


BMJ Open Comparison of demographic, clinical and laboratory characteristics between first and second COVID-19 waves in a secondary care hospital in Qatar: a retrospective study

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ABSTRACT

Objective To compare the patient profile and outcomes in Qatar during the first and second waves of the COVID-19 pandemic.

Setting A retrospective observational study was conducted comparing the demographic, clinical and laboratory characteristics of patients with COVID-19 infection admitted to a secondary care hospital, during the first and second waves of the pandemic.

Participants 1039 patients from the first wave and 991 from the second wave who had pneumonia on chest X-ray and had a confirmed SARS-CoV-2 infection by a real-time PCR test of a nasopharyngeal swab were included. Patients with a normal chest X-ray and those who had a negative PCR test despite a positive COVID-19 antigen test were excluded.

Outcome Length of stay, need for mechanical ventilation, final disposition and mortality were the key outcomes studied

Results Influenza like symptoms (18.5% in the first wave vs 36.1% in the second wave, $p < 0.001$), cough (79.2% vs 87%, $p < 0.001$) and dyspnoea (27.5% vs 38% $p < 0.001$) were more common in the second wave. Second wave patients had significantly higher respiratory rate, lower peripheral oxygen saturation, needed more supplemental oxygen and had higher incidence of pulmonary embolism. More patients received hydroxychloroquine and antibiotics during the first wave and more received steroids, antivirals and interleukin-1 antagonist during the second wave. The second wave had a shorter length of stay (14.58 ± 7.75 vs 12.61 ± 6.16 , $p < 0.001$) and more patients were discharged home (22% vs 10%, $p < 0.001$).

Conclusions Patients who presented during the second wave of COVID-19 pandemic appeared to be more ill clinically and based on their laboratory parameters. They required shorter hospitalisation and were more likely to be discharged home. This could represent greater expertise in handling such patients that was acquired during the first wave as well as use of more appropriate and combination therapies during the second wave.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ First study in the region to compare patient characteristics between the two waves.
- ⇒ All patient variables were compared, including demographics, clinical complaints, vital signs, laboratory indicators and outcomes.
- ⇒ The relationship between risk factors and outcomes was not investigated.
- ⇒ Patients with severe COVID-19 were not included.

INTRODUCTION

COVID-19, first identified in the Wuhan province of China, was declared a global pandemic by the WHO on 11 March 2020.¹ To date, it has affected 521 920 560 with more than 6 million deaths worldwide. In Qatar, COVID-19 infection has affected 367 099 individuals with 677 deaths till May 2022.² On 29 February 2020, Qatar reported its first confirmed case of COVID-19 infection. During the first and second wave, maximum number of cases was reported between 16 April 2020 and 20 July 2020 and between 8 February 2021 and 8 June 2021, respectively.

The virus responsible for the COVID-19 infection is SARS-CoV-2, a novel corona virus belonging to the family Coronaviridae.³ The initial outbreak in China was thought to be originated by zoonotic spread from the seafood markets in the Wuhan province. Afterwards human-to-human transmission was recognised for the community spread of the disease, which rapidly became a global infection leading to the pandemic.⁴⁻⁷

The mode of transmission of the virus from person to person is via respiratory droplets.

Transmission may also occur through fomites such as bed linen, thermometers and so on used by the COVID-19 infected patients. Airborne spread has been reported from aerosol generating procedures such as endotracheal intubation, bronchoscopy, open suctioning, tracheostomy and nebulisation.^{8,9}

The spectrum of clinical manifestations of COVID-19 infection ranges from asymptomatic infection to symptomatic presentation. A systematic review done before the introduction of the COVID-19 vaccination reported that 33% of COVID-19 infections are asymptomatic.¹⁰ However, these asymptomatic individuals can have radiological findings of ground glass opacities or patchy infiltrations in CT scan.¹¹ Most common symptoms of presentations are fever, malaise, myalgia, shortness of breath and dry cough. Gastrointestinal symptoms may also be found in some patients with COVID-19 infection.^{12,13}

The severity of symptomatic disease might vary from mild disease which accounts for the majority of the cases to severe or critical illness. Patients with severe disease may have dyspnoea, hypoxia or radiological imaging demonstrating more than 50% involvements of lungs, whereas patients with critical disease will have features of shock, respiratory or multiorgan failure.¹⁴⁻¹⁸ A report from Centers for Disease Control and Prevention (CDC) from USA on 1.3 million cases reported a cumulative incidence of 403.6 cases per 100 000 persons. The incidence was higher among patients more than 80 years of age. Cardiovascular disease (32%) and diabetes mellitus (30%) were the most common comorbid conditions noted. Overall 14% were hospitalised, 2% were admitted to the intensive care unit (ICU) and 5% died. The hospitalisation and death were 6 times and 12 times respectively higher among patients with underlying comorbidities than those without.¹⁹

During the first wave the Government of Qatar introduced strict preventive measures starting from March 2020, which included closure of all educational institutions and commercial establishments, closure of public and private offices, restaurants, banning of social gatherings, sports and entertainment activities, ban on international travel and strict home confinement. Wearing face mask in public space was made mandatory. As the number of cases in the first wave began to recede, the restrictions were lifted in a phased manner from second half of June 2020. During the second wave when the number of cases started to raise, the government reintroduced some of the preventive measures to contain the disease starting from February 2021. There was closure of parks, cinemas, sports activities. The public and private offices were allowed work with not more than 50% of capacity and there was ban on social gatherings however there was no complete lockdown.

