*Original Article*

# Wave-Wise Comparison of Demographics, Clinical Characteristics & In-Hospital Outcome of COVID-19 Pandemic in Bangladesh: Single Centre Study

Fazila-Tun-Nesa Malik[1], Md. Kalimuddin[3], Mir Ishraquzzaman[5], Mohammad Abdullah Al Mamun[8], Ashok Dutta[2], Md. Habibur Rahman[2], Smita Kanungo[4], Nazmun Laila[4], Md. Shamim Chowdhury[6], Sohel Reza Choudhury[7]

**Abstract:**

**Background: Most countries in the world faced two waves of Corona virus disease-19 (COVID-19). But there is a lack of data regarding the wave-wise comparison of epidemiological and clinical characteristics of the COVID-19 outbreak. This study aimed to compare the demographics, clinical characteristics, and in-hospital outcomes of two waves of the COVID-19 pandemic in Bangladesh.**

**Methods: This prospective cross-sectional study was carried out at the National Heart Foundation Hospital & Research Institute. From April 3, 2020, to January 28, 2021, was considered the first wave, and from February 27, 2021, to September 25, 2021, was considered the second wave. COVID-positive patients and all admitted patients who became COVID-19 positive during these periods were included in this study for comparison.**

**Results: The first wave included 727 patients, and the second wave included 858 patients. The mean age of the patients in the first wave was 48.11 15.75 years, and in the second wave it was 50.65 16.63 years. Males were predominant in both waves. Healthcare personnel were less affected during the second wave (11.9% vs. 30.7%; p=0.001). Hypertension, chronic kidney disease, and cardiovascular disease were more prevalent in the second wave (p 0.05), and dyslipidemia and obesity in the first wave (p<0.05). During the second wave, 80.5% of patients were unvaccinated. Asymptomatic patients were predominant in the second wave (26.9% vs. 17.5%; p=0.001). COVID-19-related symptoms (fever, body ache, headache, anosmia, sore throat, shortness of breath, and diarrhea) were less prominent during the second wave (p<0.05). Oxygen requirements and IV antibiotic use were higher during the second wave (p<0.05).**

**Asymptomatic & severe disease form were prevalent in second wave (p<0.05). Mortality rate was more during second wave (5.1% vs 3.4%; p=0.1). Age > 50 years, severe left ventricular dysfunction, severe and critically ill patients were the independent predictor of mortality.**

**Conclusion: In comparison to the first wave, during the second wave symptoms were less prominent, asymptomatic and severe disease forms were more prevalent & mortality rate was high. Unvaccinated persons are more prone to affected by COVID-19.**

***Key wards:*** *COVID-19, first wave, second wave, vaccine status, clinical features, in-hospital outcome.*

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**Introduction:**

Corona virus disease-19 (COVID-19) caused by severe acute respiratory syndrome corona virus-2 (SARS-CoV-2) is the most devastating epidemic which affected 1550371 people and 27,393 deaths in Bangladesh till

1. Professor & Head, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
2. Professor,b Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
3. Associate Professor, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
4. Assistant Professor, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
5. Consultant, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
6. Registrar, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
7. Professor & Head, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
8. Associate Professor, Department of Epidemiology & Research, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.

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25th September 2021[1]. For a developing country like Bangladesh, COVID-19 has appeared as a challenging catastrophe. Bangladesh faced first wave of COVID-19 without preparedness like other countries. During first wave, the government took numerous measures to fight the COVID-19 pandemic in Bangladesh such as increasing healthcare facilities, screening, rescuing, and lockdown, increasing social awareness regarding the spread of the disease and its probable impact, usefulness of using mask, restriction on local and international air travels, and switch to online educational activities for students instead of on campus activities[2]. Vaccination, recruitment of more HCP, addition of more hospitals & ICU facilities lead to proper preparedness against COVID-19 during second wave in Bangladesh. The increased number of cases in the second wave may be due to genetic mutation of virus, widespread disregard to the 'COVID appropriate behaviours' by the public, using highly variable quality of masks, increased number of asymptomatic patients, and the higher testing[3]. It is observed that the mutant virus has more effective transmission capability and lesser incubation period[3]. In Japan, in comparison to first wave data from the second wave indicated a demographic shift toward a younger population with fewer comorbidities, a lower proportion of severe patients at admission, and decreased mortality[4].

