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## Coexistence, Infections, and Deaths of SARS-CoV-2 in the South Asian Country of Bangladesh in June-September 2022

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### Abstract

SARS-CoV-2 is the dangerous crash of the present period that shrunken fitness, the fiscal system, and normal life. This research evaluated the state and relative of tests, recoveries, infections, and deaths of COVID-19 from June to September 2022. The study strategy was agreed upon from June 1 to September 30, 2022 (N=122 days) to state the site of Bangladesh. The total sum of SARS-CoV-2 tests, recoveries, infections and deaths from June to September 2022 was 754881, 62597, 71689, and 234, respectively. In Spearman 0.01 level correlation, the relationship was strong moderate to positive. In tests, recovered, infected, and death the mean spearman correlation was 0.419 (range 0.673 to 0.165), 0.454 (range 0.571 to 0.165), 0.528 (range 0.673 to 0.286), and 0.538 (range 0.625 to 0.418); respectively. The number of tests 0.99 (0.99–1.00) was negatively associated with COVID-19 deaths. The number of infected and recovered 1.01 (1.01–1.02), and 1.01 (1.01–1.02) were positively and significantly associated with COVID-19 deaths. In the ARIMA and Prophet Model, we found a strong declining trend of deaths of COVID-19 between observed and predictive deaths of COVID-19 with an  $R^2$ , RMSE, and MAE value of 41.92% and 13.67%, 1.70, and 2.07, and 1.07 and 1.56, respectively. The determination of cases of COVID-19 infection highlights the value of short and accurate and progressive 118 laboratory diagnostics to limit its spread. This is now harmless as measured inoculations have reduced SARS-CoV-2 invasion and death rates in the South Asian country, Bangladesh.

**Keywords:** Bangladesh, COVID-19, SARS-CoV-2, Infections, Tests, Deaths, Recoveries

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## 1. INTRODUCTION

Human contagions with the dangerous acute breathing disorder coronavirus 2 (SARS-CoV-2), the microorganism that reasons the sweeping Coronavirus disorder, twisted into first noticed in the East Asian country of China in the last month of 2019 causing the current COVID-19 pandemic (> 6 million people deceased) has been found in feces of sick patients [1,2]. This virus from the family of  $\beta$ -coronaviruses (single-stranded, enveloped, positive polarity, and non-segmented ribonucleic acid or RNA) [3] has developed high mutagenicity. At least 11 interest variants (Alpha, Beta, Gamma, Epsilon, Eta, Mu, Zeta, Iota, Kappa, Delta, and Omicron) and almost 22 lineages have been studied [4,5]. It fits into the sphere of the coronaviridae systematic cluster serbecovirus family, Noroviruses order, and Betacoronavirus genus. Coronaviruses (CoVs) are solitary beached RNA viruses, multi-species, that may contaminate humans, animals, and birds as well as provide a public-health, veterinary, livestock, and financial danger. COVID-19 contagions habitually cause breathing and gastralsyndromes in humans and other animals [6-7]. It is a gram-superb RNA virus twenty-six to thirty kb long, crown-form oldster eighty-one hundred sixty nm in length, and later-age sequencing and genetic method scrutiny exposed SARS-CoV-2 [8].

Coronaviruses, like “HCoV-229E and HCoV-OC43”, are existing in the municipal, and these calm with the more newly revealed “HCoV-NL63 and HCoV-HKU1”, can be answerable for classically mild breathing contagions. “SARS-CoV, MERS-CoV, and SARS-CoV-2” [9] are very risky microorganisms which have only lately emerged in people. This has been justified with bat-derivative coronaviruses such as SARS and MERS-CoV and other insensitivity to SARS-CoV [10]. The coronavirus point protein binding to cellular entering receptors, “which have been originated for numerous coronaviruses and

comprise human aminopeptidase N (APN; HCoV-229E), angiotensin-converting enzyme 2 (ACE2; HCoV-NL63, SARS-CoV and SARS-CoV-2) and dipeptidyl peptidase 4 (DPP4; MERS-CoV)”, penalties are pathogenicity by a microorganism [11]. It's by far a communicable pandemic that presently reddened superior to two hundred global sites about the world. It has stretched to alternate universal locations stated as a global sickness confidential the worldwide [12]. SARS-CoV-2 affects the agricultural sectors, especially in agricultural fruit [13-14] but many plants such as black pepper are used against SARS-CoV-2 [15].