During both pandemic waves, Ras Laffan Hospital, a secondary care hospital, was one of the COVID-19 designated hospitals under Hamad Medical Corporation (HMC). If patients met the admission criteria, they were transferred to Ras Laffan Hospital from non-COVID

hospitals and tertiary care COVID-19 facilities. During the first and second waves, respectively, 3650 and 4050 patients with a confirmed SARS-CoV-2 infection were hospitalised and treated at the Ras Laffan hospital.

From the time, it was originally discovered in Wuhan, the disease profile, epidemiology and treatment guidelines for COVID-19 infection had evolved continuously. On the basis of the most recent scientific findings, WHO released and updated diagnostic and treatment guidelines, as well as quarantine guidelines, on a regular basis. Countries around the world revised their management and quarantine standards on a regular basis based on this and locally available data.

Although the data on first 5000 cases of COVID-19 infection in Qatar have been reported,²⁰ there is a lack of published literature comparing the epidemiology and consequences of repeated waves of the COVID-19 pandemic across the Middle East area, including Qatar. Furthermore, Qatar's population is made up mostly of people of diverse countries and ethnic backgrounds. Hence, we chose to investigate and compare the characteristics and outcomes in both waves to better understand and manage future events.

OBJECTIVE

The goal of this study was to examine the patient profile and outcomes in COVID-19-infected hospitalised patients during the first and second waves of the pandemic.

METHODS

Study type and setting

A retrospective observational study was conducted at Ras Laffan hospital, HMC, Qatar. This hospital was one of the COVID-19 designated hospitals under HMC.

Study participants and sample selection

Patients admitted between 1 and 30 May 2020 in the first wave (n=1039) and those admitted between 1 and 15 March 2021 during the second wave (n=991) were included in the study. The duration of the recruitment of patients was shorter in the second wave in order to make it comparable and equal number with the first wave. Though we did not use random sampling technique to select patients, it is worth to note that all the patients who met the inclusion criteria within the specified period were included. The patients were included if they had pneumonia on chest X-ray and had a laboratory-confirmed SARS-CoV-2 infection by a real-time PCR test of a nasopharyngeal swab specimen. The study excluded patients with a normal chest X-ray and those who had a negative PCR test despite a positive COVID-19 antigen test.

Patient and public involvement

No patient involved.

Table 1 Baseline epidemiological and clinical characteristics of patients during the first and second wave of the COVID-19 pandemic

Variables	First wave (n=1039) n (%)	Second wave (n=991) n (%)	P value
Age (in years)			
Mean±SD	44.90±9.99	44.34±9.57	0.194*
18–35	202 (19.4)	192 (19.4)	0.896†
36–50	550 (52.9)	535 (54)	
51–65	265 (25.5)	247 (24.9)	
Above 65	22 (2.1)	17 (1.7)	
Gender			
Male	989 (95.2)	877 (88.5)	<0.001†
Female	50 (4.8)	114 (11.5)	
Signs and symptoms			
Asymptomatic	48 (4.6)	94 (9.5)	<0.001†
Mean duration of symptoms in days±SD	4.88±2.91	4.57±2.50	0.010*
Fever	893 (85.9)	870 (87.8)	0.220†
Respiratory symptoms	856 (82.4)	709 (71.5)	<0.001†
Influenza-like symptoms	192 (18.5)	358 (36.1)	<0.001†
Cough	823 (79.2)	862 (87)	<0.001†
Shortness of breath	286 (27.5)	377 (38)	<0.001†
Chest pain	43 (4.1)	37 (3.7)	0.639†
Gastrointestinal symptoms	88 (8.5)	66 (6.7)	0.124†
Vomiting	50 (4.8)	38 (3.8)	0.280†
Diarrhoea	49 (4.7)	38 (3.8)	0.327†
Comorbidities			
Immunosuppression	12 (1.2)	4 (0.4)	0.056†
Chemotherapy	6 (0.6)	5 (0.5)	0.823†
Diabetes mellitus	307 (29.5)	217 (21.9)	<0.001†
Hypertension	270 (26)	263 (26.5)	0.777†
Coronary artery disease	41 (3.9)	26 (2.6)	0.095†
Chronic kidney disease	17 (1.6)	14 (1.4)	0.681†
Cancer	5 (0.5)	5 (0.5)	0.940†
Liver disease	3 (0.3)	6 (0.6)	0.283†
COPD/asthma	19 (1.8)	8 (0.8)	0.045†
Body mass index (kg/m ²)			
Mean±SD	27.95±4.46	28.29±4.83	0.263*
<18.5	1 (0.2)	6 (1.1)	0.360†
18.6–25	102 (24.5)	137 (25.4)	
25.1–30	201 (48.2)	243 (45)	
>30	113 (27.1)	154 (28.5)	

Categorical and quantitative data expressed as frequencies and percentages (in parenthesis) and as mean±SD. In all statistical comparative analysis performed, second wave was considered as a reference group.

