Original Article

Region-Specific Blood Group, Demography and Meteorological Parameters on the Spreading of COVID-19: A Study in Bangladesh

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Received: 06-04-2023; **Revised:** 24-06-2023; **Accepted:** 03-07-2023; **Published on:** 15-07-2023.

ABSTRACT

Since the end of 2019, the SARS-CoV-2 pandemic has impacted every country's health, economy, and social life. Numerous studies have found relationships between ABO blood types, meteorological parameters, and COVID-19 infection and severity. This study aimed to examine ABO blood group distribution among COVID-19-infected patients and analyze the possible association of meteorological parameters with the spread of the ongoing COVID-19 pandemic. The total number of cases evaluated was 3115 infected cases, were1446, and non-infected cases were 1669. Meteorological data, mainly temperature, and humidity, from almost every district of Bangladesh between Jan 2021 to December 2021 were evaluated. It was found that O+ blood groups were more prevalent (28.8%) among those who had not yet been exposed to the disease, and B+ blood groups were more frequent (32.4%) among those who had it, with AB- individuals least frequent (0.8%). It was also found that temperature and humidity are negatively associated with the spreading SARS-CoV-2.

Keywords: ABO blood group, Metrology, disease susceptibility, SARS-CoV-2, COVID-19.

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DOI: 10.47583/ijpsrr.2023.v81i01.005

DOI link: http://dx.doi.org/10.47583/ijpsrr.2023.v81i01.005

INTRODUCTION

Numerous studies have been conducted to understand the disease and its management better since the SARS-CoV-2 outbreak in December 2019 and its pandemic spread in the months that followed.[1,2] By September 2022, the infected cases exceeded 617 million, with more than 6.5 million deaths worldwide [https://www.worldometers.info]. According to preliminary studies, males are more likely to develop more severe disease forms and complications that result in death.[3] Angiotensin-converting enzyme 2 (ACE2) is used by the ß-coronavirus SARS-COV-2, which is significantly comparable to SARS-CoV. The virus impacts Human health, with some people being more prone to infection than others. According to epidemiological research, 80% of infected individuals are asymptomatic yet still contagious. In comparison, the remaining 20% either have mild symptoms like a cough and fever or severe respiratory issues like acute respiratory distress syndrome. The different immune system of the body was thought to be the cause of variation in COVID-19 clinical characteristics. An early effective immune response can lower the viral load and prevent infection from spreading to the lungs. Still, an overly aggressive immune response can result in an excessive inflammatory response with serious adverse effects.[4]

The ABO blood group system, discovered in 1901, consists of three alleles, A, B, and O, all coded by the ABO gene. These three alleles produce six genotypes and four phenotypes in red blood cells (RBCs), which result in antigens on (RBCs) and antibodies in plasma.[5] Since its discovery, efforts have been made to investigate possible connections between the ABO blood group system and different diseases and infections. ABO blood group has reportedly been linked to both the risk of developing and the outcomes of several illnesses and infections, including tumors, coronary heart disease, and the hepatitis B virus. Additionally, recent evidence points to a potential role for the ABO blood group in the susceptibility to and severity of SARS-CoV-2 infection.[6]

Some scientists believe the ABO blood group may be a biological biomarker of COVID-19 vulnerability. The ABO blood type system's impact on COVID-19 susceptibility in confirmed cases at three separate hospitals in China was initially reported by Zhao.[7] It was found that patients with blood group A had a greater rate of COVID-19 infection than patients with blood group O, particularly in an area where blood groups A and O are common. Patients with blood group O made up just 26% of the COVID-19 instances that were confirmed, while patients with blood group A made up 37% of all COVID-19 cases. The relationship between the ABO blood group on COVID-19 cases was further discussed by Gupta et al., 26 which included 187 confirmed COVID-19 cases and revealed that 37% of the patients had blood group A while only 22% had blood group O. In addition, Li et al. observed that in another case-control research with 265 COVID-19 patients, patients with blood group A represented 39% of cases. In contrast, patients with blood group O represented 26% of cases. Besides, it was narrated that blood type O is typically referred to as a protective factor, whereas blood type A is frequently linked to higher risks of developing COVID-19.[8-11] However, there are several debates, particularly concerning higher susceptibility. For instance11 assessed, the distribution of ABO blood types in two cohorts: hospitalized COVID-19 patients and regular patients as the control groups, and convalescent plasma donors as the study cohort. Blood type O was significantly underrepresented compared to non-O types, while blood type A was mainly represented compared to non-A blood types in the former. [12-14]

