Case Characteristics, Clinical Data, And Outcomes of Hospitalized COVID-19 Patients In Qom Province, Iran: A Prospective Cohort Study

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Abstract

The outbreak of severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) dates back to December 2019 in China. Iran has been one of the most virus inflicted countries. The aim of this study was to report demographics, signs and symptoms, laboratory findings, therapeutic approaches, and outcomes. This observational cohort study was performed from 20th February 2020 to 20th July 2020. Patients' information was recorded in their medical files. Multivariable analysis was performed to assess demographics, signs and symptoms, paraclinical data, treatments, outcomes of disease, and finding the risk factors of death subject to COVID-19. Of all 2468 participants, the mean age was 57.9±17.6 years and 56.8% of patients were male. The most significant comorbidities were seen among those who have Hypertension and Diabetes Mellitus. 14.42% were admitted to ICU, and 17.2% died in hospital. The significant risk factors of death were ageing, male gender, HTN, CHF, CVA, CKD, increasing ESR, PT, WBC, liver function tests, and decreasing Oxygen saturation. Incontinent results in the case of COVID-19 outcomes and death-related risk factors attribute to marked differences in demographics and health care systems. The patients with hazardous risk factors must be detected urgently and monitored closely to save more lives.

Introduction

Severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) was discovered as an infectious pathologic agent following a widespread outbreak in Wuhan city, the capital of Hubei province of China, in December 2019. [1].

At the outset, fever and respiratory were deemed the major symptoms of this storage virus (2). As time went by, the virus caused other serious clinical manifestations ranging from asymptomatic or mild constitutional symptoms to life-threatening complications leading to hospitalization and even death (3).

The rapid spread of SARS-CoV-2 to other countries including Japan, USA, Italy, Russia, Iran, South Korea revealed that COVID-19 is a highly contagious disease in that it caused a pandemic (4).

Iran has been one of the most prone countries to the virus of all [2]. It is approximately 1459370 identified COVID-19 patients by nasopharyngeal and oropharyngeal swabs polymerase chain reaction (PCR) test alongside with 58412 deaths (mortality rate: 4.00%) have been recorded in Iran until February 06, 2021[3]. The first confirmed case of SARS-CoV-2 in Iran that was officially reported belonged to Qom, a holy city in the north-central Iran, on 19th February, 2020. At the onset of coronavirus disease-2019 (COVID-19) outburst, Qom proved to be not only the foremost city with regard to increasing number of patients and deaths among all cities in Middle East but also the source of sufficient and proper virus- related awareness and studies[4].

In an observational study from China, men figured the most hospitalized cases, ,with a median age of 56 years, a 26% intensive care unit (ICU) admission and 28% mortality rate [5]. Whereas, an Iranian article reported different figures in that the mean age of 50.75 ± 19.33 years, ICU admission and mortality rate of 8% and 10.8%, respectively were recorded [6]. Definitely, various information attributes to the differences between countries in population demographic data, genetic, prevalence of comorbidities, and health care systems[7]. Reporting the clinical manifestations, risk factors, and outcomes of COVID-19 is essential to improve our knowledge and managerial skills related to the patients.

There was limited information to describe the characteristics and outcomes of Iranian hospitalized patients in relation to COVID-19-. This study aims to describe detailed demographics, comorbidities, signs and symptoms, para clinical tests, therapeutic protocols, severity of disease, death risk factors, outcomes of the hospitalized patients,

and the follow up of post-discharge COVID-19 cases .The data gathered from academic health care centers in Qom, Iran, at the outset of COVID-19 pandemic crisis.

Methods

This prospective cohort study was conducted at four hospitals (Kamkar, Forghani, Beheshti, and Imam Reza) affiliated with the Qom University of Medical Sciences. Kamkar hospital was the first center in the Qom to admit the first case of COVID-19 in Iran.

We prospectively traced patients who admitted to all four hospitals from February 20 to July 20, 2020 the infectious cases diagnosed by nasopharyngeal or oropharyngeal swab PCR tests and spiral chest CT scan. All patients admitted according to world health organization (WHO), Centers for Disease Control and Prevention (CDC) and Iran's national guidelines. Furthermore, hypoxemic patients received different types of therapeutic agents and respiratory facilities included nasal cannula, simple facemask, facemask with reserve bag, noninvasive ventilation (NIV) and invasive ventilation based on the severity of hypoxemia during hospitalization. Serious patients admitted to ICUs while those who are required non-invasive oxygen therapy admitted to general wards.

The Qom University of medical sciences ethics committee (IR.MUQ.REC.1399.013) approved this cohort study. The procedures were in accordance with the ethical standards of the Qom University of medical sciences ethics committee and with the Helsinki Declaration of the World Medical Association. Informed consent was taken from all participants.

Patients were confirmed based on their PCR test, spiral chest CT scan findings, and clinical presentations. Second confirming PCR tests were performed on either highly suspicious clinical presentations patients or those with false-negative PCR tests coming from insufficient sample collection. There were no cases transfer among hospitals. For readmission cases, the first admission data were recorded. The data were collected only from COVID-19 cases whose full-length hospital stay (died or discharged) was available during the study.

Two criteria including 1.O2sat ≥ 93percentage without Oxygen support, and 2. Normal body temperature for 2–3 days without any anti-pyretic drugs were considered for discharging patients.

Patients' demographics, comorbidities, exposure history, signs and symptoms, vital signs, laboratory data, CT scan findings, therapeutic approaches, duration of hospitalization, and outcomes were documented in their paper medical records. Afterwards, these data were collected as the standard data collection form and then rechecked by both a physician and a statistician. In case of any disagreements, they were reassessed by a third physician. A 30-day telephone investigation of post-discharged patients was taken into account after patients' discharge. Patients were asked about the existence of symptoms, relapse of symptoms, and the requirement of readmission and the occurrence of death by the telephone investigation.

Symptoms, vital signs, radiological findings, laboratory data and type of respiratory facilities were defined within the first day of admission.

All data regarding demographics, exposure history, co-morbidities, signs and symptoms, Chest CT scan and laboratory findings were collected within 24 hours of admission. Additionally, the data with respect to therapeutic interventions including supplemental oxygen (facemask with or without reserve bag, noninvasive or invasive

ventilation), administration of anti-viral agents, anti-bacterial agents, immunomodulatory agents, hemodialysis and therapeutic plasma exchange were recorded. Finally, data collected from post-discharge follow up.

All diagnostic real-time reverse-transcriptase-polymerase chain-reaction (RT-PCR) tests of nasopharyngeal and oropharyngeal specimens were performed in all of these four hospitals.