Like other countries, Bangladesh also experienced two waves of COVID-19. There is a lack of data regarding comparison of epidemiological and clinical characteristics of the first wave and second wave of COVID-19 outbreak. This study aimed to compare the demographics, clinical characteristics and in-hospital outcome of two waves of COVID-19 pandemic in Bangladesh.

**Material and Methods:**

This prospective cross-sectional study was carried out at National Heart Foundation Hospital & Research Institute. From 3rd April, 2020 to 28th January, 2021 was considered as the first wave and from 27th February, 2021 to 25th September, 2021was considered as second wave (Figure 1)[5]. WHO defined a pandemic, consider better control if the infection below 5%[6]. The start points for both the first and second wave were defined during the time of infection rate above 5% & end points were defined during the time of infection rate below 5%. COVID-positive patients & all admitted patients who become COVID-19 positive during these periods were included in this study for comparison.

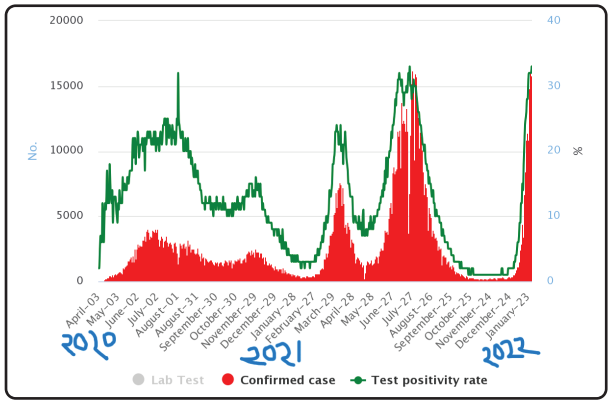


**Fig.-1:** *Infection rate of COVID-19 patients according to time-frame.*
Abbreviation: COVID-19: coronavirus disease 2019.

Demographic information included gender, age, risk factors and co-morbidities (diabetes mellitus, hypertension, smoking, dyslipidemia, obesity, cardiovascular disease, cerebro-vascular disease, chronic obstructive pulmonary disease /asthma, chronic kidney disease, pregnancy). The degrees of severity of COVID-19 were classified as mild, moderate, severe, and critical ill[7,8]. Mild type was defined as mild clinical symptoms without imaging findings of pneumonia. Moderate type was defined as clinical symptoms (fever or other respiratory symptoms) with imaging findings of pneumonia. Patients with severe type had any of the following parameters: (I) respiratory distress, respiratory rate e"30 times/min; (II) oxygen saturation d"93% at rest. Also patients showing a rapid progression (>50%) on chest imaging within 24–48 hours was regarded as severe type. Patients with critical ill type had to meet any of the following standards: (I) respiratory failure requiring mechanical ventilation; (II) shock; (III) complicated extrapulmonary organ failure requiring care in the intensive care unit.

Continuous variables are described using the mean and standard deviation (SD), and compared using unpaired Student's't' test. Discrete variables are expressed as number of cases and percentage. Comparison between variables was performed using the two-sided chi-square tests for discrete variables, or Fisher's exact tests (expected frequency <5). Binary logistic regression was used to identify the predictors of mortality. Variables significantly related to in-hospital outcome such as mortality in univariate analysis were included in a binary logistic regression model to identify independent predictors of the mortality. A two-sided p value <0.05 was

considered statistically significant. All analyses were performed using SPSS statistical software version 16.0 (SPSS Inc., Chicago, IL, USA).