*Unpaired t test.

†Pearson χ^2 test.

COPD, chronic obstructive pulmonary disease.

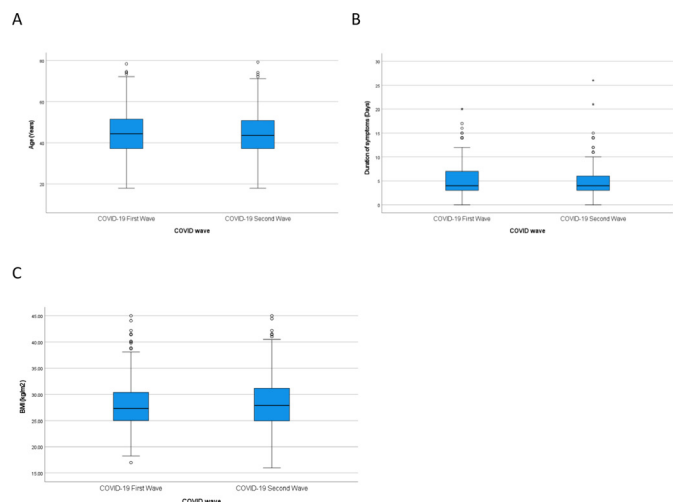


Figure 1 (A–C) Box plot showing the distribution of age, duration of symptoms and body mass index (BMI).

Data collection

Using the patients' healthcare numbers, files from the clinical information system were reviewed. Data were collected on demographics, admission symptoms, comorbidities, length of stay, laboratory and radiographic results, need for supplemental oxygen, treatment details, complications and outcomes.

Outcome of the study

The need for mechanical ventilation, length of stay, final disposition and mortality were the key outcomes studied along with their clinical and laboratory characteristics.

Statistical analysis

Descriptive statistics were used to summarise demographic, anthropometric, clinical, laboratory, radiological characteristics and related follow-up outcome measures of these patients. Continuous variables with normal distribution were presented as mean and SD, whereas median and IQR were used in case of skewed/non-normal data. Categorical variables were presented as frequencies and proportions. The Shapiro-Wilk test was used to test for normality of the data distribution. The statistical analysis method for outcomes measured quantitatively and differences between the two independent groups (first and second COVID-19 waves) were compared using unpaired t or Mann-Whitney U tests as appropriate depending on the normality of the data distribution. Associations between two or more qualitative or categorical variables across two independent groups were compared using Pearson χ^2 or Fisher exact test as applicable. Within each group of COVID-19 wave, vital signs and oxygen requirement measured on and after admission were compared using paired t test and McNemar's χ^2 test. Box plots were constructed to depict distribution of age, duration of symptoms, body mass index (BMI), vital signs and various parameters related to laboratory profiles across both groups (first and second COVID-19 waves). All p values presented were two-tailed, and $p < 0.05$ was considered as statistically significant. All Statistical analyses were performed using statistical packages SPSS V.27.0 (IBM Corp) and Epi-info (CDC, Atlanta, Georgia, USA) software.

Table 2 Showing vital signs and oxygen requirement

Variables		First wave (n=1039)	Second wave (n=991)	P value*
Temperature °C Mean±SD	On admission	37.3±0.75	37.3±0.72	0.976
	Maximum	38.1±0.89	38.2±0.88	0.024
P value†		<0.001	<0.001	
Pulse rate (beats/min) Mean±SD	On admission	89±14	88±13	0.439
	Maximum	102±11	103±11	0.164
P value†		<0.001	<0.001	
Respiratory rate /min Mean±SD	On admission	19±2	19±3	0.030
	Maximum	22±5	23±6	<0.001
P value†		<0.001	<0.001	
SpO ₂ (%) Mean±SD	On admission	97±2	97±1	0.327
	Lowest	94±4	93±5	<0.001
P value†		<0.001	<0.001	
Patients received supplemental oxygen, number (%)	On admission	238 (22.9)	399 (40.3)	<0.001
	After admission	315 (30.3)	394 (39.8)	<0.001
P value‡		<0.001	<0.001	

In all statistical comparative analysis performed, second wave was considered as a reference group.

SpO₂ -Peripheral oxygen saturation

*Unpaired t test.

†Paired t test.

‡McNemar's χ^2 test.