The association of COVID-19 pandemic severity and high level of contagiousness with several meteorological parameters were investigated in the USA [15], China [16], Singapore [17], Saudi Arabia [18], and India.[19] Coronavirus is an example of an epidemiological infectious disease whose survival and transmission are influenced by meteorological conditions, including temperature, humidity, dew point, surface pressure, etc. According to some studies, the leading causes of coronavirus outbreaks include temperature, air quality, and population.[20-22] The correlation between COVID-19 and extremely hot and cold weather was also documented.[10,23,24] Conclusions regarding the impact of weather on COVID-19 transmission are still debatable. Evidence from COVID-19 published to date has not conclusively established that weather is a significant modulator of the transmission of SARS-CoV-2.[25-26] So, understanding the information of this virus may be possible by knowing the impact of climate.

With a recent spike in new cases, Bangladesh, a nation well-known for its high pollution loads and complex meteorology, has been severely affected by the COVID-19 epidemic. As of September 2022, 2,022,408 documented cases and 29,359 reported deaths related to the COVID-19 pandemic. Since the climate in Bangladesh varies from region to region, it is crucial to conduct a study to analyze the association between the meteorological parameters, ABO blood group, and the COVID-19 pandemic. As COVID-19 spreads, scientists and researchers examine its characteristics from every practical angle, including identifying the elements that can slow its spread. The main aim of this study is to analyze the correlation between metrological factors, an association of the ABO blood group, and the severity of the SARS-CoV-2 virus in Bangladesh. The study will also provide a better insight into the effects of environmental factors on the COVID-19 pandemic in Bangladesh.

RESEARCH METHOD & STUDY DESIGN

Research method

The research issues for this study were addressed using the quantitative research approach. According to Polit and Beck, [27] the quantitative methodology generates hypotheses tested in the real world using deductive reasoning. Thus, a quantitative study methodology is needed to assess and evaluate patients' knowledge and attitudes concerning COVID-19. The participant's expertise may have been explored or analyzed in-depth well with a qualitative technique, though. To make sure that all the crucial and pertinent data for the study was utilized, both quantitative and qualitative methodologies were employed. Another rationale is to neutralize the biases inherited in either method through the strength of the other or minimize their weaknesses. Following this, mixed research methodologies increase the reliability of the study's conclusions. Additionally, it enhances the data collection methods' instrumentation. Many explanatory variables were incorporated to identify their effect on the dependent variable.

Research design

A cross-sectional design entails data collection simultaneously, capturing the phenomena under research throughout that period. [27] It also has the benefit of being less expensive and more time-efficient than alternative designs. Nevertheless, its main drawbacks are the likelihood of recollection bias, design bias, and using a questionnaire to gather sensitive data.

Sample collection & processing

All of these data are being collected from the COVID-19-infected patients based on age, sex, blood group, profession, infected region, hospitalized or non-hospitalized, several symptoms such as fever, cough, sore throat, headache & body aches, fatigue, runny nose, breathing conditions, loss of appetite, loss of smell, etc. through a face-to-face interview. Data on confirmed and unconfirmed covid cases are gathered from people who visited the University of Dhaka's Center for Advanced Research in Sciences for a covid test and from friends and family, some records are collected over the phone & a few are managed via an online survey. Besides that, we collected blood groups randomly from non-infected people. The medical records of COVID-19 patients in Bangladeshi people were analyzed & reviewed by the research team of the Centre for Advanced Research in Sciences (CARS), Dhaka. Metrological data were both measured using weather station TFA, Model: kat. Nr. 35.1099.IT, Germany, and collected from the website.

RESULT AND DISCUSSION

Several explanations for the link between ABO blood groups and COVID-19 susceptibility have been put forth, including the presence of anti-A antibodies, antigen production of glycan antigens by SARS-CoV-2, the role of the coagulation system, and genetic variations in the ABO gene.[28] In this study, the total number of cases evaluated was 3115, with infected cases 1446 and non-infected cases 1669. From Table 1, it is seen that respondents with the higher number of O+ blood group are more (28.8%) among the people who have not been infected & it is noteworthy that the number of B+ people is highest (32.4%) among the infected people. It is notable (fig: 1) that the number of B+ people (32.4%) was higher among the infected people & the least is AB- (0.8%). This result does not match with previously reported articles. This might be due to the genetic dissimilarities between the people of different regions.

