for identity verification and authentication. NID is one of the most important documents needed to register for the COVID-19 vaccination; therefore, NID is a key independent variable in our model.

From Table 5, we can see that 100% of the household heads (above 40 years old) have a NID card. On the other hand, 70.59% of the household help (above 40 years old) have a NID card. A Chi-Square Test for "Have NID" vs. "Do not have NID" was conducted. The test result suggested that the null hypothesis of no class discrepancy can be rejected at the 1% significance level. As can be seen from Table 6, there are significant differences between the actual frequencies vs. the expected frequencies if the rows and columns were independent. The highly significant test statistic suggests that the row and column independence (which would establish no discrepancy due to class difference) can be firmly rejected.

Table 5: Access to National Identity Card (NID)

Individuals	Have NID	Do not have NID	Total
Household head above 40	294 (100%)	0 (0%)	294
Household help above 40	36 (70.59%)	15 (29.41%)	51
Total	330	15	345

Source: Calculated from the survey.
Note: Figures in the parentheses represent the percentage of respondents in that respondent type.

Table 6: Chi-Square Test for "Have NID" vs. "Do not have NID" (Above 40 Years of Age)

	Have NID	**Do not have NID**
Household Head	294 (281.22)	0 (12.78)
Household Help	36 (48.78)	15 (2.22)
Total	330	15
H₀: Access to NID and respondents' type are not associated		
Hₐ: Access to NID and respondents' type are associated	Test Statistic: 90.40***	
Decision	Reject the null hypothesis at the 1% significance level.	

Source: Calculated from the survey. *** Significant at 1% level.
Note: Figures outside the parentheses represent the actual frequencies, and figures in the parentheses represent the expected frequencies if the rows and columns were independent.

The household heads and the household help were asked to suggest how Bangladesh could successfully address this pandemic. As shown in Table 7, because the household help lack knowledge on health issues and policies, many of them responded emotionally rather than logically. Also, even though the household help is aware of the virus's deadliness and is trying to take adequate preventive measures based on their limited knowledge, they are not affluent enough to sit at home. These respondents were more concerned about dying from hunger than they were about the pandemic. The household heads appeared to be conscientious citizens, suggesting the equitable and inclusive distribution of the vaccination, and affirming that they are affluent enough to survive without earning for a few months.

A Chi-Square Test for the level of awareness was conducted. The test result suggested that the null hypothesis of no class discrepancy can be rejected at the 1% significance level. As can be seen from Table 8, the highly significant test statistic suggests that the row and column independence (which would establish that there is no discrepancy due to class difference) can be firmly rejected.

Table 7: Level of Awareness Across Classes

Level of Awareness	Household head	Household help
Reduce age limit for vaccine	25 (8.04%)	
Make the registration process easier and available to everyone rather than to people only with internet and NID	38 (12.22%)	2 (0.64%)
Raise awareness, encourage, and promote vaccination by the government and other organizations	97 (31.19%)	26 (8.36%)
More availability/accessibility of vaccines, making more inclusive vaccination programs	40 (12.86%)	31 (9.975%)
Door to door or area-based vaccination service	13 (4.18%)	1 (0.32%)
Bangladesh should produce their vaccine	1 (0.32%)	
Provide free vaccines to people	3 (0.96%)	
A more reliable vaccine should be given to people, which will have no side effects	12 (3.86%)	1 (0.32%)
Make vaccination mandatory for all	5 (1.61%)	
Ensure stimulus package for everyone		12 (3.86%)
Allah will take care of us		41 (13.18%)
Stay home and maintain all sorts of precautions		129 (41.50%)
Enforce strict rules during lockdown		4 (1.29%)
Eat healthy to make your immune system stronger		4 (1.29%)
Others	77 (24.75%)	60 (19.29%)
Total	311	311

Source: Calculated from the survey.
Note: Figures in the parentheses represent the percentage of respondents in that respondent type.

Table 8: Chi-Square Test for Awareness Level

H_0: Awareness level and respondents' type are not associated	Test Statistic: 320.23***
H_a: Awareness level and respondents' type are associated	
Decision	Reject the null hypothesis at the 1% significance level.

Source: Calculated from the survey. *** Significant at 1% level.

Multivariate Logistic Regression Analysis

For conducting a multivariate analysis, we used a logistic regression framework as follows:

$$L_i = \ln (P_i/1\text{-}P_i) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \varepsilon_i \dots [1]$$

Where P is the log-likelihood of the function to be maximized.

And,

       $P_i = 1$ if the respondent is above 40 years old and vaccinated

       $P_i = 0$ if the respondent is above 40 years old and not vaccinated

X_{1i} is a dummy variable that takes the value of 1 if the respondent is a household head, and it takes the value of 0 if the respondent is a household help

X_{2i} is a dummy variable that takes the value of 1 if the respondent has access to the mobile phone, computer, or laptop; and 0 otherwise

X_{3i} is a dummy variable that takes the value of 1 if the respondent has a National ID Card (NID) and 0 otherwise

$X_{4i} = LY_i$ is the log of the monthly income of household head or household help in terms of Bangladeshi Taka

The expected sign of $\beta 4 > 0$.