**Results:**

First wave included 727 patients and second wave included 858 patients. The mean age of the patients in first wave was 48.11 ±15.75 years and in second wave was 50.65 ± 16.63years. In the first wave the number of positive cases between 1 and 20 years, 21 and 40 years, 41 and 60 years, and 81 and 100 years were 1.7%, 32.2%, 43.5%, 22.0%, and 0.6%, respectively. The number of positive cases between the age 1 and 20 years, 21 and 40 years, 41 and 60 years, 61 and 80 years, and 81 and 100 years were 3.0%, 23.0%,45.2%, 27.1%, and 1.7%, respectively in the second wave.

Male were predominant in both waves. Healthcare personnel were less affected during second wave (11.9% vs 30.7%; p=0.001). Hypertension, chronic kidney disease and cardiovascular disease were more prevalent in second wave (p<0.05) & dyslipidemia and obesity in first wave (p<0.05). Comparison of baseline characteristics between the first and second wave COVID-19 are outlined in table 1. During first wave patients without co-morbidities were more prevalent than second wave. During second wave patients with <4 co-morbidities were more prevalent than first wave.

During first wave vaccine was unavailable and all COVID-19 patients were unvaccinated. During second wave, 80.5% COVID-19 patients were unvaccinated, 14.6% patient received first dose vaccine and 4.9% patients received first & second dose vaccine (Figure 2).

**Table-I**

*Comparison of baseline characteristics between the first and second wave COVID-19 in Bangladesh*

| Variables | First wave (n=727) | Second wave (n=858) | P value |
|---|---|---|---|
| Age (Mean age ±SD) | 48.11 ±15.75 years | 50.65 ± 16.63years | 0.7# |
| <20 years | 12(1.7%) | 26(3.0%) | 0.074 |
| 21-40 years | 234(32.2%) | 197(23.0%) | 0.001 |
| 41-60 years | 317(43.5%) | 390(45.2%) | 0.46 |
| 61-80 years | 160(22.0%) | 230(27.1%) | 0.019 |
| >80 years | 4(0.6%) | 15(1.7%) | 0.029 |
| Gender Male | 470(64.6%) | 557(64.9%) | 0.9* |
| Female | 257(35.4%) | 301(35.1%) | |
| HCP | 223(30.7%) | 102(11.9%) | 0.001* |
| Non-HCP | 504(69.3%) | 756(88.1%) | |
| Risk factors & co-morbidities | | | |
| HTN | 374(51.4%) | 548(63.9%) | 0.001* |
| DM | 304(41.8%) | 343(40.0%) | 0.458* |
| Smoking | 229(31.5%) | 293(34.1%) | 0.263* |
| Dyslipidemia | 283(38.9%) | 176(20.5%) | 0.001* |
| Cardiovascular disease | 425(58.5%) | 623(72. 6%) | 0.001* |
| COPD/BA | 53(7.3%) | 46(5.4%) | 0.114* |
| Obesity | 249(34.3%) | 230(26.8%) | 0.005* |
| CKD | 234(32.2%) | 352(41.0%) | 0.001* |
| Pregnancy | 9(1.2%) | 2(0.2%) | 0.001* |
| Number of co-morbidities | | | |
| 0 | 129(17.7%) | 89(10.4%) | |
| <4 | 275(37.9%) | 394(45.9%) | 0.0001* |
| ≥4 | 323(44.4%) | 375(43.7%) | |

Abbreviation: COVID-19: coronavirus disease 2019; HCP: healthcare personnel; non-HCP: non-healthcare personnel; SD: standard deviation; HTN: hypertension; DM: diabetes mellitus; COPD: chronic obstructive pulmonary disease; BA: Bronchial asthma; CKD: chronic kidney disease. *Chi square test was done to find out the significance; #Student's 't' test was done to find out the significance.