Based on age, the study found that (Table: 2) people over their fifties (29.7%) were more likely to be hospitalized & those who were not hospitalized were likely to be between the ages of 21-30. People over their fifties were hospitalized due to poor immunity & several geriatric diseases, chronic diseases such as high blood pressure, high cholesterol, coronary heart disease, diabetes, chronic kidney disease, etc. Alongside, older people face more lungs problem due to smoking, drinking alcohol & air pollution. On the other hand, people between the age of 21-30 usually have strong immunity and have less chance of being affected by chronic disease.

Table 1: Distribution of respondents by blood group and COVID status

	Not Infected		COVID Infected		Total
Blood Group	**n**	**%**	**n**	**%**	**n**
O+	480	28.8	413	28.6	893
B+	436	26.1	469	32.4	905
A+	328	19.7	320	22.1	648
AB+	180	10.8	157	10.9	337
B-	78	4.7	21	1.5	99
AB-	16	1	12	0.8	28
A-	24	1.4	22	1.5	46
Other	127	7.6	32	2.2	159
Total	1669		1446		3115

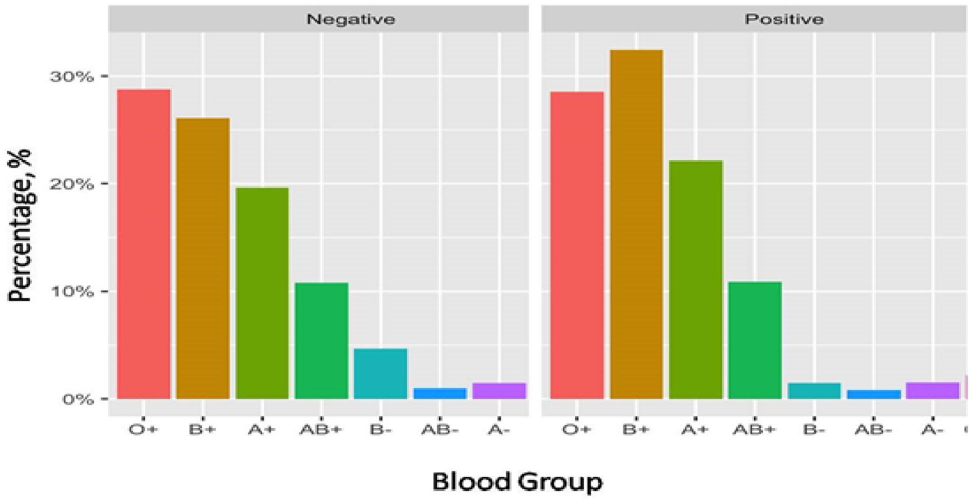

Figure 1: Histogram of respondents by blood group and COVID status

Table 2: Distribution of respondents by demographic and geographic characteristics and hospitalization

Characteristics	Categories	Hospitalized	Total Infected	Chi-square p-value
		%	%	
Age	<20	8.1	7.9	0.451
	21-30	27	31.1	
	31-40	27	24.4	
	41-50	8.1	17.7	
	>50	29.7	18.9	
Sex	Female	27	39.6	0.213
	Male	73	60.4	
Profession	Private	5.4	19.5	0.017
	Govt	8.1	6.7	
	Homemaker	5.4	20.1	
	Student	21.6	23.8	
	Business	21.6	11	
	Other	37.8	18.9	
Region	Dhaka	83.8	89.6	0.469
	Other	16.2	10.4	

Based on sex, infected male people are more hospitalized than females. Similarly, most of those not admitted to the hospital were men. Not only men had a higher rate of infection, but they also had a higher rate of hospital admission because a large portion of men had not been able to maintain proper social distancing due to earning the livelihood of their families.

Based on the profession of the respondents, it is notably seen that a large portion of the population from a different sector of society was hospitalized & it turns out that there is a preponderance of students among non-hospitalized people. Those who were daily laborers, street hawkers, beggars, garment workers, etc., had to go out almost daily for their earning purpose and were more infected than people from other professions. In the cases of students and people in business, all the educational institutes were closed, and many people maintained home offices and stayed at home were less infected. Our survey also reflects the same scenario in this regard. Based on profession, it is notably seen that a large portion of the population from different sectors (37.8%) of society was hospitalized & it turns out that there is a preponderance of students among infected people. The p-value of the chi-square test is <0.001, indicating respondents' percentage distribution by demographic and geographic characteristics and hospitalization are significantly different.

