The Dissimilarity of Attack Rate (AR) of SARS-CoV-2 Virus and Infection Fatality Risk (IFR) Across Different Divisions of Bangladesh

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ABSTRACT

Bangladesh has been identified the novel coronavirus disease 2019 (COVID-19) first cases by the Reverse Transcription Polymerase Chain Reaction (RT-PCR) test in March, 2020. As of 15 May 2020, Bangladesh has reported 20,065 confirmed cases. We aimed to assess the variation in the attack rate (AR), sample test, positivity rate and infection fatality risk (IFR) related to COVID-19 patients in these divisions. The number of testing COVID-19 samples by RT-PCR per 100000 populations was the highest in Dhaka (271) and lowest in Barishal (33). Dhaka is the most overcrowded division (1751 per square kilometers). We found that the highest sample tested (271 per 100000), higher attack rate (AR) (386 per million) and positivity rate (14.2%) in Dhaka division compared to those of the other 7 divisions. Rajshahi is the lowest densely-populated division, was the most infected fatality risk (IFR) (11%) compared to the other 7 divisions. This study suggests that more sample testing would be necessary to explore the burden of COVID-19 and mortality rate in the adult population and rural communities.

Keywords: COVID-19; Fatality; Population

INTRODUCTION

Though novel coronavirus disease 2019 (COVID-19) emerged during December 2019 in Wuhan city in China, Bangladesh reported its first case on March 8, 2020 [1]. Up to May 15, 2020, Directorate General of Health Services, Ministry of Health and Family Welfare, Government of Bangladesh has reported more than 20,000 confirmed cases by Reverse Transcription Polymerase Chain Reaction (RT-PCR) test, from all 8 divisions (Dhaka, Chittagong, Mymensingh, Barisal, Sylhet, Khulna, Rajshahi and Rangpur). The division is the first-level administrative structures in Bangladesh which is further divided into several districts. Bangladesh is the densely-population country with medium human development index (0.614) varies from division to division. Compared to Dhaka, other divisions have limited opportunities in terms of diagnosis and health care facilities. Each division has unique demographic and socioeconomic characteristics [2].

Understanding the patterns of COVID-19 outbreak throughout Bangladesh could assist public health and policy strategies to mitigate the ongoing COVID-19 disease transmission. Therefore, we aimed to investigate population characteristics, isolation bed capacities of hospitals and RT-PCR sample test performance across Bangladesh and assess the variation in the Attack Rate (AR), positivity rate and Infection Fatality Risk (IFR) related to COVID-19 patients in these divisions.

METHODS

We used data from population demographic characteristics from the lasted Bangladesh population census conducted by the Bangladesh Bureau of Statistics (BBS) in 2011 [3]. The isolation bed capacities of hospitals, the number of hospitals facility, and the cumulative number of collected and RT-PCR tested samples for COVID-19, the number of positive patients, the number of deaths and the number of recovered patients were collected from Directorate General Health Service (DGHS), Ministry of Health and Family Welfare, Government of Bangladesh on May 15, 2020 [4].

We performed descriptive statistical analyses to calculate the COVID-19 sample test rate and the Attack Rate (AR) per million

populations for each division. We also calculated the positivity rate among samples tested by using the formula as;

Positivity rate

$$= \frac{Number\ of\ RT-PCR\ test\ positive}{Total\ numer\ of\ RT-PCR\ tested\ samples} \times 100\ , [5,6]\ and$$

calculated the proportion of recovered from COVID-19 among the positive patients by using the formula as;

Recovered rate

$$= \frac{Number\ of\ released\ from\ COVID-19\ disease}{Total\ number\ of\ COVID-19\ disease\ patients} \times 100$$

The fatality risk is expressed as the risk of deaths among the SARS-CoV-2 virus infected patients using a formula as;

$$IFR = \frac{(Number\ of\ deaths)}{(Number\ of(deaths + recovered))} \times 100\ [7\text{-}10].$$