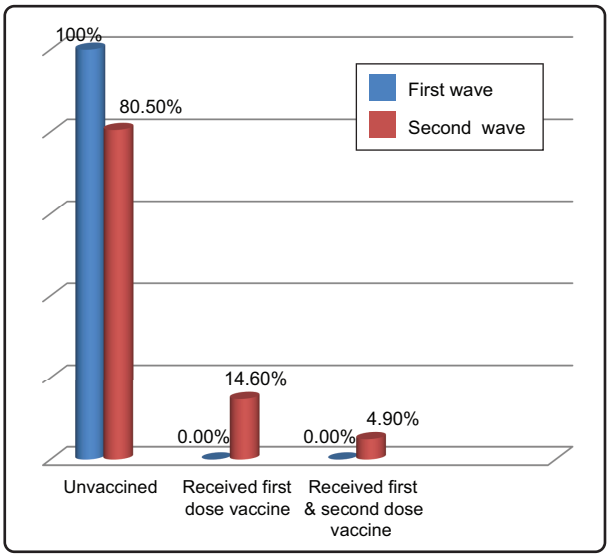


**Fig.-2:** *Vaccine status of the COVID-19 patients during first & second wave*

Symptomatic patients were more predominant during first wave (82.5% vs 73.1%; p=0.001) and asymptomatic patients were in second wave (26.9% vs 17.5%; p=0.001). COVID-19 related symptoms (fever, body ache, headache, anosmia, sore throat, shortness of breath and diarrhea) were less prominent during second wave (p<0.05). Comparison of clinical characteristics between the first and second wave COVID-19 are depicted in table II.

Oxygen requirement was more during second wave (45.9% vs 37.4%; p<0.05). High flow nasal cannula was unavailable during first wave but in second wave it was used in 1.6% (14) patients. About 40% patients received IV antibiotics during second wave, although 38.2% patients did not receive antibiotics. Comparison of treatment option between the first and second wave COVID-19 are detailed in table III.

Regarding disease severity, asymptomatic patients were more prevalent during second wave in comparison to first wave. Mild, moderate and critical ill forms of disease severity were more predominant during first wave and severe form during second wave respectively. Mortality rate was high during second wave.

Wave-wise comparison of in-hospital outcome of COVID-19 patients is shown in table IV.

Table V shows the univariate analysis of in-hospital outcome of study population. Age more than 50 years, non-health care personnel, presence of cardiovascular disease, EF category, disease severity, diabetes mellitus and hypertension significantly related with in-hospital mortality.

Out of 1585 patients, 69 patients died in this study. Univariate analysis factors analysis several factors were significantly related with in-hospital mortality. Based on these variables, binary logistic regression using the forward method was performed, and we found that age >50 years, severe & critically ill form and severe LV dysfunction were the independent predictor of mortality (Table VI).

**Table-II**

*Comparison of clinical characteristics between the first and second wave COVID-19*

| Variables | First wave (n=727) | Second wave (n=858) | P value* |
|---|---|---|---|
| Clinical presentation | | | |
| Symptomatic | 600(82.5%) | 627(73.1%) | 0.001 |
| Asymptomatic | 127(17.5%) | 231(26.9%) | |
| Presenting symptoms | | | |
| Fever | 481(66.2%) | 425(49.5%) | 0.001 |
| Fatigue | 210(28.9%) | 231(26.9%) | 0.38 |
| Cough | 269(37.0%) | 313(36.5%) | 0.83 |
| Body ache | 140(19.3%) | 121(14.1%) | 0.006 |
| Headache | 125(17.2%) | 93(10.8%) | 0.001 |
| Anosmia | 120(16.5%) | 62(7.2%) | 0.001 |
| Sore throat | 91(12.5%) | 45(5.2%) | 0.001 |
| Shortness of breath | 80(44.2%) | 37(26.6%) | 0.002 |
| Diarrhea | 50(6.9%) | 30(3.5%) | 0.002 |
| Generalized itching | 29(4.0%) | 23(2.7%) | 0.14 |
| Left ventricular ejection fraction | | | |
| Good | 439(60.4%) | 475(55.4%) | 0.076 |
| Mild | 156(21.5%) | 222(25.9%) | |
| Moderate | 113(15.5%) | 128(14.9%) | |
| Severe | 19(2.6%) | 33(3.8%) | |

Abbreviation: COVID-19: coronavirus disease 2019. *Chi square test was done to find out the significance.