Distribution of respondents by COVID symptoms

According to epidemiological research, over 80% of infected people are asymptomatic but contagious, while others have moderate symptoms like cough and fever or severe respiratory consequences like acute respiratory distress syndrome. Differences in the body's immunological response to the infection were assumed to cause the diversity in COVID-19 clinical characteristics. While an early effective immune response might produce an overwhelming inflammatory response with a severe infection, an early, effective immune response can lower viral load and stop the infection from reaching the lungs.6

Furthermore, statistics show that severe COVID-19 cases have a higher prevalence of diabetes, hypertension, and liver disease, implying that metabolic abnormalities have a role in directing the body's response to the infection. [29] From the table-3, it is found that symptomatic people (83.8%) are more hospitalized than asymptomatic people (16.2%). Some significant symptoms, such as cough, fever, aching, breathing problem, fatigue, loss of appetite, and loss of smell, are seen in infected people. From the figure-2, it is found that due to COVID-19, people are severely affected by coughing problems who are comparatively older. This happens because they are immune-compromised hosts in relatively younger people. A significant portion of the COVID patient (67.6%) had to be admitted to the hospital with symptoms of severe coughing. 89.2% of people suffering from fever due to COVID are admitted to the hospital. Surveys have proven that people who are less than 20 & between 31-40 are more affected by breathing problems. This problem can happen for many reasons, but it is assumed that smoking & few chronic diseases are responsible for that. The aching has been observed comparatively more in young people (Fig: 3). The data also reveals that 64.9% of those infected people suffer from fatigue. Still, the rest of the infected people had not any symptoms of fatigue. It is also come up in this study that 56.8% lost their loss of appetite & others had not any problem with appetite. These claimed that 54.1% of people lost their sense of smell & remaining was normal. The p-value of the chi-square test is <0.001 indicating the percentage distribution of respondents by COVID symptoms is significantly different.

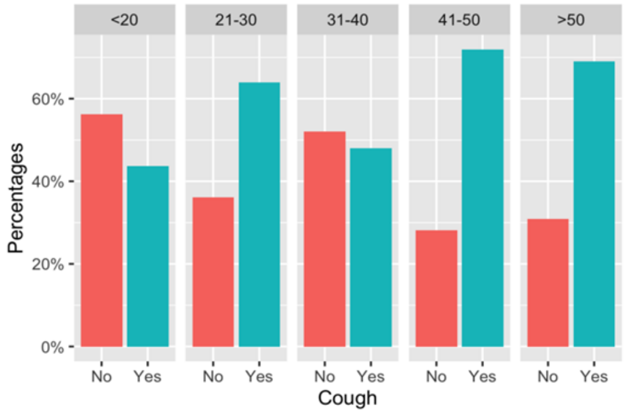

Figure 2: The trend respondents by symptoms (cough) & age.