The main outcome of this study was to define the rate of death and survive in hospitalized patients. The secondary outcomes were frequency of demographics, comorbidities, signs and symptoms, respiratory facilities (invasive or non-invasive), drugs, laboratory data, and their association with the severity of disease and mortality.

Descriptive statistics were regarded as mean ± SD or median (interquartile range) for continuous data and frequency (percentage) for categorical data. The chi-square independent was used to determine whether there is a significant relationship between categorical variables. The independent t-test and Mann-Whitney U test were applied to compare differences of continuous variables between groups. Graphs including Euler diagram and Heat map were utilized to represent the relationship between groups and the different frequencies respectively.

The death outcome as the event of interest for survival analysis was considered the time interval between hospitalization and event (death or discharged) was deemed as the survival time. Discharged Patients were regarded as the censored cases. The single and multiple Cox regression were used to evaluate the single and adjusted effect of risk factors on the survival time. Adjusted model was chosen with the help of stepwise selection method with forward approach. Kaplan-Meier survival curve was applied to illustrate cumulative probability of occurring event of interest. All analyzes were performed by R 3.6.2. P-values less than 0.05 were considered as the statistically significant.

Results

2468 patients with clinical presentations, chest CT scan findings that were confirmed by positive RT-PCR tests, based on Iran's national guidelines, were admitted to the hospitals between February 20 and July 20, 2020.

Table 1 summarized the baseline characteristics and their association with disease outcome (death or survive) and severity. The mean age of patients was 57.9 ± 17.6 years while the mean age of the dead was significantly higher than survivors (66.8 ± 15.0 vs 56.0 ± 17.6, p-value < 0.001). Although all age groups probable infected with SARS-CoV-2, the highest rate of infection belonged to 60–69 years age group. The mean BMI of patients was 25.4 ± 3.2 kg/m^2 of which 55.2% were overweight and obese, 1402 (56.8%) were men, 2291(92.9%) were Iranian and 2354 (95.4%) were non-smokers while 2167(87.8%) of cases were reported none or unknown history of exposure. 5.4% of cases had misused Antibiotics before admission.

Table 1.Baseline characteristics of patients with COVID-19

Variables	Total (n=2468)	Disease Outcome		*P*-value	Ward		*P*-value
		Deceased (n=424)	Survivor (n=2044)		General (n=2112)	ICU (n=356)	
Age							
Mean ± SD	57.9 (17.6)	66.8 (15.0)	56.0 (17.6)	<0.001[a]	56.8 (19.6)	63.9 (16.5)	<0.001[a]
Median (Q1 - Q3)	59.0 (45.0 – 71.0)	68.0 (58.0 – 78.0)	57.0 (42.0-69.0)	<0.001[b]	58.0 (44.0 – 70.0)	65.0 (53.0 – 77.0)	<0.001[b]
0-9	0 (0)	0 (0)	0 (0)	<0.001[c]	0 (0)	0 (0)	<0.001[c]
10-19	34 (1.4)	0 (0)	34 (1.7)		33 (1.6)	1 (0.3)	
20-29	123 (5)	7 (1.7)	116 (5.7)		112 (5.3)	11 (3.1)	
30-39	271 (11)	10 (2.4)	261 (12.8)		251 (11.9)	20 (5.6)	
40-49	365 (14.8)	47 (11.1)	318 (15.6)		327 (15.5)	38 (10.7)	
50-59	483 (19.6)	60 (14.2)	423 (20.7)		422 (20)	61 (17.1)	
60-69	513 (20.8)	101 (23.8)	412 (20.2)		433 (20.5)	80 (22.5)	
70-79	386 (15.6)	111 (26.2)	275 (13.5)		307 (14.5)	79 (22.2)	
80-89	246 (10)	69 (16.3)	177 (8.7)		193 (9.1)	53 (14.9)	
90-99	47 (1.9)	19 (4.5)	28 (1.4)		34 (1.6)	13 (3.7)	
Gender No (%)				0.039 [c]			0.929 [c]
Female	1066 (43.2)	164 (38.7)	902 (44.1)		913 (43.2)	153 (43.0)	
Male	1402 (56.8)	260 (61.3)	1142 (55.9)		11199 (56.8)	203 (57.0)	
Pregnancy, N (%)*				0.211 [c]			0.760 [c]
Yes	32 (3.0)	2/164 (1.2)	30/902 (3.3)		28/913 (3.1)	6/153 (3.9%)	
BMI							
Mean ± SD	25.4 (3.2)	25.6 (3.1)	25.3 (3.2)	0.055 [a]	25.3 (3.2)	25.5 (3.1)	0.421 [c]
Underweight (= <18.5)	10 (0.4)	2 (0.5)	8 (0.4)	0.043 [c]	9 (0.4)	1 (0.3)	0.496 [c]
Normal weight (= 18.5–24.9)	1097 (44.4)	163 (38.4)	934 (45.7)		947 (44.8)	150 (42.1)	
Overweight (= 25–29.9)	1211 (49.1)	234 (55.2)	977 (47.8)		1024 (48.5)	187 (52.5)	

Obesity (30 or greater)	150 (6.1)	25 (5.9)	125 (6.1)		132 (6.3)	18 (5.1)	
Location, No (%)				0.051 [c]			0.078 [c]
Village	103 (4.2)	25 (5.9)	78 (3.8)		82 (3.9)	21 (5.9)	
City	2365 (95.8)	399 (94.1)	1966 (96.2)		2030 (96.1)	335 (94.1)	
Nation, N0 (%)				0.545 [c]			0.291 [c]
Other	175 (7.1)	33 (7.8)	142 (7.0)		145 (6.9)	30 (8.4)	
Iran	2291 (92.9)	391 (92.2)	1900 (93.0)		1965 (93.1)	326 (91.6)	
Exposure History, No (%)				0.936 [c]			0.800 [c]
No or Unknown	2167 (87.8)	368 (86.8)	1799 (88)		1860 (88.1)	307 (86.2)	
Household contact	170 (6.9)	36 (8.5)	134 (6.6)		143 (6.8)	27 (7.6)	
Transmission out of Home	125 (5.1)	20 (4.7)	105 (5.1)		104 (4.9)	21 (5.9)	
Travelling to China	6 (0.2)	0 (0)	6 (0.3)		5 (0.2)	1 (0.3)	
Comorbidity, No of yes (%)							
Hypertension (HTN)	773 (31.3)	167 (39.4)	606 (29.6)	<0.001[c]	633 (30)	140 (39.3)	<0.001[c]
Ischemic heart disease (IHD)	259 (10.5)	49 (11.6)	210 (10.3)	0.443[c]	218 (10.3)	41 (11.5)	0.496 [c]
Coronary artery bypass grafting (CABG)	71 (2.9)	18 (4.2)	53 (2.6)	0.064[c]	59 (2.8)	12 (3.4)	0.547 [c]
Cognitive hear failure (CHF)	37 (1.5)	18 (4.2)	19 (0.09)	<0.001[c]	25 (1.2)	12 (3.4)	0.002 [c]
Asthma	100 (4.1)	13 (3.1)	87 (4.3)	0.258[c]	84 (4)	16 (4.5)	0.647 [c]
Chronic obstructive pulmonary disease (COPD)	100 (4.1)	30 (7.1)	70 (3.4)	0.001[c]	83 (3.9)	17 (4.8)	0.454 [c]
Diabetes mellitus (DM)	679 (27.5)	145 (34.2)	534 (26.1)	0.001[c]	552 (26.1)	127 (35.7)	<0.001[c]
Pneumonia	62 (2.5)	17 (4.0)	45 (2.2)	0.030[c]	49 (2.3)	13 (3.7)	0.137 [c]
Cerebrovascular accident (CVA)	61 (2.5)	19 (4.5)	42 (2.1)	0.003[c]	47 (2.2)	14 (3.9)	0.055 [c]
Gastrointestinal (GI)	68 (2.8)	13 (3.1)	55 (2.7)	0.668[c]	58 (2.7)	10 (2.8)	0.947 [c]