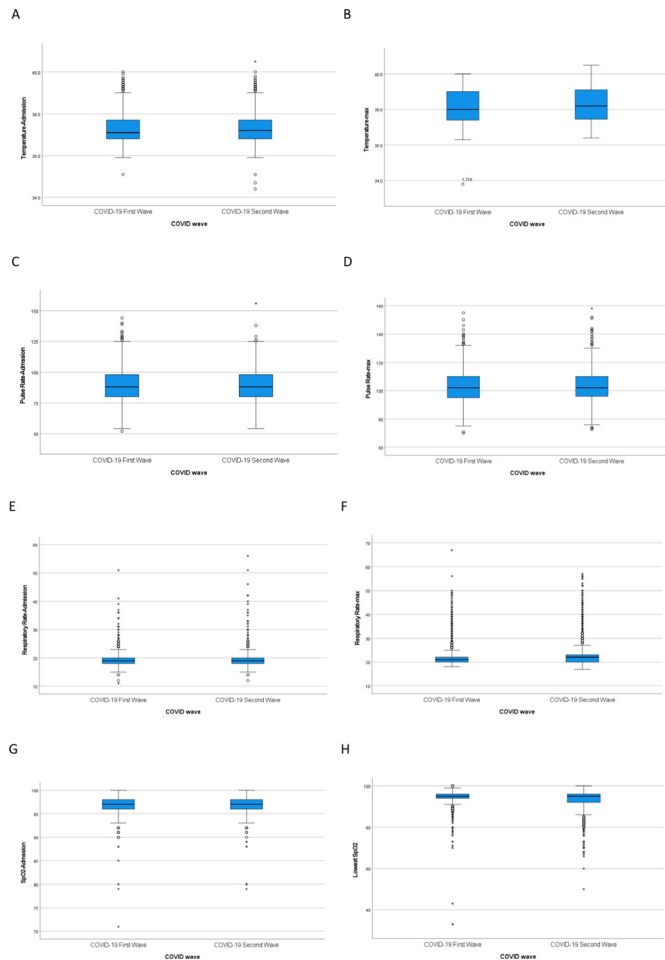


Figure 2 (A–D) Box plots depicting the vital signs. (E–H) Box plots depicting the vital signs.

RESULTS

Baseline demographic characteristics

During the first and second waves, respectively, 3650 and 4050 patients with a confirmed SARS-CoV-2 infection were hospitalised. The study included 1039 patients from the first wave and 991 participants from the second wave. During both waves, the average age of the subjects was similar (44.9 ± 9.99 vs 44.34 ± 9.57). In both waves, the proportion of patients among various age groups was comparable, with the majority of patients being between the ages of 36 and 50 (52.9% vs 54.0%). Men made up 95.2% of the first wave and 88.5% of the second wave patients (table 1).

Clinical characteristics on admission

In the first wave, patients had longer duration of symptoms prior to admission compared with second wave (4.88 ± 2.91 vs 4.57 ± 2.50 , $p = 0.010$). Influenza-like symptoms (36.1% in the second wave vs 18.5% in the first wave, $p < 0.001$), cough (87% vs 79.2%, $p < 0.001$) and shortness of breath (38% vs 27.5%, $p < 0.001$) were significantly higher in the second wave than the first. We did not find any significant difference in gastrointestinal symptoms between the two waves.

Diabetes mellitus (29.5% vs 21.9%) and hypertension (26% vs 26.5%) were the most common comorbid conditions observed in both waves; however, frequency of diabetes mellitus was significantly higher in the first wave ($p < 0.001$).

The mean BMI was 27.95 ± 4.46 and 28.29 ± 4.83 in the first and second waves, respectively ($p = 0.263$). Most patients had higher BMI in both the waves, with the majority having a BMI between 25.1 and 30 (48.2% vs 45%) followed by more than 30 (27.1% vs 28.5%) (table 1). The details of distribution of age, duration of symptoms and BMI are plotted in figure 1A–C.

Vital signs and oxygen requirement

Patients in the second wave had significantly higher respiratory rate (23 ± 6 vs 22 ± 5 , $p < 0.001$) and significantly lower peripheral oxygen saturation [Spo₂] (93 ± 5 vs 94 ± 4 , $p < 0.001$) when compared with the first wave. Furthermore, during the second wave significantly higher number of patients received supplemental oxygen on admission (40.3% vs 22.9%, $p < 0.001$) and also during their stay in the hospital (39.8% vs 30.3%, $p < 0.001$). During the stay in the hospital, there was significant variation in the vital parameters of the patients within the group from admission value to their respective maximum/minimum values ($p < 0.001$) (Table 2 and figure 2A–H).