Bangladesh is a developing agricultural country that will become a middle-income country in 2026. Dealing with coronavirus was one of the most challenging issues for Bangladesh. This was an exciting issue that was well managed by the present Awami League government. The corona vaccine is ensuring the people of the country as well as the overall development of the country even though its cost was a little higher in South Asia. The government's policy to control the coronavirus was to keep the general public away from public places through lockdowns, curb market activity, and tight security at schools, colleges, universities, and places of worship, such as mosques with a small number of worshipers or madrasa-based institutions. Ensuring the corona vaccine in a short time of these measures has reduced corona mortality as well as controlled the rate of infection. Corona incentives were also included in the country's budget which helped the poor financially. An alternative method was voted on on January 26, 2021, but that campaign had a vaccine. The working people of the countries of the world, the elderly people over the age of 50, individuals are given priority. Subsequent mass vaccinations are provided to help control the virus.

SARS-CoV-2 was inveterate on March 8,

2020, in the South Asian country Bangladesh. The first lockdown was introduced on 1 June 2020, which was lengthy to deal with the difficulty. In a plague condition, the COVID-19 infections, tests, and deaths progressively enlarged every day in the South Asian country Bangladesh from 2020 to 2021 but now the situation is changed. The current government's policy and corona vaccine on control can be evaluated. The vaccination was administered to all humans i.t. why the SARS-CoV-2 situation of infections, tests, and deaths have progressively decreased in Bangladesh

## **2. METHODS**

### **2.1 Study design and period**

The SARS-CoV-2 was inveterate on March 8, 2020, in the South Asian country Bangladesh. We collected openly published everyday data from the sites of DGHS [16] and IEDCR [17]. The data gathering date was from June to September 2022 (N=122 days).

### **2.2 COVID-19 tests**

There are binary kinds of tests: a) Diagnostic (virus) trial on bronchial examples (nasal samples). It is relics to be realized whether a human has SARS-CoV-2 in the instant. b) Antibody tests: In the past, confirmed to rule out SARS-CoV-2 if it is present.

### **2.3 Data Retrieval**

This research involved the patient role in testing, recoveries, infections, and deaths of SARS-CoV-2 founded on an optimistic outcome of the COVID-19 test by authorized sites of DGHS, MoHFW, and IEDCR. Information on COVID-19 was learned from numerous therapeutic units in the South Asian country of Bangladesh statuses, counting different organizations that include the health system.

### **2.4 The outcome variable of COVID-19**

In this study, COVID-19 deaths were taken as the main outcome variable.

#### **2.4.1 Predictor variables**

Three variables were included in the model as predictors: number of tests, number of infections, and number of recovered.

during the study period. The coronavirus is now largely controlled. The present study pronounces the status of testing, infections, recoveries, and deaths in the South Asian country Bangladesh from June to September 2022. We evaluated the current state of the South Asian country Bangladesh and the position of testing, infections, recoveries, and deaths of COVID-19 from June to September 2022.

### **2.5 Ethics code**

All the information is factual, and verified from administrative sites, media, newspapers, net news sites, and social media [18-19].

### **2.6 Time series models**

This data depended on the study total of three important well-known time-series models namely SES, ARIMA, and Prophet models applied to predict the trend of patient deaths due to COVID-19. To analyze and identify the scenario these models are used where daily deaths or the outcome variable are relaid on the earlier history. Using DGSH (Director General Health Service) data we analyzed the trends for the prospective 10-days where results are visualized in the figure. In addition, we used the SES model as a benchmark to differentiate the performance of the ARIMA model [20].