Chronic kidney disease (CKD)	89 (3.6)	31 (7.3)	58 (2.8)	<0.001[c]	70 (3.3)	19 (5.3)	0.058 [c]
Rheumatoid arthritis (RA)	76 (3.1)	16 (3.8)	60 (2.9)	0.363[c]	66 (3.1)	10 (2.8)	0.750 [c]
Cancer	37 (1.5)	14 (3.3)	23 (1.1)	0.001[c]	28 (1.3)	9 (2.5)	0.084 [c]
Hyperlipidemia (HLP)	322 (13.0)	65 (15.3)	257 (12.6)	0.125 [c]	280 (13.3)	42 (11.8)	0.449 [c]
Hepatitis C virus (HCV)	17 (0.7)	4 (0.9)	13 (0.6)	0.515 [c]	15 (0.7)	2 (0.6)	0.754 [c]
Thyroid disease	60 (2.4%)	9 (2.1)	51 (2.5)	0.650[c]	53 (2.5)	7 (2)	0.538 [c]
Other Immune deficiencies	38 (1.5)	5 (1.2)	33 (1.6)	0.508 [c]	33 (1.6)	5 (1.4)	0.823 [c]
Hysteria	32 (1.3)	8 (1.9)	24 (1.2)	0.328 [c]	24 (1.1)	8 (2.2)	0.087 [c]
Tuberculosis	31(1.3)	7 (1.7)	24 (1.2)	0.422 [c]	26 (1.2)	5 (1.4)	0.786 [c]
Anemia	29 (1.2)	5 (1.2)	24 (1.2)	0.993 [c]	24 (1.1)	5 (1.4)	0.664 [c]
Fatty liver	105 (4.3)	78 (4.2)	87 (4.3)	0.992 [c]	86 (4.1)	19 (5.3)	0.274 [c]
Other Neurological disorders	34 (1.4)	6 (1.4)	28 (1.4)	0.942 [c]	30 (1.4)	4 (1.1)	0.657 [c]
Parkinson	11 (0.4)	2 (0.5)	9 (0.4)	0.930 [c]	9 (0.4)	2 (0.6)	0.722 [c]
Alzheimer	23 (0.9)	6 (1.4)	17 (0.8)	0.255 [c]	19 (0.9)	4 (1.1)	0.684 [c]
Smoke, N (%)				0.719 [c]			0.347 [c]
Yes	114 (4.6)	21 (5.0)	93 (4.5)		101 (4.8)	13 (3.7)	
Opium addiction, N (%)				0.309 [c]			0.051 [c]
Yes	28 (1.1)	7 (1.7)	21 (1.0)		20 (0.9)	8 (2.2)	
Improper use of drugs, N (%)							
Proton-pump inhibitors (PPIs)	323 (13.1)	60 (14.2)	263 (12.9)	0.476 [c]	271 (12.8)	52 (14.6)	0.354 [c]
Nonsteroidal anti-inflammatory drug (NSAID)	147 (6.0)	20 (4.7)	127 (6.2)	0.236 [c]	133 (6.3)	14 (3.9)	0.081 [c]
Antibiotics (oral agents)	133 (5.4)	34 (8.0)	99 (4.8)	0.008 [c]	79 (3.7)	54 (15.2)	<0.001[c]
Onset of symptom to hospital admission							

Mean (SD)	7.4 (3.7)	7.4 (3.7)	7.4 (3.7)	0.986[a]	7.4 (3.7)	7.2 (3.6)	0.247[a]
Median (IQR)	7.0 (5.0 – 10.0)	7.0 (5.0 – 10.0)	7.0 (5.0 – 10.0)	0.930[b]	7.0 (5.0 – 10.0)	7.0 (5.0 – 9.0)	0.263[b]
Sign and symptoms, No. of Yes (%)							
Fever (temperature≥ 37.8°C(	1439 (58.3)	253 (59.7)	1186 (58)	0.532 [c]	1244 (58.9)	195 (54.8)	0.144 [c]
Cough	1868 (75.7)	305 (71.9)	1563 (76.5)	0.048 [c]	1627 (77)	241 (67.7)	<0.001[c]
Throat clearing	283 (11.5)	45 (10.6)	238 (11.6)	0.544 [c]	250 (11.8)	33 (9.3)	0.160 [c]
Dyspnea	1944 (78.8)	331 (78.1)	1613 (78.9)	0.698 [c]	1646 (77.9)	298 (83.7)	0.014 [c]
Myalgia or arthralgia	580 (23.5)	58 (13.7)	522 (25.5)	<0.001 [c]	517 (24.5)	63 (17.7)	0.005 [c]
Fatigue	584 (23.7)	106 (25.0)	478 (23.4)	0.477 [c]	496 (23.5)	88 (24.7)	0.612 [c]
Headache	172 (7.0)	17 (4.0)	155 (7.6)	0.009 [c]	155 (7.3)	17 (4.8)	0.079 [c]
Nausea	505 (20.5)	79 (18.6)	426 (20.8)	0.305 [c]	441 (20.9)	64 (18)	0.209 [c]
Diarrhea	182 (7.4)	21 (5.0)	161 (7.9)	0.036 [c]	165 (7.8)	17 (4.8)	0.043 [c]
Abdominal pain	133 (5.4)	23 (5.4)	110 (5.4)	0.972 [c]	115 (5.4)	18 (5.1)	0.764 [c]
Dizziness	79 (3.2)	9 (2.1)	70 (3.4)	0.166 [c]	72 (3.4)	7 (2)	0.153 [c]
Parosmia	246 (10)	44 (10.4)	202 (9.9)	0.757 [c]	204 (9.7)	42 (11.8)	0.213 [c]
Anorexia	416 (16.9)	61 (14.4)	355 (17.4)	0.136 [c]	362 (17.1)	54 (15.2)	0.358 [c]
loss of consciousness	61 (2.5)	23 (5.4)	38 (1.9)	<0.001[c]	41 (1.9)	20 (5.6)	<0.001[c]
Sweating	33 (1.3)	2 (0.5)	31 (1.5)	0.088 [c]	29 (1.4)	4 (1.1)	0.705 [c]
Hemoptysis	45 (1.8)	10 (2.4)	35 (1.7)	0.365 [c]	39 (1.8)	6 (1.7)	0.833 [c]
Hallucination	51 (2.1)	7 (1.7)	44 (2.2)	0.509 [c]	42 (2)	9 (2.5)	0.508 [c]
Chest CT images, No./total No. (%)							
Normal	144/2468 (5.8)	23/424 (5.4)	121/2044 (5.9)	0.692 [c]	123/2112 (5.8)	21/356 (5.9)	0 955 [c]
Abnormal	2324/2468 (94.2)	401/424 (94.6)	1923/2044 (94.12)		1989/2112 (94.2)	335/356 (94.1)	
Bilateral	1453/2324	256/401	1194/1923		1238/1989	215/335	