Laboratory parameters and chest X-ray findings

The first wave had significantly higher C reactive protein (median 35.4, IQR 12.9, 72 vs median 15.2, IQR 15.2, 32.2, $p < 0.001$) and HbA1c values (7.37 ± 2.04 vs 6.94 ± 1.83 , $p < 0.001$). The mean values of white blood cell count (6.49 ± 2.41 vs 6.27 ± 2.21 , $p = 0.031$), haemoglobin (14.35 ± 1.37 vs 14.16 ± 1.43 , $p = 0.003$) and platelet counts (234.99 ± 89.44 vs 225.55 ± 82.50 , $p = 0.014$) were lower in the second wave than the first. The patients in the second wave had considerably lower mean albumin levels than the first wave (35.58 ± 4.94 vs 36.97 ± 4.83 , $p < 0.001$). Patients in the second wave had higher hepatic transaminases and alkaline phosphatase levels than the first wave, although the differences were statistically insignificant. In both waves, the majority of patients had bilateral pneumonia on chest X-ray (Table 3 and figure 3A–K).

Treatment received

In the first wave, the usage of amoxicillin/clavulanic acid (60.9% vs 29.3%) and azithromycin/clarithromycin (74.1% vs 41.9%) and usage of hydroxychloroquine (88.5% vs 60.3%, $p < 0.001$) was higher.

A significantly higher number of patients in the second wave received steroids (47.7% vs 17.1%, $p < 0.001$), favipiravir (71% vs 22.1%, $p < 0.001$) or lopinavir/ritonavir (63.6% vs 35.5%, $p < 0.001$) and anakinra (10.6% vs 2.7%, $p < 0.001$).

Similar number of patients in both the waves received cephalosporins (74.3% vs 70.5%, $p = 0.058$) and prophylactic anticoagulation (97.4% vs 99%) (table 4).

Table 3 Showing laboratory parameters and chest X-ray findings

Variables	First wave Mean±SD (median, IQR)	Second wave Mean±SD (median, IQR)	P value
White blood cells (10 ³ /μL)	6.49±2.41 (6.10, 4.80–7.60)	6.27±2.21 (5.90, 4.70–7.40)	0.031*
Haemoglobin (g/dL)	14.35±1.37 (14.40, 13.50–15.22)	14.16±1.43 (14.20, 13.3–15.2)	0.003*
Platelet count (10 ³ /μL)	234.99±89.44 (217, 175–269)	225.55±82.50 (209, 168–259)	0.014*
Albumin (g/L)	36.97±4.83 (37, 34–40)	35.58±4.94 (35, 32–39)	<0.001*
C reactive protein (mg/L)	50.54±53.28 (35.35, 12.90–72.02)	33.68±44.20 (15.2, 15.20–32.20)	<0.001†
Lactate	1.74±0.77 (1.60, 1.20–2.10)	1.73±0.91 (1.50, 1.20–2.10)	0.924*
Procalcitonin	0.41±1.62 (0.11, 0.06–0.21)	0.30±1.15 (0.11, 0.06–0.21)	0.456†
D-dimer	1.20±4.28 (0.44, 0.32–0.68)	1.10±3.84 (0.42, 0.30–0.63)	0.139†
Aspartate aminotransferase	44.14±34.47 (35, 26–50)	46.81±40.14 (37, 28–52)	0.020†
Alkaline phosphatase	77.56±31.71 (71, 59–87.5)	78.29±34.96 (71, 58–87)	0.626*
Alanine aminotransferase	42.74±33.28 (32.9, 23–50.55)	44.30±34.24 (34, 24–54)	0.267†
Total bilirubin	9.97±5.73 (8.30, 7–12)	9.57±6.20 (8.0, 6.0–11.0)	0.143*
HbA1c	7.37±2.04 (6.60, 5.90–8.40)	6.94±1.83 (6.20, 5.80–7.3)	<0.001*
Chest X-ray findings			
Unilateral infiltrations	185 (17.8)	236 (23.8)	0.001‡
Bilateral infiltrations	854 (82.2)	755 (76.2)	

In all statistical comparative analysis performed, second wave was considered as a reference group.
 *Unpaired t test.
 †Mann-Whitney U test
 ‡Pearson χ^2 test.

Complications/outcome and disposition

In the first and second waves, 5.3% and 6.5% of patients, respectively, required transfer to a higher centre for further care. Among those who were transferred, 28 (2.7%) patients in the first wave and 40 (4%) in the second wave received mechanical ventilation ($p=0.093$). In the second wave, the percentage of patients who developed pulmonary embolism was significantly higher (1.1% vs 0.03%, $p=0.025$); furthermore, a higher proportion of mortality (0.81% (8/991) vs 0.3% (3/1030)) was recorded in the second wave; however, this difference was statistically insignificant ($p=0.112$).

In the second wave, the average length of stay was 1.9 days shorter which was statistically significant (14.58 ± 7.75 vs 12.61 ± 6.16 , $p<0.001$). The majority of patients in the first wave stayed for 15–30 days (50.9% vs 21.4%), while the majority of patients in the second wave stayed for 8–14 days (64.4% vs 25.15%) (table 5).