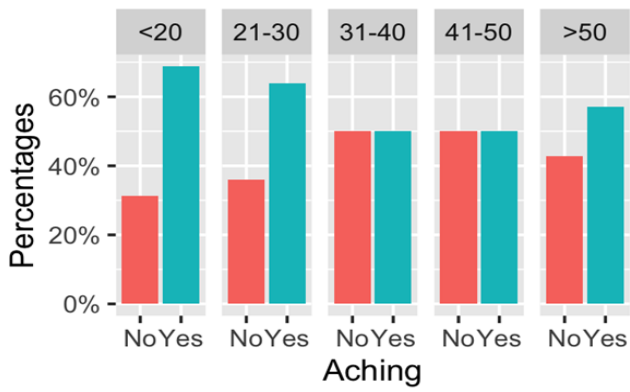

Figure 3: Histogram of respondents by symptoms (aching) & age

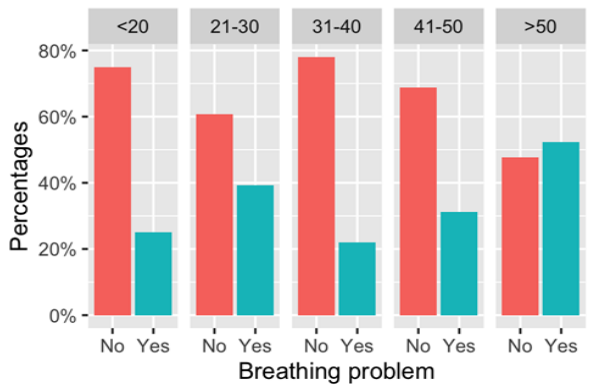

Figure 4: Histogram of respondents by symptoms (Breathing problem) & age

Table 3: Distribution of respondents by COVID symptoms

Characteristics	Categories	Hospitalized	Not Hospitalized	Chi-square p-value
		%	%	
Asymptomatic	No	83.8	84.1	0.957
	Yes	16.2	15.9	
Cough	No	32.4	40.9	0.447
	Yes	67.6	59.1	
Fever	No	10.8	7.9	0.808
	Yes	89.2	92.1	
Aching	No	32.4	45.1	0.159
	Yes	67.6	54.9	
Breathing problem	No	54.1	67.1	0.135
	Yes	45.9	32.9	
Fatigue	No	35.1	42.7	0.51
	Yes	64.9	57.3	
Loss of appetite	No	43.2	33.5	0.355
	Yes	56.8	66.5	
Loss of smell	No	45.9	37.2	0.424
	Yes	54.1	62.8	

Table 4: Average temperature and humidity over the entire sampling period.

	Hospitalized	Not Hospitalized	t-test p-value
Temperature (mean)	28.86	28.56	0.47
Humidity (mean)	77.97	77.97	0.99

It is found that symptomatic people (83.8%) are more hospitalized than asymptomatic people (16.2%). A significant portion of the COVID patient (67.6%) had to be admitted to the hospital with symptoms of severe coughing. 89.2% of people who are suffering from fever due to COVID are admitted to the hospital. Surveys have proven that people who are less than 20 & between 31-40 are more affected by breathing problems (Fig; 4). It reveals that 64.9% of those infected people suffer from fatigue, but the rest had no symptoms of fatigue. It is also come up in this study that 56.8% lost their loss of appetite & others had not any problem with appetite. These claimed that 54.1% of people lost their sense of smell & remaining was normal. The p-value of the chi-square test is <0.001 indicating the percentage distribution of respondents by COVID symptoms is significantly different.

Despite multiple studies, the evidence on the effect of weather on COVID-19 spread still needs to be mixed, owing to significant differences in data sources, methodology, study period, socioeconomic level, and other factors. Several reviews and research studies on the links between environmental factors and COVID-19 spread have been published. [30-32] Most only covered a portion of the research region, failing to provide a thorough and complete picture of how temperature/humidity influences COVID-19 distribution. To elucidate the connections of meteorological parameters with the spread of COVID-19 status, the critical role of the most important factors among weather conditions, temperature, and humidity was observed.

No significant effects of temperature and humidity on the transmission of SARS-COV-2 were observed in this study. From the table-4 it is clearly stated that the mean temperature and mean humidity are equal from the region where people were hospitalized and non-hospitalized. The p-value of the chi-square test is <0.001 indicating the Full COVID sample temperature and humidity are significantly different.

CONCLUSION

The primary goal of the current study is to advance knowledge by examining the relationship between active COVID-19 cases, ABO blood groups, and meteorological variables in Bangladesh. The results revealed that O+ blood group responses were higher (28.8%) among those who had not yet been exposed, and it is noteworthy that B+ responses were higher (32.4%) among those who had been told. It is notable that the number of B+ people (32.4%) was higher among the infected people & the least is AB- (0.8%). Several of the study's findings contradict previously released data from Iran, China, and the United States. The only plausible explanation for this agreement is the research populations' varied racial and genetic backgrounds. This study also revealed that temperature and humidity don't influence the COVID- 19 infectivity. This finding also conflicts with previous outcomes, but human immunity and adaptability may vary from sect, environment, or region. For instance, it's essential to research several COVID-19 virus-related topics, such as virus resistance, population density, urbanization, mobility, cleanliness, mask use, and sanitizer use. Future research on

COVID-19 may advance knowledge of the pandemic, its causes, treatments, etc.

Acknowledgments

The authors gratefully thank the CARS and DU scientists for sharing their knowledge regarding characterization and analysis.

Author contribution

Gazi Nurun Nahar, Ahmed Rusd: Methodology, Investigation, Formal Analysis, Writing Original Draft.

Baha Uddin, Mohaimen Monsur: Formal Analysis, Validation, Reviewing, and Editing.

Muhammad Nurul Huda, Md. Anowar Hosen: provided laboratory, facilities, and developing methodology.

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Source of Support: The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.