lung	(94.2)	(64.6)	(62.1)	0.347 [c]	(62.2)	(64.2)	0.498 [c]
Unilateral lung	871/2324 (35.3)	142/401 (35.4)	729/1923 (37.9)	0.347 [c]	751/1989 (37.8)	120/335 (35.8)	0.498 [c]
Ground lass opacity (GGO)	2028/2324 (94.2)	365/401 (91.0)	1663/1923 (86.5)	0.013 [c]	1725/1989 (86.7)	303/335 (90.4)	0.059 [c]
Pleural effusion	375/2324 (15.2)	137/401 (34.2)	238/1923 (12.4)	<0.001 [c]	264/1989 (13.3)	111/335 (33.1)	<0.001 [c]
Nodules	315/2324 (12.8)	129/401 (32.2)	186/1923 (9.7)	<0.001 [c]	209/1989 (10.5)	106/335 (31.6)	<0.001 [c]
Consolidation	729/2324 (29.5)	210/401 (54.2)	519/1923 (27.0)	<0.001 [c]	506/1989 (25.4)	223/335 (66.6)	<0.001 [c]
Crazy paving	604/2324 (26.0)	158/401 (39.4)	446/1923 (23.2)	<0.001 [c]	456/1989 (22.9)	148/335 (44.2)	<0.001 [c]
Pericardial effusion	112/2324 (4.8)	32/401 (8.0)	80/1923 (4.2)	0.001 [c]	56/1989 (2.8)	56/335 (16.7)	<0.001 [c]
Vital sign							
Oxygen saturation (SpO2) (normal range 90-92%)	92 (88 - 95)	88 (80 - 93)	92 (90 - 95)	<0.001 [b]	92.0 (89.3 – 95.0)	88 (80 - 93)	<0.001 [b]
Systolic pressure(normal range≤120mmHg)	130 (110 - 146)	135 (120 - 150)	125 (110 - 145)	<0.001 [b]	126 (110 - 145)	130 (112 - 150)	0.010 [b]
Diastolic pressure(normal range≤80mmHg)	80 (70 - 90)	80 (73 - 90)	80 (70 - 90)	<0.001 [b]	80 (70 - 90)	80 (70 - 90)	0.006 [b]
Pulse rate (PR) (normal range 60-100 BPM)	87 (80 - 98)	88 (80 - 100)	86 (80 - 98)	0.043 [b]	86 (80 - 98)	88 (80 - 100)	0.010 [b]
Respiratory rate (RR) (normal range 12-20 min)	19 (18 - 20)	19 (18 - 21)	19 (18 - 20)	0.002 [b]	19 (18 - 20)	19 (18 - 21)	<0.001 [b]
Temperature (normal range 36.1-37.2 C)	38.0 (37.1 - 38.2)	38.0 (37.5 - 38.3)	37.9 (37.0 - 38.2)	<0.001 [b]	37.9 (37.0 - 38.2)	38.1 (37.9 - 38.3)	<0.001 [b]
Blood counts parameters							
White blood count (WBC) ($\times 10^3/mm^3$) (normal range:4.0-11.0)	6.6 (5.5 - 7.7)	7.3 (6.2 - 8.4)	6.4 (5.4 - 7.5)	<0.001 [b]	6.4 (5.4 - 7.5)	7.6 (6.5 - 8.7)	<0.001 [b]
Neutrophils (NEUT) ($\times 10^3/mm^3$) (normal range:2.0-7.0)	4.3 (3.6 - 5.2)	4.9 (4.1 - 5.9)	4.1 (3.5 - 5.0)	<0.001 [b]	4.1 (3.5 - 4.9)	5.4 (4.5 - 6.2)	<0.001 [b]