There was significantly higher percentage of patients who were transferred to quarantine facility in the first wave than the second wave (84.6% vs 71.1%, $p<0.001$) whereas significantly higher percentage of patients were discharged to their home in the second wave than the first wave (22.4% vs 10.1%, $p<0.001$).

DISCUSSION

To our knowledge, this is the first study from the state of Qatar to compare COVID-19 individuals hospitalised

between the first and second waves of the SARS-CoV-2 pandemic. Our findings show a significant variation between the two waves in terms of clinical features, laboratory markers and outcomes.

There was no difference in the average age of the patients between the two waves. In confirmation to our findings, a previous study conducted in Switzerland by Wolfisberg *et al*²¹ found no difference in the mean age of patients between two waves (65.9 vs 65.8 years), whereas in contrast to our results a study by Iftimie *et al* from Spain²² found that the patients in the second wave were significantly younger than the first wave (58 years vs 67 years). Our research sample, however, was substantially younger in both waves (44.90 vs 44.349.57) than the previous two study groups. The young male expatriate workforce makes up the bulk of Qatar's population, which might explain this. We predicted the duration of symptoms prior to admission to be longer in the second wave than in the first because the patients were more apprehensive and sought medical assistance earlier in the first wave than in the second. Furthermore, the knowledge acquired and improved understanding of the COVID-19 disease epidemiology gained from handling the first wave should have given health practitioners the confidence to manage patients with mild to moderate disease at home rather than in the hospital during the second wave. Our findings, on the other hand, revealed that the duration of symptoms before to admission was longer in the first wave than in the second.

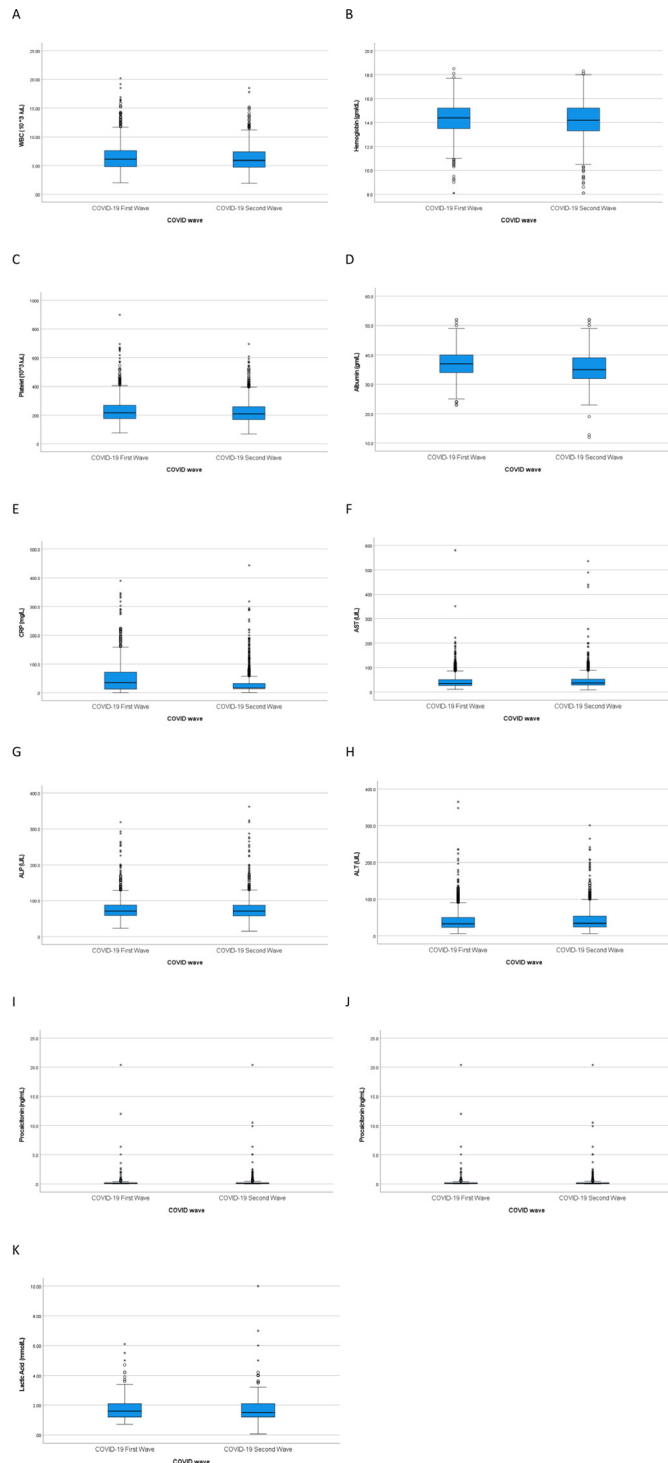


Figure 3 (A–F) Box plots depicting distribution laboratory parameters. (G–K) Box plots depicting distribution laboratory parameters.