### **2.7 Simple Exponential Smoothing**

Weller and Crone, 2012, mentioned that SES is one of the most popular and powerful models for forecasting which allows a limited-term prediction to assume data changes using a relatively stable mean. A simple exponential smoothing forecasting model is a more accurate and reliable tool for infectious diseases like COVID-19, Monkeypox, Marburg virus, or other emerging and reemerging diseases. It is first formulated and now considers the more recent observation method and is used exponentially. In this study, we used the R package 'fpp2' for this analysis [21,22].

### **2.8 Auto-Regressive Integrated Moving Average (ARIMA)**

Another important and well-known time series model AIMA allows a direct link between time series data used in this study to forecast the trend of daily deaths.

This model is the data-oriented model which assumes various time series values. The advantage of this model is the adjustment ability of a dynamically oriented system which allows over time where R package ‘forecast’ is used in this study.

### 2.9 Automatic Forecasting time-series model (Prophet)

The prophet is time series analysis model for forecasting data. We used this model based on using the R package “prophet” to assume the 10-day case fatality rate and compared it with COVID-19 deaths. This model works as an additive model that needs to use temporal dependence data.

### 2.10 Empirical evaluation

We evaluated our results with the ARIMA and Prophet models which they examined by comparing their results. The benchmark is permitted to gauge its competitors’ impact. The SES model, which allows for errors or trend elements, is the most appropriate non-seasonal model for a time series analysis [30]. The execution of the time series models is examined and contrasted in this study to ensure the robust prediction, coefficient of determination (R<sup>2</sup>), root mean square error (RMSE), and mean absolute error (MAE) [23,24].

### 2.11 Statistical analysis

In this study, we used STATA and R programming to analyze all data. Furthermore, we used NB or negative binomial models to analyze the correlation. The negative binomial regression (NBR) model was employed to further examine variations in MPX infections among nations. The Poisson-gamma mixed distribution is the foundation of a negative binomial regression model, which is helpful in forecasting count-based data.

## 1. RESULTS AND DISCUSSION

### 1.1 The COVID-19 inform in the South Asian country of Bangladesh from June to September 2022

The first three people were infested by COVID-19 on March 8, 2020, in Bangladesh and the infections, tests, and deaths have progressively amplified. Figure 1 represents the complete sum of testing, recoveries, infections, and deaths. The total sum of SARS-CoV-2 infections, tests, recoveries, and deaths from June to September 2022 was 71689, 754881, 62597, and 234,

respectively. Similar outcomes were also detected in a study and the results were the total infections, cases, recoveries, and deaths were 149576, 1100361, 136159, and 2864, respectively [25].

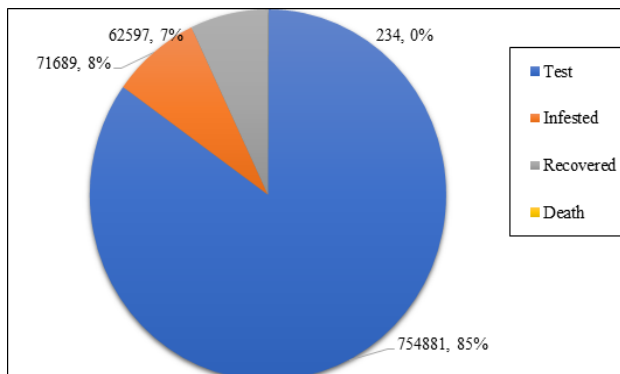
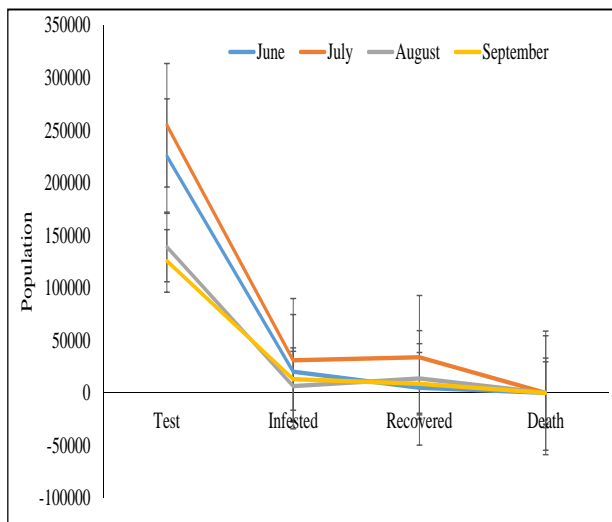