Lymphocytes (LYM) (×10^3/ mm^3) (normal range:1.0-3.0)	1.5 (1.2 – 1.8)	1.4 (1.2 - 1.6)	1.5 (1.2 - 1.8)	0.001 [b]	1.5 (1.2 - 1.8)	1.3 (1.1 - 1.5)	0.001 [b]
Neutrophil-to-lymphocyte ratio (NLR)(normal range: 0.78 - 3.53)	2.7 (2.5 – 3.5)	3.4 (2.7 - 4.6)	2.6 (2.5 - 3.2)	<0.001 [b]	2.6 (2.5 – 3.1)	4.6 (3.5 – 4.8)	<0.001 [b]
Platelets (PLT) (×10^3/ mm^3) (normal range:150-450)	184 (141 – 244)	176.0 (136 - 225)	185.0 (142 - 247)	0.024 [b]	185.0 (142 - 246)	175.5 (140 - 226)	0.209 [b]
Hemoglobin (Hb) (×gr/dL) (normal range:[Males:13.5-17.5], [Females:12.0-15.5])	13.3 (11.9 – 14.6)	13.0 (11.7 - 14.4)	13.3 (11.9 - 14.6)	0.011 [b]	13.3 (11.9 - 14.6)	13.2 (11.9 - 14.5)	0.598 [b]
Inflammatory markers							
C-reactive protein (CRP)(× mg/L) (normal range≤10)	51.0 (26.0 – 73.8)	56.0 (29.0 - 85.8)	50.0 (25.0 - 72.0)	<0.001 [b]	50.7 (26.0 - 72.0)	55.5 (26.3 - 86.0)	0.006 [b]
Erythrocyte Sedimentation Rate (ESR) (×mm/hr)(normal range:[Males≤20], [Females:≤30]) *Erythrocyte Sedimentation Rate (ESR)*	39.0 (25.0 – 63.8)	73.0 (37.3 – 84.0)	35.5 (25.0 – 52.0)	<0.001 [b]	37.0 (25.0 - 56.0)	68.0 (34.0 - 84.0)	<0.001 [b]
Biochemical Parameters							
Serum creatinine (CR)(mg/dL) (normal range: 0.84 to 1.21)	1.1 (1.0 – 1.4)	1.2 (1.0 - 1.5)	1.1 (1.0 - 1.4)	0.192 [b]	1.1 (1.0 - 1.4)	1.2 (1.0 - 1.4)	0.382 [b]
Creatine phosphokinase (CPK)(×U/L) (normal range: [Males:39-308], [Females:26-192])	218 (158 – 315)	264.0 (178.- 319)	215.0 (156- 315)	<0.001 [b]	215.0 (156 - 315)	274.0 (178 - 342)	<0.001 [b]
High-sensivity Troponin T(×ng/L) ([Males≤22], [Females≤14])	24.6 (16.2 – 34.6)	37.9 (27.3 - 49.2)	22.5 (16.2 - 31.2)	<0.001 [b]	23.1 (16.2 - 33.8)	37.4 (27.4 - 47.1)	<0.001 [b]

Coagulation profile							
prothrombin time (PT)(seconds) (normal range:11-13.5)	15.0 (14.0 – 16.2)	15.6 (14.4 - 17.0)	14.9 (13.9 - 16.0)	<0.001 [b]	14.9 (14.0 - 16.1)	15.3 (14.3 - 16.9)	<0.001 [b]
Partial Thromboplastin Time (PTT) (seconds)(normal range:25-35)	35.0 (30.0-39.4)	37.0 (30.6 - 40.2)	34.2 (30.0 - 39.1)	<0.001 [b]	34.6 (30.0 - 39.1)	37.0 (30.8 - 40.3)	<0.001 [b]
international normalized ratio (INR) (normal range:0.8-1.1)	1.3 (1.2-1.4)	1.3 (1.2 - 1.4)	1.3 (1.1 - 1.4)	0.021 [b]	1.3 (1.2 - 1.4)	1.3 (1.2 - 1.4)	0.859 [b]
Liver function test							
Alanine aminotransferase (ALT)(U/L) (normal range:10-45)	34.0 (25.0 – 49.0)	52.0 (34.0 - 62.8)	31.0 (25.0 - 42.0)	<0.001 [b]	31.0 (25.0 - 43.0)	51.0 (34.0 - 61.0)	<0.001 [b]
Aspartate aminotransferase (AST)(U/L) (normal range:10-40)	39.0 (30.0 – 52.0)	58.5 (37.0 - 75.0)	37.0 (29.0 - 49.0)	<0.001 [b]	37.0 (29.0 - 49.0)	59.0 (40.0 - 76.0)	<0.001 [b]

Note: Data were expressed as mean (standard deviation) and median (IQR) for symmetric and asymmetric numeric variables. Categorical variables were shown as No. (%). P-values denoted a) the comparison of mean variables between survivor and non-survivor cases using independent t-test, b) the mean rank difference of variables between survivor and non-survivor using Mann Whitney test, and c) the relation between baseline variables and survivor/non-survivor patients using Pearson chi-squared. * Pregnancy percentage was calculated among females.

The most prevalent comorbidity seen in Hypertension (HTN) (31.3%), Diabetes Mellitus (DM) (27.5%), Hyperlipidemia (HLP) (13.0%), and Ischemic heart disease (IHD) (10.5%). An overlap was seen in Fig. 1.B1 among patients where for example, 14 of them had Hypertension (HTN), Diabetes Mellitus (DM), and Chronic Obstructive Pulmonary Disease (COPD) in their past medical history. The most prevalent comorbidities was recorded among 51–80 years old patients, especially 61–70 years old ones (Fig. 1.B2).

Patients hospitalization was occurred a mean of 7.4 ± 3.7 days after the onset of symptoms. The most common symptoms of patients were dyspnea (78.8%), cough (75.7%), fever (58.3%), fatigue (23.7%), and myalgia or arthralgia (23.5%). 927(37.5%) concurrent fever, cough, and dyspnea, and also 13 (0.52%) presented all intestinal-related manifestation upon admission day (Fig. 1.A).

At triage, vital signs included oxygen saturation, respiratory rate, and temperature were reported as a median of 92 %(88–95), 19(18–20), and 38.0°C (37.1–38.2), respectively while 92.3% of them underwent oxygen therapy. Higher Blood pressure, Pulse Rate, Respiratory Rate, and Temperature and lower Oxygen Saturation were detected among death cases.

Median white blood cell was reported 6600 per micro liter (5500–7700) with the median of 1500 per micro liter (1200–1800) for lymphocytes. Concentrations of C-reactive protein (median: 51.0 (26.0–73.8)), Erythrocyte Sedimentation Rate (median: 39.0 (25.0–63.8)), high-sensitivity Troponin (median: 24.6 (16.2–34.6)) were elevated in most patients. Significantly Higher range of inflammatory markers, coagulation profile, and liver function tests were observed among serious patients.

Spiral chest CT-scan was taken from all participants that reported by the radiologist in which Just 144 (5.8%) of patients had normal radiological findings. Most of the patients (94.2%) presented radiological features bilaterally. The most frequent features reported by the radiologists were bi lateral peripheral patchy Ground Glass Opacities (GGO) (94.2%) and consolidations (29.5%).

Table 2 described treatment protocols and their association with survival and mortality. During hospitalization, patients were supported by respiratory facilities, 555(22.5%) of whom by means of nasal cannula, 287(11.6%) via simple facemask, 1437(58.2%) through face mask with reserve bag, and 210(8.5%) with the help of intubation.