On admission to the hospital cough, shortness of breath and upper respiratory symptoms were more common in the second wave. The patients in the second wave had more symptoms and were sicker as evidenced by tachypnoea and hypoxia and more patients requiring oxygen. We did not observe a significant difference in the prevalence of gastrointestinal symptoms between both the waves. This is in contrast to previous research,^{22 23}

which reported a higher prevalence of gastrointestinal complaints in the second wave.

The most common comorbidities in both waves of the research population were diabetes mellitus and hypertension. The number of patients with diabetes, on the other hand, was much higher in the first wave. One possible explanation for the lower number of patients with diabetes mellitus in the second wave is that health advice given by the WHO as well as published literature showing evidence of diabetes mellitus as a risk factor for having the severe disease made these patients more cautious and isolate themselves, thereby shielding and protecting them from being exposed to infected patients. When comparing comorbidities in both the waves, previous research have yielded conflicting outcomes. Itimie *et al*²² showed no significant differences in comorbidity between the two waves; however, Jarrett *et al*²⁴ and Sargin *et al*²⁵ identified a higher frequency of chronic kidney illness in the second wave than in the first wave.

Despite the fact that the mean BMI did not alter significantly between the two waves, the majority of our research group had a higher BMI in both, suggesting obesity as a probable risk factor for COVID-19 infection. However, this needs further studies analysing the correlation between obesity as a risk factor and COVID-19 infection. Obesity was found in 30% of the whole study population in both waves, according to a study from Switzerland.²¹ Another study from the USA²⁴ found that the second wave had a higher BMI than the first wave (32.58 vs 29.83).

The study of laboratory measurements revealed that the first wave had higher mean values of C reactive protein and HbA1c, while hypoalbuminaemia was significantly higher in the second wave. Furthermore levels of leucocyte and platelet count were lower in second wave than the first wave. The second wave had higher mean levels of hepatic transaminases but the difference was statistically not significant. The higher HbA1c readings in the first wave are unsurprising given the higher prevalence of diabetes mellitus in the first wave compared with the second wave. The higher hepatic transaminases in the second wave could be due to a variety of factors. One probable reason could be secondary to the side effect of favipiravir, as it was used more frequently in the second wave than in the first wave.

In our study population, the use of steroids was much higher in the second wave (47% vs 17%). This is because during the early stage of the first wave scientific literature regarding the benefit of steroids in COVID-19 infection was still in its preliminary stage and its use was limited. The frequency of usage of steroids in published data was still greater (99%,²⁴ 76%²¹) than ours in the second wave. Because the aforementioned two studies included individuals with more severe disease than our research sample, the frequency of steroid administration differed. In terms of prophylactic anticoagulation, practically more than 97% of the patients in both waves received anticoagulation in our research group. This was much greater

Table 4 Showing the details of treatment received

Treatment*	First wave (n=1039) n (%)	Second wave (n=991) n (%)	P value†
Dexamethasone	178 (17.1)	473 (47.7)	<0.001
Anticoagulation	1012 (97.4)	981 (99)	0.007
Favipiravir	230 (22.1)	704 (71)	<0.001
Hydroxychloroquine	920 (88.5)	598 (60.3)	<0.001
Lopinavir/ritonavir	369 (35.5)	630 (63.6)	<0.001
Anakinra	28 (2.7)	105 (10.6)	<0.001
Tocilizumab	21 (2.0)	19 (1.9)	0.866
Amoxicillin/clavulanic acid	633 (60.9)	290 (29.3)	<0.001
Ceftriaxone/cefuroxime	772 (74.3)	699 (70.5)	0.058
Azithromycin/clarithromycin	770 (74.1)	415 (41.9)	<0.001
Piperacillin/tazobactam	51 (4.9)	68 (6.9)	0.061

In all statistical comparative analysis performed, second wave was considered as a reference group.

*Some patients might have received more than one type of treatments.

†Pearson χ^2 test.

than the 59% in the first wave and 74% in the second wave reported in a research conducted in the USA.²⁴

The usage of hydroxychloroquine was significantly higher in the first wave, whereas the use of favipiravir and anakinra was much higher in the second wave, according to our findings. This is because treatment guidelines evolved and modified from the first wave to the second wave based on published scientific information around the world. Furthermore, use of antibiotics was significantly higher in the first wave than the second wave. There are multiple reasons for this. First, during the first wave azithromycin was more commonly used along with

hydroxychloroquine as a treatment for COVID-19 infection. Second, due to lack of experience and expertise in managing the COVID-19 pandemic antibiotics were more commonly prescribed for patients with COVID-19 pneumonia during the first wave; however during the second wave, clinicians acquired adequate knowledge and experience and were more confident to treat patients without antibiotics unless indicated.