X_{5i} = Reasons for not getting vaccinated. It is an indicator variable that ranges from 0, 1, 2, …, 12 where the meaning of codes is as follows:

0: Did not answer or was not vaccinated (reference category which was dropped from the final estimation)

1: No one is above 40 in the household; 2: Vaccine is less reliable, and we have trust issues; 3: Suffering from other health issues; 4: Waiting to get registered / Not registered; 5: Registered; 6: No reason; 7: Others; 8: Lower availability of vaccine; 9: Vaccination is for rich people; 10: I do not know the procedure to register for vaccination; 11: I did not know about the vaccine; 12: I do not believe in vaccination. God will help us!

Table 9: The Estimated Regression Result for Binary Logistic and Other Competing Methods
(The dependent variable is whether the individual is vaccinated or not)

Predictor	Logit	Normit (Probit)	Gompit
Constant	-2.95	-1.38	-2.80*
	(2.39)	(1.27)	(1.52)
Individual Type HH or Hm (HH=1, Hm=0)	2.58**	1.58**	1.58**
	(1.21)	(0.68)	(0.80)
Access to mobile phone and computer (YES=1, NO=0)	2.51**	1.37**	2.10***
	(1.05)	(0.59)	(0.72)
NID (YES=1, NO=0)	0.33	-0.04	0.47
	(1.46)	(0.80)	(1.26)
LY (Log of Monthly Income)	-0.01	-0.01	-0.04
	(0.24)	(0.12)	(0.11)
Reasons for not getting the Vaccine (Ref category $X_{5i}=0$)			
1	-3.84***	-2.25***	-2.47***
	(0.61)	(0.34)	(0.51)
2	-4.44***	-2.57***	-3.10***
	(0.62)	(0.32)	(0.55)
3	-23.65	-7.58	-21.79
	(11236.4)	(2596.25)	(9230.96)
4	-23.66	-7.58	-21.81
	(7575.71)	(1750.46)	(6223.71)
5	-23.65	-7.58	-21.79
	(17766.2)	(4105.01)	(14595.4)
6	-4.00***	-2.35***	-2.62***
	(1.13)	(0.62)	(1.01)
7	-3.62***	-2.13***	-2.32***
	(0.70)	(0.40)	(0.59)
8	-23.65	-7.57	-21.78
	(17764.0)	(4104.03)	(14592.7)
9	-0.56	-0.06	-0.56
	(1.53)	(0.87)	(1.30)
10	-20.31	-5.88	-19.61
	(8217.59)	(1834.44)	(6901.00)
11	-19.90	-5.80	-19.20
	(13108.9)	(2916.22)	(11015.0)
12	-1.44	-0.84	-1.14
	(1.39)	(0.78)	(1.21)
Maximized Log-likelihood	-99.61***	-99.68***	-99.23***
Test that all slopes are zero	269.26***	269.10***	270.04***

Source: Calculated from the survey. ***, **, and * represent significance at 1%, 5%, and 10% level, respectively. Standard errors are provided in the parenthesis.

The Odds ratio for the first three dummies is 13.25, 12.26, and 1.39, respectively, which indicates the ratio of probabilities between being vaccinated and not vaccinated is above 1. That means the significant difference between

household heads and household help in terms of class, mobile phone, laptop, computer, or internet accessibility, and NID all favors household heads in getting vaccinated because of their current position. However, monthly income was not found as a statistically significant determinant. The estimated β coefficients also take the correct sign and significance for the three dummies. Nevertheless, the desired sign of the estimated coefficient of $\beta 4$ is not found, and it is not statistically significant either. This could be because the dataset has an apparent size bias towards the household head for persons aged above 40, and most of them are vaccinated. In the case of $\beta 5$, the indicators 1, 2, 6, and 7 are statistically significant. That means that "no one is above 40," "vaccines are not reliable and we have trust issues," "other reason," and "no reason" has been found as statistically significant determinants for not being vaccinated. This indicates that perception plays a role for both classes for not being vaccinated. To check the robustness of these results, we also ran Probit or Normit and Gompit estimation and found that the results do not vary much. We have also found some support for this in a separate question where we asked both groups about the solutions for COVID-19 and found that the two groups substantially differ in their perspectives on the pandemic (see Table 7).

Further Analysis

The authors have also conducted some qualitative analysis to further examine the vaccine gap determinants among the two classes of people in Dhaka city. The survey results show that government organizations and ward commissioners have also played a significant role in motivating people to get COVID-19 vaccination. A good number of household help (including those who were not vaccinated) stated that they were encouraged to get vaccinated by different organizations, such as government organizations, mosques, NGOs, and ward commissioners. However, health consciousness and knowledge about vaccination encourage people to get vaccinated more than the other factors, demonstrating the significance of the educational background of the vaccinated people.