Table 2. Intervention results of patients with COVID-19

Variables	Total (n=2468)	Disease Outcome		*P*-value
		Deceased (n=424)	Survivor (n=2044)	
Respiratory facilities, No (%)				<0.001 [c]
None or Unknown	189 (7.7)	51 (12)	138 (6.8)	
Nasal	555 (22.5)	52 (12.3)	503 (24.6)	
Simple face mask	287 (11.6)	44 (10.4)	243 (11.9)	
Reserve bag	1437 (58.2)	277 (65.3)	1160 (56.8)	
Intubation	210 (8.5)	136 (32.1)	74 (3.6)	
Drug, N (%)				
Hydroxychloroquine (PO)	2012 (81.5)	342 (80.7)	1670 (81.7)	0.615 [c]
Kaletra (Lopinavir/ritonavir) (PO)	1647 (66.7)	257 (60.6)	1390 (68)	0.003 [c]
Oseltamivir (PO)	1835 (74.4)	226 (53.3)	1609 (78.7)	<0.001 [c]
Paracetamol (Inj)	2015 (81.6)	337 (79.5)	1678 (82.1)	0.206
Naproxen (PO)	947 (38.4)	145 (34.2)	802 (39.2)	0.052 [c]
Ribavirin (PO)	381 (15.4)	128 (30.2)	253 (12.4)	<0.001 [c]
Pantoprazole (PO)	1211 (49.1)	215 (50.7)	996 (48.7)	0.458 [c]
Ceftriaxone (Inj)	1687 (68.4)	262 (61.8)	1425 (69.7)	0.001 [c]
Metoclopramide (Inj)	105 (4.3)	14 (3.3)	91 (4.5)	0.286 [c]
Ondansetron (Inj)	419 (17)	70 (16.5)	349 (17.1)	0.778 [c]
Diphenhydramine (PO)	651 (26.4)	98 (23.1)	553 (27.1)	0.094 [c]
Meropenem (Inj)	904 (36.6)	227 (53.5)	677 (33.1)	<0.001 [c]
Linezolid (PO)	230 (9.3)	69 (16.3)	161 (7.9)	<0.001 [c]
Atrovent (Ipratropium bromide) (Inh)	451 (18.3)	94 (22.2)	357 (17.5)	0.023 [c]
Atorvastatin (PO)	447 (18.1)	91 (21.5)	356 (17.4)	0.049 [c]

Vancomycin (Inj)	1151 (46.6)	247 (58.3)	904 (44.2)	<0.001 [c]
Dexamethasone (Inj)	337 (13.7)	88 (20.8)	249 (12.2)	<0.001 [c]
Salbutamol (Inh)	590 (23.9)	121 (28.5)	469 (22.9)	0.014 [c]
Combivent (Ipratropium bromide/salbutamol) (Inh)	296 (12)	77 (18.2)	219 (10.7)	<0.001 [c]
Pulmicort (Budesonide) (Inh)	316 (12.8)	63 (14.9)	253 (12.4)	0.164 [c]
Levofloxacin (PO)	297 (12)	47 (11.1)	250 (12.2)	0.509 [c]
Enoxaparin sodium (Inj)	963 (39)	141 (33.3)	822 (40.2)	0.007 [c]
Heparin (Inj)	373 (15.1)	114 (26.9)	259 (12.7)	<0.001 [c]
Aspirin (PO)	290 (11.8)	71 (16.7)	219 (10.7)	<0.001 [c]
N-acetyl cysteine (Inj)	309 (12.5)	65 (15.3)	244 (11.9)	0.055 [c]
Clindamycin (PO)	32 (1.3)	6 (1.4)	26 (1.3)	0.813 [c]
Azithromycin (PO)	1624 (65.8)	238 (56.1)	1386 (67.8)	<0.001 [c]
Dextromethorphan (PO)	114 (4.6)	22 (5.2)	92 (4.5)	0.539 [c]
Remdesivir (Inj)	123 (5)	42 (9.9)	81 (4)	<0.001 [c]
Clopidogrel (PO)	88 (3.6)	22 (5.2)	66 (3.2)	0.048 [c]
Interferon Beta-1A (Inj)	175 (7.1)	41 (9.7)	134 (6.6)	0.023 [c]
Fluconazole (PO)	70 (2.8)	14 (3.3)	56 (2.7)	0.526 [c]
Prednisolone (PO)	140 (5.7)	36 (8.5)	104 (5.1)	0.006 [c]
Promethazine (Inj)	82 (3.3)	12 (2.8)	70 (3.4)	0.534 [c]
Seroflo(Fluticasone/salmeterol) (Inh)	90 (3.6)	18 (4.2)	72 (3.5)	0.470 [c]
Ciprofloxacine (PO)	348 (14.1)	70 (16.5)	278 (13.6)	0.117 [c]
Vitamin B- Complex (Inj)	266 (10.8)	60 (14.2)	206 (10.1)	0.014 [c]
Vitamin C (Inj)	199 (8.1)	54 (12.7)	145 (7.1)	<0.001 [c]
Vitamin D (Inj)	139 (5.6)	35 (8.3)	104 (5.1)	0.010 [c]

MgSo4 (Inj)	237 (9.6)	41 (9.7)	196 (9.6)	0.959 [c]
Dimenhydrinate (PO)	260 (10.5)	37 (8.7)	223 (10.9)	0.183 [c]
Selenium (PO)	65 (2.6)	26 (6.1)	39 (1.9)	<0.001 [c]
Clidinium-C (PO)	55 (2.2)	4 (0.9)	51 (2.5)	0.049 [c]
Bromhexine (PO)	102 (4.1)	21 (5)	81 (4)	0.351 [c]
CaCo3 (PO)	82 (3.3)	23 (5.4)	59 (2.9)	0.008 [c]
Amantadin (PO)	129 (5.2)	26 (6.1)	103 (5)	0.357 [c]
Imipenem (Inj)	150 (6.1)	23 (5.4)	127 (6.2)	0.536 [c]
Piperacillin (Inj)	30 (1.2)	6 (1.4)	24 (1.2)	0.680 [c]
Atazonavir (PO)	78 (3.2)	20 (4.7)	58 (2.8)	0.044 [c]
Dialysis, No. of yes (%)	75 (3)	40 (9.4)	35 (1.7)	<0.001 [c]
Plasmapheresis, No. of yes (%)	28 (1.1)	17 (4)	11 (0.5)	<0.001 [c]
Plateletet transfusion, No. of yes (%)	8 (0.3)	1 (0.2)	7 (0.3)	0.725 c
Blood transfusion, No. of yes (%)	331 (13.4)	66 (15.6)	265 (13)	0.153 c

Note: Data were expressed as mean (standard deviation) and median (IQR) for symmetric and asymmetric numeric variables. Categorical variables were shown as No. (%). P-values denoted a) the comparison of mean variables between survivor and non-survivor cases using independent t-test, b) the mean rank difference of variables between survivor and non-survivor using Mann Whitney test ,and c) the relation between baseline variables and survivor/non-survivor patients using Pearson chi-squared. PO = per os (orally), Inj = injection, Inh = inhalation. Antibacterial agents were prescribed for most of patients, namely, Ceftriaxone for 1687(68.4%), Meropenem for 904(36.6%), and Vancomycin for 1151(46.6%) patients.