Despite the fact that patients in the second wave were sicker as evidenced by more symptoms, tachypnoea and hypoxia on admission and laboratory parameters, the duration of hospitalisation were significantly lower

Table 5 Showing final outcomes and disposition

Variables	First wave (n=1030) n (%)	Second wave (n=991) n(%)	P value
Mechanical ventilation	28 (2.7)	40 (4.0)	0.093*
Pulmonary embolism/Deep vein thrombosis	3 (0.3)	11 (1.1)	0.025*
Death	3 (0.3)	8 (0.8)	0.112*
Discharge disposition			
Discharged home	105 (10.1)	222 (22.4)	<0.001*
Transfer to quarantine	879 (84.6)	705 (71.1)	
Transfer to higher centre	55 (5.3)	64 (6.5)	
Length of stay in days			
Mean±SD	14.58±7.75	12.61±6.16	<0.001†
0–7	227 (21.8)	126 (12.7)	<0.001*
8–14	261 (25.1)	638 (64.4)	
15–30	529 (50.9)	212 (21.4)	
>30	22 (2.1)	15 (1.5)	

In all statistical comparative analysis performed, second wave was considered as a reference group.

*Pearson χ^2 test.

†Unpaired t test.

in the second wave. In the present study, the average length of stay in the second wave was nearly 2 days less than in the first. This supports the findings of other research,^{21 22 25} which similarly found a shorter length of stay in the second wave. In addition, more patients were discharged home in the second wave than transferred to quarantine facility. Possible explanation for this could be the change in discharge/transfer criteria. Second, better understanding of the disease course and experience of managing the first wave made the healthcare professionals more confident in early discharge of patients in the second wave. Finally, better home surveillance of discharged patients, development of better follow-up care and community awareness and education might have also played an important role.

Even while the number of patients who needed to be transferred to a higher centre, those who needed mechanical ventilation, had a pulmonary embolism and those who died were all somewhat higher in the second wave than in the first, the difference was not statistically significant. Available published data from two studies, one from Switzerland²¹ and another from Turkey²⁵ found no significant difference in the proportion of patients requiring or at risk for ICU admission in both the waves. However, the percentage of patients needing ICU care in the above two studies was higher than our results in both the waves. This could be related to the fact that our study and theirs had different severity of cases and also could be due to the difference in admission criteria in our study and others. Our admission criteria included patients with pneumonia requiring less than 4 L of oxygen at the time of admission, whereas other studies included more severe cases or ICU cases. Others have reported similar results, finding no substantial change in the number of patients requiring mechanical ventilation in both waves.^{24 25} There was no significant change in mortality rates between the two waves in the present study. Previous research comparing mortality rates between the two COVID-19 pandemic waves came up with mixed results. Our findings are consistent with those of Wolfisberg *et al*²¹ and Sargin Altunok *et al*,²⁵ who found no difference in mortality rates between the two waves, but Ifimie *et al*²² and Jarrett *et al*²⁴ reported lower mortality in the second wave, in contrast to our findings. Similarly, two studies from the USA found that the second wave had a reduced mortality rate.^{26 27} According to published statistics from Japan based on a public registry reported that the second wave of patients were younger, had fewer underlying comorbidities and had lower mortality rates.²⁸

A few studies from Europe also found lower mortality in the second wave. Chest X-ray severity of pneumonia, in-hospital mortality and C reactive protein readings were considerably greater in the first wave, according to an Italian study involving 200 Caucasian men over 50 years. They also discovered that the first wave had more patients who required mechanical ventilation.²⁹ Another study from Spain found that the second wave had younger patients, a shorter duration of stay in the hospital, fewer invasive mechanical ventilation and decreased mortality.²²

The first wave's experience and lessons acquired by healthcare professionals, as well as a collaborative team effort involving numerous government agencies and community awareness and engagement, have helped us to manage the second wave more effectively.

Limitations

There were certain limitations to our research. To begin with, some data on comorbidity and symptoms may have been overlooked due to the retrospective nature of the study. Second, there might have been selection bias because our research population was mostly male patients as most female patients with COVID-19 were admitted to other COVID-19 designated hospitals. Third, because our research sample included only mild to moderate COVID-19 infections, the findings may not be generalised to severe COVID-19 infections. Finally, the relationship between risk variables and outcomes was not examined as it was not the primary goal of our study.

Recommendation for future research

Future study should compare the relationship between various risk variables and outcomes over serial COVID-19 waves. Long-term consequences of COVID-19 infection in the first and second waves can also be studied and compared.

CONCLUSIONS

Patients in the second wave were more symptomatic and unwell than those in the first wave, but they stayed in the hospital for a shorter time and were more likely to be discharged home, according to our data. The most prevalent symptoms in both waves were cough and shortness of breath, although they were much greater in the second wave. Diabetes mellitus and raised C reactive protein levels were more common in the first wave, but hypoalbuminaemia was more prevalent in the second wave. In the first wave, antibiotics and hydroxychloroquine were more commonly used, but in the second wave, steroids, antivirals and interleukin-1 antagonists were more commonly employed. There was no significant difference in the need for mechanical ventilation or mortality rate between the two waves.

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