Table 7 shows that around 42% of the household workers have stated that staying at home and maintaining all sorts of precautions will help them deal with the pandemic. However, most household help can barely read and write, and their low level of education generally constraints them from gaining factual knowledge about any disease; therefore, this group of people is prone to giving high authority to healthcare organizations and news reports regarding their physical wellbeing.

Table 7 also shows that 13.18% of the household help have solid religious beliefs regarding how the world can eradicate the pandemic; they responded, "Allah has given the pandemic, and He will take it away." Surprisingly, none of the household heads based their answers on religious faith when asked the same question. Instead, their responses were in the line of "Bangladesh should produce its vaccination." The household heads, who are generally highly educated, have made substantial comments about the pandemic and evaluated the validity of the vaccination. In contrast, the household help, most of whom are uneducated, seem to only keep faith in God without taking preventive actions to protect their health. The analysis shows that the education gap can also create a vaccine gap among different classes of people in Dhaka city, which can be an area of future research.

Conclusion and Policy Suggestions

The non-medical literature on COVID-19 can be classified into three broad groups: first, examining the determinants of the transmission of the virus, second, the determinants of the death rate or mortality, and third, the socio-economic impact of this pandemic. The third group gave rise to a subcategory where the researchers primarily focus on the vaccination gap across regions, countries, areas, ethnic groups, professions, gender, rural-urban divide, income status, and wealth disparity. Many developed countries have had a difficult time fighting against this pandemic. However, some developing countries can also be listed as a success story in vaccine management due to the active role of the state from the very inception of the disease, and Bangladesh can be enlisted as one of these types of countries in the world.

Even though Bangladesh has an acute shortage of capacity in producing enough vaccines locally, the government has rightly managed to buy from Serum Institute (India) and made it available to all classes of citizens freely through a first-come, first-serve basis with the age requirement of 40+ years. This policy has paid a dividend in the sense that the death rate and transmission did not cross the danger limit, and the country can be classified as a moderately good performer in COVID-19 management globally. The registration process is fully automated, and any

Bangladeshi citizen with National Identity Number (NID) can register for vaccination online. The network also covers remote areas of the country where people have cell phones and internet networks. As the government freely provides the vaccine, there is no apparent bar or restriction in getting two doses if the supply is available. However, a puzzle or contradiction remains in the process. Do people who have no access to cell phones, computers, laptops, or internet get access to the vaccine? This research question led us to conduct an online survey of more than 1,400 respondents belonging to 311 households in Dhaka city, Bangladesh, from April 16 to April 30, 2021. A cross-section of respondents, selected on a purposive sampling basis, were interviewed in two categories through a structured questionnaire with 41 questions about their status of vaccination, income, age, education, access to cell phone, laptop or computer, internet, awareness/consciousness level, and other relevant information on a confidential basis. Using simple descriptive statistics, bivariate Chi-Square measure of association, and multivariate binary logistic regression method, this study found new and exciting results that contribute to the existing literature on the vaccine gap, which is dominated mainly by developed vs. developing country disparity.

This study found that the probability of getting vaccinated is substantially lower for household workers than the head of the household in which they work. The disparity in access to vaccination does not stem directly from income or wealth disparity; instead, the main reasons are disparity in access to the internet, cell phone, laptop or computer, and national identity card. The most alarming reason for the disparity is the lack of awareness, religious perception, and education. A binary logistic regression model has rightly identified the channels of these relationships at a 5% level of significance. Even though income can be perceived as a significant determinant of access to vaccination, this study has not identified it as significant, whereas access to technology is identified as the prime driver both for the rich and the poor. Online registration is not enough to ensure equal access to vaccination in Bangladesh;a massive campaign by the government, NGOs, social media, electronic and print media encouraging people from all walks of life to register for vaccination can yield better results.

Moreover, an urgent decision to provide walk-in services for registration must be introduced to encourage people from the working class. Mosques, temples, churches, pagodas, and other religious institutions can promote vaccination awareness to the general people. At the same time, a smooth supply of vaccines must be ensured. The country should also invest more money and allow local companies to go for vaccine production. Using only foreign sources is not sufficient to vaccinate this massive population at such a high rate. The vaccination can be considered genuinely universal if people from all walks of life can access it without legal, economic, or cultural constraints.

Endnotes

[1] Covishield is the Indian made version of AstraZeneca's Vaxzevria jab.

[2] Four out of the five vaccinated household helpers were part-timers. Two of them were encouraged by NGOs and government bodies to take the shot, and the other two got the shot as they felt it is crucial to get vaccinated, which implies that the household heads do not play a significant role in encouraging the household workers to be immunized against COVID-19.

Ethical Declaration

All participants have voluntarily taken part in the survey. Personal information collected from the respondents is kept confidential, and the individuals' identities are kept anonymous. Data was compiled based on the ethical guidelines, and hence there is no conflict of interest.

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