Besides, Antiviral agents also were advised for most patients, predominantly, 2012 (81.5%) received Hydroxychloroquine, 1835(74.4%) received Oseltamivir, 1647(66.7%) received Kaletra, 381(15.4%) received Ribavirin, and 123(5%) received Remdesivir. Glucocorticoids were applied to patients including Dexamethasone in 337 (13.7%) and Prednisolone in 140(5.7%). Furthermore, Immunomodulators such as Interferons were administered for 157(7.1%) of cases. Therapeutic procedures like kidney replacement therapy and Plasmapheresis were performed for 3% and 1.1% of critically ill patients, respectively.

The most remarkable adverse events and outcomes of COVID-19 is presented in Table 3. Weight loss (9.3%) defined as ≥ 5% in comparison to initial weight, myocardial injuries (6.6%) diagnosed by triple-elevation of Troponin level and electrocardiogram and echocardiogram findings, kidney injury (6%), and abnormal bleeding (5.1%) were reported as the most frequent adverse events resulted from COVID-19. During the study, 424 (17.2%) of patients

died in hospital following a median of 5 days (3–10) hospitalization. This range included 220 (61.8%) of 356 patients and 204 (9.7%) of 2112 patients who were admitted to Intensive Care Unit(ICU) and general ward, respectively. 2044(82.8%) of patients were discharged alive after a median of 5 days (3–10) of hospitalization. During the 30-day post-discharge follow-up, 148(6.0%) of 2468 patients readmitted and 25(1.2%) of 2034 discharged cases died. Full recovery from symptoms after discharge took a median of 14(10–18) days, although the manifestation remained in 5.3% of cases for more than 30 days. Our results revealed that just 26 (5.8%) of 450 Cardiopulmonary resuscitations (CPR) were successful.

Table 3
Event results of patients with COVID-19

Variables	Total (n = 2468)
Readmission (≤ 30 days post-discharge), No. of yes (%)	148 (6.0)
Death in hospital, No. of yes (%)	424 (17.2)
Death out of hospital (≤ 30 days post-discharge), No. of yes (%)	25/2034 (1.2)*
Death in general ward, No. of yes (%)	204/2112 (9.7)
Death in ICU, No. of yes (%)	220/356 (61.8)
CVA (ischemic type), No. of yes (%)	41 (1.7)
Myocardial infarction, No. of yes (%)	36 (1.5)
DVT, No. of yes (%)	69 (2.8)
Kidney injury, No. of yes (%)	148 (6)
Alopecia, No. of yes (%)	46 (1.9)
Myocardial injury, No. of yes (%)	164 (6.6)
Abnormal bleeding, No. of yes (%)	126 (5.1)
Weight loss, No. of yes (%)	187 (9.3)**
Skin problems (Acro-ischemic lesions), No. of yes (%)	44 (1.8)
Duration of hospitalization, median (IQR)	
Total with death	5.0 (3.0–10.0)
Total with discharge	5.0 (3.0–7.0)
General with death	4.0 (2.0–6.0)
General with discharge	5.0 (3.0–7.0)
ICU with death	5.0 (2.0–9.0)
ICU with discharge	5.0 (2.0–7.8)
Successful CPR in hospital, No. of yes (%)	26/450 (5.8)***
Full time recovery of symptoms after discharge	

Note: Data were expressed as mean (standard deviation) and median (IQR) for symmetric and asymmetric numeric variables. Categorical variables were shown as No. (%). P-values denoted a) the comparison of mean variables between survivor and non-survivor cases using independent t-test, b) the mean rank difference of variables between survivor and non-survivor using Mann Whitney test, and c) the relation between baseline variables and survivor/non-survivor patients using Pearson chi-squared. * All deaths out of hospital were occurred between discharge patients; ** all weight loss cases are related to patients who survived. *** The denominator is the summation of CPR cases and number of deaths; **** the denominator is those who were discharged from the hospital and did not die outside the hospital for a month. ICU = intensive care unit, CVA = cerebrovascular accident,

DVT = deep venous thrombosis, CPR = cardiopulmonary resuscitation

Variables	Total (n = 2468)
Median (Q1 – Q3)	14 (10–18)
Existence of symptoms after 30 days of discharge, No. of yes (%)	106/2009 (5.3)****
Note: Data were expressed as mean (standard deviation) and median (IQR) for symmetric and asymmetric numeric variables. Categorical variables were shown as No. (%). P-values denoted a) the comparison of mean variables between survivor and non-survivor cases using independent t-test, b) the mean rank difference of variables between survivor and non-survivor using Mann Whitney test, and c) the relation between baseline variables and survivor/non-survivor patients using Pearson chi-squared. * All deaths out of hospital were occurred between discharge patients; ** all weight loss cases are related to patients who survived. *** The denominator is the summation of CPR cases and number of deaths; **** the denominator is those who were discharged from the hospital and did not die outside the hospital for a month. ICU = intensive care unit, CVA = cerebrovascular accident,	
DVT = deep venous thrombosis, CPR = cardiopulmonary resuscitation	

On single and multiple Cox regression model, the significant risk factors of death due to COVID-19 like age, gender, a number of comorbidities, symptoms, Para clinical data and treatment protocols were found, presented in detail in Appendix 1.

The analysis of the final Cox regression model (Fig. 2) revealed that the hazard of death due to COVID-19 significantly increased by more than five-fold per each year of increase in 70–79 age group (HR = 5.25, 95%CI: 2.79, 9.87), by 74% in smokers (HR = 1.74, 95%CI: 1.06, 2.85), and by nearly three-fold in patients with congestive heart failure (HR = 2.92, 95%CI: 1.44, 5.95). The therapeutic agents significantly decreased risk of death, by 74% with Lopinavir/Ritonavir (HR = 0.74, 95%CI: 0.60, 0.92), 35% with Oseltamivir (HR = 0.35, 95%CI: 0.29, 0.43), 66% with Azithromycin (HR = 0.66, 95%CI: 0.53, 0.82), and more than half among patients who received Interferon (HR = 0.55, 95%CI: 0.39, 0.77). On the contrary, surprisingly, the hazard of death increased by more than two-fold when it comes to plasmapheresis (HR = 2.37, 95%CI: 1.39, 4.03), and by 32% and 34% in patients who received Aspirin (HR = 1.32, 95%CI: 1.02, 1.71) and Ribavirin (HR = 1.34, 95%CI: 1.05, 1.70), respectively. Notably, the hazard ratio of each factor was assessed considering the effect of all other variables.