**Table-III**
*Distribution of treatment*

| Variables | First wave (n=727) | Second wave (n=858) | P value* |
|---|---|---|---|
| Oxygen therapy | 272(37.4%) | 394(45.9%) | 0.001 |
| HFN cannula | 0(0%) | 14(1.6%) | 0.001 |
| Antibiotics | | | |
| IV | 112(15.4%) | 336(39.2%) | 0.001 |
| Oral + IV | 62(8.5%) | 29(3.4%) | |
| Oral | 482(66.3%) | 165(19.2%) | |
| Not received | 71(9.8%) | 328(38.2%) | |
| Antibiotics | | | |
| Single | 493(67.8%) | 416(48.5%) | 0.001 |
| Double | 163(22.4%) | 114(13.3%) | |
| Not received | 71(9.8%) | 328(38.2%) | |
| Steroids | 56(7.7%) | 66(7.7%) | 0.99 |
| Favipiravir | 39(5.4%) | 6(0.7%) | 0.001 |
| Remdesivir | 35(4.8%) | 57(6.6%) | 0.12 |
| Ivermectin | 539(74.1%) | 283(33.0%) | 0.001 |
| Hydroxy-chloroquine | 4(0.6%) | 0(0%) | 0.03 |
| Enoxaparine | 447(61.5%) | 646(75.3%) | 0.001 |

Abbreviation: HFN: high flow nasal; IV: intravenous. *Chi square test was done to find out the significance.

**Table-IV**
*In-Hospital outcome*

| Variables | First wave (n=727) | Second wave (n=858) | P value* |
|---|---|---|---|
| Disease severity | | | |
| Asymptomatic | 127(17.5%) | 231(26.9%) | 0.001 |
| Mild | 491(67.5%) | 532(62%) | 0.02 |
| Moderate | 51(7.0%) | 3(0.3%) | 0.001 |
| Severe | 44(6.1%) | 89(10.5%) | 0.002 |
| Critical ill | 14(1.9%) | 3(0.3%) | 0.002 |
| Mortality | 25 (3.4%) | 44(5.1%) | 0.1 |

Abbreviation: COVID-19: coronavirus disease 2019. *Chi square test was done to find out the significance.

**Table-V**

*Univariate analysis of in hospital outcome of study population*

| Variables | Outcome | | P value* |
|---|---|---|---|
| | In hospital deathf(%)# | Recoveredf(%)# | |
| Age group | | | |
| <50 Y | 9 (1.1) | 791 (98.9) | 0.000 |
| >50 Y | 60 (7.6) | 725 (92.4) | |
| Gender | | | |
| Male | 51 (5.0) | 976 (95.0) | 0.122 |
| Female | 18 (3.2) | 540 (96.8) | |
| NOHCP/HCP | | | |
| NOHCP | 67 (5.3) | 1193 (94.7) | 0.000 |
| HCP | 2 (0.6) | 323 (99.4) | |
| CVD | | | |
| Present | 55 (5.2) | 993 (94.8) | 0.015 |
| Absent | 14 (2.6) | 523 (97.4) | |
| Obesity | | | |
| Non obese | 54 (4.9) | 1052 (95.1) | 0.117 |
| Obese | 15 (3.1) | 464 (96.9) | |
| EF Category | | | |
| Severe LV Dysfunction | 6 (11.5) | 46 (88.5) | 0.001 |
| Moderate LV Dysfunction | 11 (4.6) | 230 (95.5) | |
| Mild LV Dysfunction | 25 (6.6) | 353 (93.4) | |
| Good Function | 27 (3.0) | 887 (97.0) | |
| Disease Severity | | | |
| Asymptomatic | 2 (0.6) | 356 (99.4) | 0.000 |
| Mild | 18 (1.8) | 1005 (98.2) | |
| Moderate | 1 (1.9) | 53 (98.1) | |
| Severe | 37 (27.8) | 96 (72.2) | |
| Critically ill | 11 (64.7) | 6 (35.3) | |
| Diabetes Mellitus | | | |
| Diabetic | 44 (6.8) | 603 (93.2) | 0.001 |
| Non diabetic | 25 (2.7) | 913 (97.3) | |
| Blood Pressure | | | |
| Hypertensive | 51 (5.5) | 871 (94.5) | 0.007 |
| Normotensive | 18 (2.7) | 645 (97.3) | |