RESULTS

The total estimated population 2019 of Bangladesh is 164681600 [11]. Across the 8 divisions, the population density ranged from 1751 per square kilometers in Dhaka to 613 per square kilometre in Barisal division. The average household size ranged from 5.5 in Sylhet to 4.1 in Rajshahi division. The proportion of older adults (aged >50 years) was the lowest in Sylhet (12.57%) and highest in Dhaka (16.25%). The hospital facility rate per million populations was the highest in Barisal (186 hospitals) and lowest in Dhaka (129 hospitals). The number of prepared isolation beds per million population for COVID-19 was the highest in Sylhet (88 beds) and lowest in Dhaka (30 beds) (Table 1).
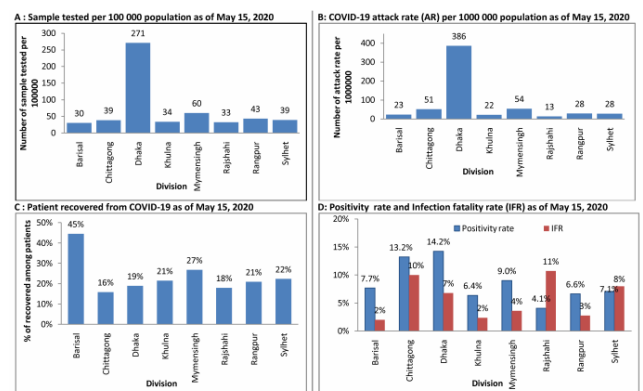
Table 1: Population characteristics and hospital facilities among Bangladesh.

Characteristics	Dhaka	Chittagong	Rajshahi	Rangpur	Khulna	Mymensignh	Sylhet	Barisal
Total population 2019[a], (thousands)	41367	33091	20989	17925	17812	12910	11135	9453
Density per km^2	1751	831	1007	960	699	1074	779	613
Person per household, average	4.4	5.0	4.1	4.1	4.2	4.5	5.5	4.4
Age group (%)								
<31	62.21	66.04	59.22	60.65	57.89	62.59	66.39	60.9
31-50	21.54	21.12	26.37	25.11	26.72	22.66	21.04	23.32
50+	16.25	12.84	14.41	14.41	15.39	14.75	12.57	15.78
Hospital facility per million	129	135	153	166	175	145	131	186
Isolation beds per million	30	40	39	34	52	41	88	72

a: estimated population based on census 2011 at growth rate1.6% per year. Estimated total population in Bangladesh 2019 is 164681600

As of May 15, there was inequality in the number of testing COVID-19 samples by RT-PCR per 100,000 populations (271 in Dhaka; 60 in Mymensingh; 43 in Rangpur; 39 in Chittagong; 39 in Sylhet; 34 in Khulna; 33 in Rajshahi; 30 in Barisal). The AR of COVID-19 per million populations was the highest in Dhaka (386) and lowest in Rajshahi (13). The positivity rate among the collected samples was the highest in Dhaka (14.2%) and Chittagong (13.2%) and the lowest in Rajshahi (4.1%). The IFR of patients with COVID-19 was the highest in Rajshahi (11%) and lowest in Barisal (2%) and Khulna (2%). The proportion of patients recovered from COVID-19 disease was the highest in Barisal (45%) and lowest in Chittagong (16%) (Figure 1).

Figure 1: Coronavirus disease 2019 (COVID-19) sample test rate, positivity rate, Attack Rate (AR) and Infection Fatality Risk (IFR) by divisions in Bangladesh.

DISCUSSION AND CONCLUSION

The AR of SARS-CoV-2 virus, number of samples tested, positivity rate and IFR disparities across Bangladesh is concerning. Dhaka, where the number of tested samples was the highest, had higher AR and positive rate compared to the other 7 divisions. Dhaka is the most overcrowded division with the highest number of older populations. In contrast, the AR and positivity rate were the lowest in Rajshahi, which is characterized by predominantly average household size and lower sample testing by RT-PCR. The spatial study in China has shown that the overcrowded provinces were more likely to be infected with SARS-CoV-2 virus than lower crowded provinces [12].

Prior analyses have shown the comorbidity in adult population and inequalities in accessing health care facilities across different divisions in Bangladesh. A previous study shows that the highest number of the older population with the comorbid condition live in Rajshahi, which might be one reason for higher IFR in Rajshahi [13]. Previous studies in other countries have shown that the older SARS-CoV-2 virus infected with comorbidities were more likely to die compared to young population [14-16].

This study has limited follow-up up to May 15, 2020. Demographic characteristics of COVID-19 patients were not available. The distribution of migrant workers from COVID-19 infected countries in different divisions is not known. The statistical hypothesis test was not performed for significant variability of the outcomes.

Further studies are needed to investigate whether the disparities of the burden of COVID-19 in the adult population and rural communities in Bangladesh.

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AUTHOR CONTRIBUTIONS

Probir G wrote the manuscript.

CONFLICT OF INTEREST

None declared.

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