Figure 1. Total number of COVID-19 testings, infections, recoveries, and deaths from June to September 2022

The total sum of SARS-CoV-2infections, tests, recoveries, and deaths are included in Figure 2. The total number of coronavirus tests, recoveries, infections, and expiries in June 2022 was 225463, 4855, 20278, and 18, respectively. The total sum of coronavirus infections, tests, recoveries, and expiries in July 2022 was 31106, 254908, 34033, and 139, respectively. The total sum of coronavirus infections, tests, recoveries, and expiries in August 2022 was 6475, 138957, 13791, and 32, respectively. The total number of coronavirus infections, tests, recoveries, and expiries in September 2022 was 13251, 125718, 8768, and 41, respectively. Similar results were also noted in a study and the results of the total sum of coronavirus tests, recoveries, infections, and expiries were 439111, 49147, 36858, and 975, respectively in May and in June 2021, the total number of coronavirus infections, tests, recoveries, and deaths was 112718, 661250, 87012, and 1889, respectively [25].



**Figure 2. The total number of COVID-19 tests, recoveries, infections, and deaths from June to September 2022**

The SARS-CoV-2 tests varied from 1460 to 14712 from June to September 2022 (Table 1) where the mean standard error and standard deviation were 259.29 and 2863.90, respectively in tests. The SARS-CoV-2 infections varied from 22 to 2284.00 from June to September 2022 where the mean standard error and standard deviation were 51.14 and 564.88, respectively. The SARS-CoV-2 recovered varied from 47 to 1997 from June to September 2022 where the mean standard error and standard deviation were 43.51 and 480.61, respectively. The SARS-CoV-2 deaths varied from 0 to 12.00 from June to September 2022 while the mean standard error and standard deviation were 0.23 and 2.24, respectively. Analogous outcomes were found in the South Asian country of Bangladesh and the results were 49492 and 1653 as the most and lowest SARS-CoV-2 tests in 2022. On 22 January 2022, the maximum SARS-CoV-2 infections were achieved at 16033 while on 5 May 2022, the lowest was 1653. On 13 February 2022, the most SARS-CoV-2 recovered was achieved at 13853 while on 9 May 2022 the lowest was 1653. On 8 February 2022, the most SARS-CoV-2 death was achieved at 13853 where the lowest was 0 in several days in 2022 [26].

**Table 1. The Descriptive statistics of coronavirus update in Bangladesh from June to September 2022**

		Descriptive Statistics					
Items	N	Range	Minimum	Maximum	Mean	Std. Error	Std. Deviation
Test	122	13252.00	1460.00	14712.00	6187.55	259.29	2863.90
Infested		2262.00	22.00	2284.00	587.61	51.14	564.88
Recovered		1950.00	47.00	1997.00	513.09	43.51	480.61
Death		12.00	0.00	12.00	0.192	0.23	2.24

**3.1 Spearman's rho correlation analysis among tests, infections, recoveries, and deaths of SARS-CoV-2**

Spearman's rank-order association explored the connotation between variables (tests, recoveries, infections, and deaths) in the South Asian country of Bangladesh. Variable quantities were gritty to have statistically significant relationships. At the 0.01 level in the two-tailed investigation, the outcomes confirmed a positive, moderate to strong correlation between the variables (Table 2).