Abbreviation: HCP: healthcare personnel; non-HCP: non-healthcare personnel; CVD: cardiovascular disease; EF: ejection fraction; LV: left ventricular. # Value in the parenthesis shows the corresponding row percentage; *Chi square test to find out significance.

**Table-VI**

*Multivariate analysis of in hospital outcome of study population*

| Variables | OR | Sig. | 95.0% CI | |
|---|---|---|---|---|
| | | | Lower | Upper |
| Age >50 years | 3.222 | .005 | 1.423 | 7.298 |
| Gender Male | 1.457 | .273 | .743 | 2.859 |
| NOHCP | 2.914 | .188 | .593 | 14.328 |
| CVD | .793 | .579 | .349 | 1.802 |
| Obese | .743 | .403 | .371 | 1.489 |
| LV Dysfunction | | .059 | | |
| · Good function | 1.837 | .090 | .910 | 3.709 |
| · Mild LV Dysfunction | .624 | .315 | .248 | 1.567 |
| · Moderate LV Dysfunction | 2.039 | .229 | .639 | 6.507 |
| · Severe LV Dysfunction | | .000 | | |
| Disease Severity | | | | |
| · Asymptomatic | | .000 | | |
| · Mild | 3.083 | .136 | .703 | 13.520 |
| · Moderate | 2.746 | .418 | .238 | 31.653 |
| · Severe | 50.707 | .000 | 11.732 | 219.156 |
| · Critically ill | 288.919 | .000 | 48.680 | 1714.738 |
| DM 1.213 | .534 | .660 | 2.227 | |
| HTN | .943 | .868 | .473 | 1.879 |

Variable(s) entered on step 1: Age>50Y, Gender, NOHCP, CVD, Obesity, EF category, Disease Severity, DM, HTN. Abbreviation: non-HCP: non-healthcare personnel; CVD: cardiovascular disease; EF: ejection fraction; LV: left ventricular; DM: diabetes mellitus; HTN: hypertension.

**Discussion**

Important findings of this study are: 1) Healthcare personnel (HCP) were less affected during second wave (11.9% vs 30.7%); 2) Patients aged 21-40 years were more prevalent in first wave (32.2% vs 23%); 3) Patients aged more than 60 years (28.8% vs 22.6%) were more prevalent in second wave; 4) Vaccinated people were less affected by COVID-19; 5) COVID-19 related symptoms were less prominent during second wave; 6) Asymptomatic & severe disease forms were prevalent in second wave; 7) Mortality rate was higher during second wave (5.1% vs 3.4%; p=0.1) and, 8) Age > 50 years, severe left ventricular dysfunction, severe and critically ill patients were the independent predictor of mortality.

Understanding how SARS-CoV-2 infection varies across the age spectrum is the key for developing responses to the COVID-19 epidemic[9]. There is a trend toward decreasing age among persons with laboratory-confirmed SARS-CoV-2 infection, but that these trends seem to be specific to the outpatient population[9].

In our study, the mean age of the patients was higher in second wave than first wave (50.65± 16.63 vs 48.11± 15.75 years). In contrast to our study, the mean age of patients in the second waves was significantly lower in other two studies (53.60±23.05 and 56.84±18.29 years)[10] and (58 ± 26 *vs*. 67 ± 18 years)[11].

Also in Japan, patients in the second wave tended to be younger (median age, 37/ vs 56 years)[4]. Patients aged up to 40 years were more prevalent in first wave (33.9%) than second wave (26%). Although the exact cause for the difference of the patient's age between the two waves is unknown, it has been hypothesized that lower infection rate among HCP may be a reason as they were relatively young. Surprisingly, about 56.2% of individuals were positive below the age of 40 in the first wave, while during the second wave, this number was increased and reached 65.6% in another study[6].

Hypertension, chronic kidney disease and cardiovascular disease were more prevalent in second wave. It may be due to older age of the patients. Similar to our study, Jalali et al.[10] showed cardiovascular disorders, hypertension, chronic renal disorders, malignancies, and opium use were more prevalent among the study population during second wave as compared to the first

wave. A recent meta-analysis of 16 published studies with 3994 patients, found out that comorbidities had a major effect on patients with COVID 19 and leads to higher chances of serious events[12]. The presence of chronic respiratory disorders, chronic kidney diseases, cardiovascular diseases, and diabetes mellitus associated with a 6.6, 5.3, 4.5, and 3.07 times higher risk of developing serious events in COVID 19 patients, respectively[12]. Another meta-analysis by Li et al.[13] found that hypertension and cardio-cerebrovascular diseases had a statistically significant impact on ICU admission.

One of the important findings of this study was that HCP were less affected during second wave (11.9% vs 30.7%). During first wave vaccine was not available in Bangladesh. Lower infection rate among HCP may be due to proper utilization of personal protective measures and vaccination of HCP in priority basis as front line fighter against COVID-19.

COVID-19 related symptoms (fever, body ache, headache, anosmia, sore throat, shortness of breath and diarrhea) were significantly less prominent during second wave in our study. It may be due to mutation of virus. In contrast to our study, gastro-intestinal manifestations were more common in the second wave in another studies[3,10.11].

Vaccination is the simplest method to regulate rapidly spreading infectious diseases[14]. Vaccines were unavailable during first wave in our country. Later on, several vaccines were invented to provide acquired immunity against the coronavirus[15]. Unvaccinated people (80.5%) were more commonly affected by COVID-19 in our study in the second wave. COVID-19 vaccination has substantially altered the course of the pandemic, saving tens of millions of lives globally[16].

Oxygen requirement was more during second wave (45.9% vs 37.4%). High flow nasal cannula was unavailable during first wave but in second wave it was used in 1.6% patients. About 40% patients received IV antibiotics during second wave, although 38.2% patients did not receive antibiotics. Regarding other treatments, patients in the first wave received ivermectin, favipiravir, hydroxychloroquine, and remdesivir, while those in the second wave received remdesivir.

Mortality rate was higher during second wave (5.1% vs 3.4%) in our study. Older age, presence of cardiovascular disease and other co-morbidities may be the reasons for increased mortality in second wave. Age > 50 years, severe left ventricular dysfunction, severe and critically ill patients were the independent predictor of mortality in our study. In contrast to our study, mortality rate was lower in other studies (1.2% vs 7.3%)[4], (8.0% vs 23.4%)[10] and (13.2% vs 24.0%)[11]. Lower mortality rate in Japan in the second wave may be because of the shorter time between disease onset and admission, differences in patient background, co-morbidities, and advances in treatment methods[4]. In the first wave older age and the presence of fever, shortness of breath, acute respiratory distress syndrome, diabetes, and cancer were independently associated with higher mortality[11]. On the other hand, in the second wave age, gender, and the presence of acute respiratory distress syndrome and chronic neurological diseases were associated with mortality[11].

There have several limitations to our study. Firstly, study conducted in non-COVID-dedicated hospital. Secondly, the genomic variants were not considered. Thirdly, COVID variants were not determined and fourthly, the brand name of vaccine was not included.

**Conclusion:**

In comparison to the first wave, during the second wave healthcare personnel were less affected, symptoms were less prominent, asymptomatic and severe disease form were more prevalent & mortality rate was high. Unvaccinated persons were more prone to SARS-CoV-2 infection. Age > 50 years, severe left ventricular dysfunction, severe and critically ill patients were the independent predictor of mortality.

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