**Tests:** The outcomes exposed a moderate association between tests and infections ( $r_s=0.673$ ), recoveries ( $r_s=0.165$ ), and deaths ( $r_s=0.418$ ) of COVID-19. **Infections:** The outcomes exposed a moderate to a strong association between infections and tests ( $r_s=0.673$ ), recoveries ( $r_s=0.286$ ), and deaths ( $r_s=0.625$ ) of COVID-19. **Recoveries:** The outcomes exposed a moderate to strong connection between recoveries and tests ( $r_s=0.165$ ), infections ( $r_s=0.286$ ), and deaths ( $r_s=0.571$ ) of COVID-19. **Deaths:** outcomes exposed a moderate to strong connection between deaths and tests ( $r_s=0.418$ ), infections ( $r_s=0.625$ ), and recoveries ( $r_s=0.571$ ) of COVID-19. Before scheming  $r_s$ , graphics scrutiny of the scatter plot of infections, tests, recoveries, and deaths established that the relationship between these variables was non-linear and flat. Many studies were done the using Spearman relationship. The tests and deaths were regarded as 0.20 and 0.35 [27]. Another research also noted similar outcomes, and the average outcomes of Spearman correlation for tests, recoveries, infections, and deaths were 0.31, 0.796, 0.35, and 0.808 in the South Asian country of Bangladesh in April 2022 [28]. Another study supported these results [29]. Comparable results were detected in the positive connection between infections, recoveries, and deaths in 2020 and 2022 [29-31]. COVID-19 is meaning fully communicable, signifying that the second wave will



become even more detached in the South Asian country of Bangladesh in 2020 and 2021. The total sum of tests (722, 848), infections (128, 555), recoveries (150,816), and deaths (2237) were calculated in April 2021[31-33].This microorganism of covid-19 severely affects the environment and human life, which is an epidemic situation for global health[34].

**Table 2. Spearman's rho association study amongst tests, infections, recoveries, and deaths of coronavirus.**

		Spearman's rho Correlations			
		Test	Infested	Recovered	Death
Test	Correlation Coefficient	1.000	0.673**	0.165	0.418**
	Significance (2-tailed)	0.000	0.000	0.069	0.000
	N		122		
Infested	Correlation Coefficient	0.673**	1.000	0.286**	0.625**
	Significance (2-tailed)	0.000	0.000	0.001	0.000
	N		122		
Recovered	Correlation Coefficient	0.165	0.286**	1.000	0.571**
	Significance (2-tailed)	0.069	0.001	0.000	0.000
	N		122		
Death	Correlation Coefficient	0.418**	0.625**	0.571**	1.000
	Significance (2-tailed)	0.000	0.000	0.000	0.000
	N		122		

\*\* . Correlation is significant at the 0.01 level (2-tailed).

**3.2 Factors Associated with Reported Death of COVID-19 using Negative Binomial Regression (NBR) model from June to September 2022**

In the NBR model, the estimated effect of each variable is presented in relative risk (RR) and its significance is shown by its p-value. The number of tests (0.99 [0.99–1.00]) was negatively associated with COVID-19 deaths. The number of infected (1.01 [1.01–1.02]) and the number of recovered (1.01 [1.01–1.02]) was positively and significantly associated with COVID-19 deaths, indicating that infected and

recovered person contributed to an increase in deaths of COVID-19 (Table 3).

Method and Period	R <sup>2</sup>	RMSE	MAE
<i>Simple Exponential Smoothing</i>			
Overall	39.24%	1.85	1.22
<i>Auto-Regressive Integrated Moving Average</i>			
Overall (1,1,2)	ARIMA 41.92%	1.70	1.07
<i>Automatic Forecasting time-series model</i>			
Overall	13.67%	2.07	1.56

**Legend:** RMSE: Root Mean Square Error; MAE: Mean Absolute Error

**4. CONCLUSIONS**

In the South Asian country of Bangladesh, SARS-CoV-2 has infected all the districts in 2020. The enduring SARS-CoV-2 infection epidemic has underscored the want for early and progressive research laboratory diagnoses to limit the relation of the ailment and effectively deal with an infected human. In these circumstances, humans should preserve absence from roving to community spaces.

It would be offensive to allow families without a critical need. If you must move, get the appropriate mask and get it back home as soon as possible after the initiative is over. To preserve SARS-CoV-2 under the regulator, the establishments should set up new megaprojects to contribute to the undesirable situation.

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