Figure 3 showed the Kaplan-Meier survival curve with the 95% confidence interval and representation of the censoring time. Accordingly, the survival probability was 0.14 and 0.12 in the two groups of <59 and ≥59 years, respectively, after thirty days of hospitalization.

Discussion

To the extent of our knowledge, this is the first cohort study of COVID-19 in the case of gathered precise information from admitted patients in the first center of SARS-CoV-19 in Iran. 2468 COVID-19 patients were admitted to four hospitals of Qom during the first months of the Iran's COVID-19 outbreak. Our findings provided informative and stringent demographic data, Para clinical findings, therapeutic approaches, disease outcomes, and post-discharge follow-up in details. However, multivariable analysis were performed to define the risk factors of death subject to COVID-19.

The majority of patients were men having the mean age of 57.9 ± 17.6 years and hypertension and diabetes, nearly half of which had upper than normal weight, which was in line with China [8] and USA pattern [5]. The most prevalent symptoms were dyspnea (78.8%), cough (75.7%), and fever (58.3%), which are consistent with Ashraf et

al [2] and Guan et al[9]. These data may represent fever as a minor symptom of COVID-19, whilst cough and dyspnea are major ones. 92.3% of patients received respiratory facilities while 14.42% of whom were admitted to ICU. In the course of the study, 17.2% and 1.2% of patients died in hospital and out of hospital, respectively, which is similar to Germany and France[7], but lower than UK with 39% of mortality[10]. Surely, the inconsistency result ascribes insignificant differences between countries in population demographic data and health care systems. The mortality rate was reported 2.3% at the onset of COVID-19 epidemic [11]. This controversy may result from investigating the patients until 30-days after discharge, and just admitted patients were participated.

356 (14.42%) out of 2468 participants were critically ill and admitted to ICU, which is similar to reports from china [9, 12], Italy [13], and New York City [14]. 92.3% of patients required respiratory facilities which is consistent with Italy reports, but it is higher than China[8, 9, 12, 15], New York[14], and Washington state [16]. These high rates of critically ill patients requiring respiratory support and ICU admission, emphasizes the severity of the disease in Iran and urgent need for Iran's hospital conveniences. .

In this cohort study, 424(17.2%) patients died in hospital and 2044(82.8%) were discharged. The significant risk factors of death related to COVID-19 were ageing, male gender, HTN, CHF, CVA, CKD, increasing ESR, PT, WBC, liver function tests, and decreasing Oxygen saturation. Particularly, our data showed the higher survival rate for younger than 59 years, which is in line with Germany reports [7]. Similarly, Cummings et al reported that older age, underlying cardiopulmonary diseases, and higher ranges of D-dimer, ALT, CRP, and Troponin are regarded as risk factors of poor outcomes [14]. The abnormal level of Prothrombin might result from procoagulant state in COVID-19 [17]. Abnormal serum Creatinine levels might be secondary to direct kidney injury or fluid imbalance, and higher levels of WBC might be a clue of bacterial super-infection.

Similarly to data from China [12] and Italy [18], Hypertension was associated with poor in-hospital outcomes. In consistent with CVA as a risk factor of death in our study, an analysis of Aggawal G et al revealed a 2.5-fold increase in severity of COVID-19 illness among patients with underlying cerebrovascular disease [19].

55.2% of admitted patients were overweight while critically deceased cases had higher BMI mean in comparison with the survivors. These data are similar to UK[20] and USA[14], where obesity has been related with higher rates of ICU admission and mortality. Although obesity is an exacerbating factor for many diseases including HTN, DM, CVA, liver and renal dysfunctions, confirming studies needs to be performed to approve that association.

Non-survivors had higher range of Blood pressure, Temperature, Pulse rate, Respiratory rate, and lower Oxygen saturation compared to survivors. These findings illustrates that patients' abnormal vital signs might be prognostic factors of severity.

Anti-viral agents were administered to all patients. Lopinavir/Ritonavir and Remdesivir played a significant role in patients' survival. Ashraf et al reported the positive effect of Kaletra on patients' outcomes[2]. It should be noted that the US National Institute of Allergy and Infectious Diseases approved an emergency administration of Remdesivir for critical cases of COVID-19 inpatients. The efficacy of administrating Hydroxychloroquine with respect to COVID-19 patients remains to be understood. The revealed information from the USA have not disclosed the beneficial effect of Hydroxychloroquine for COVID-19 inpatients[21]. Interferon was one of the Immunomodulators with remarkable effects on COVID-19 patients' survival in our study. Interferons (IFN) strengthen the immune system by antiviral and immunomodulatory activities[22]. Nile et al reported the benefits of IFNs against SARS-CoV-2, alone or in combination with the other anti-viral agents[23].The most challenging therapeutic agent would be plasmapheresis, which increases the hazard of death on the contrary with other studies

in which it has reported the beneficial effect of a COVID-19 convalescent plasma transfusion on the treatment of critically ill COVID-19 cases through neutralization of SARS-CoV-2 and inhibition of cytokine storm[24–26]. However, we evaluated this effect beside other co-factors, and just 1.1% of the participants underwent plasmapheresis, therefore, it requires further studies with larger study population.

One of the most striking features of this study would be a 30-day post-discharge follow-up indicated 6.0% readmission, 1.2% post-discharge death, the median of 14 days of recovery of symptoms, and existence of symptoms in 5.3% of patients after 30 days of discharge. Similarly, Ashraf et al reported 8.6% of readmission and 4.3% of death after discharge[2]. These data emphasizes the symptoms relapse and the importance of close follow-up after discharge.

To our knowledge, this study is the first study of COVID-19 with detailed information of participants in Qom, The first city in Middle East in which COVID-19 was diagnosed.

To wrap up, various outcomes of COVID-19 among different countries attribute to different demographic data and health care systems. This disease has the potential to aggravate with regard to identified risk factors. As a result, at-risk patients need to be looked after specifically in favor of saving more lives.

Declarations

Data sharing statement

Data would be available upon reasonable request by contacting the corresponding author.

Authors' contributions

MAP, HY and SHA developed the original idea for the study. HY, HF, NN, ZH, MY, ZS, MA and EM contributed in data gathering, data extraction and checking the validity of laboratory results in documents. MAP and MAL conducted the analysis. NT, MAP HY wrote the first draft of the manuscript. MA and SHA revised manuscript. All authors reviewed and accepted the paper prior to submission.

Declaration of Competing Interest

None to declare.

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Conflict of Interest: No conflict of interest for all authors

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Figures

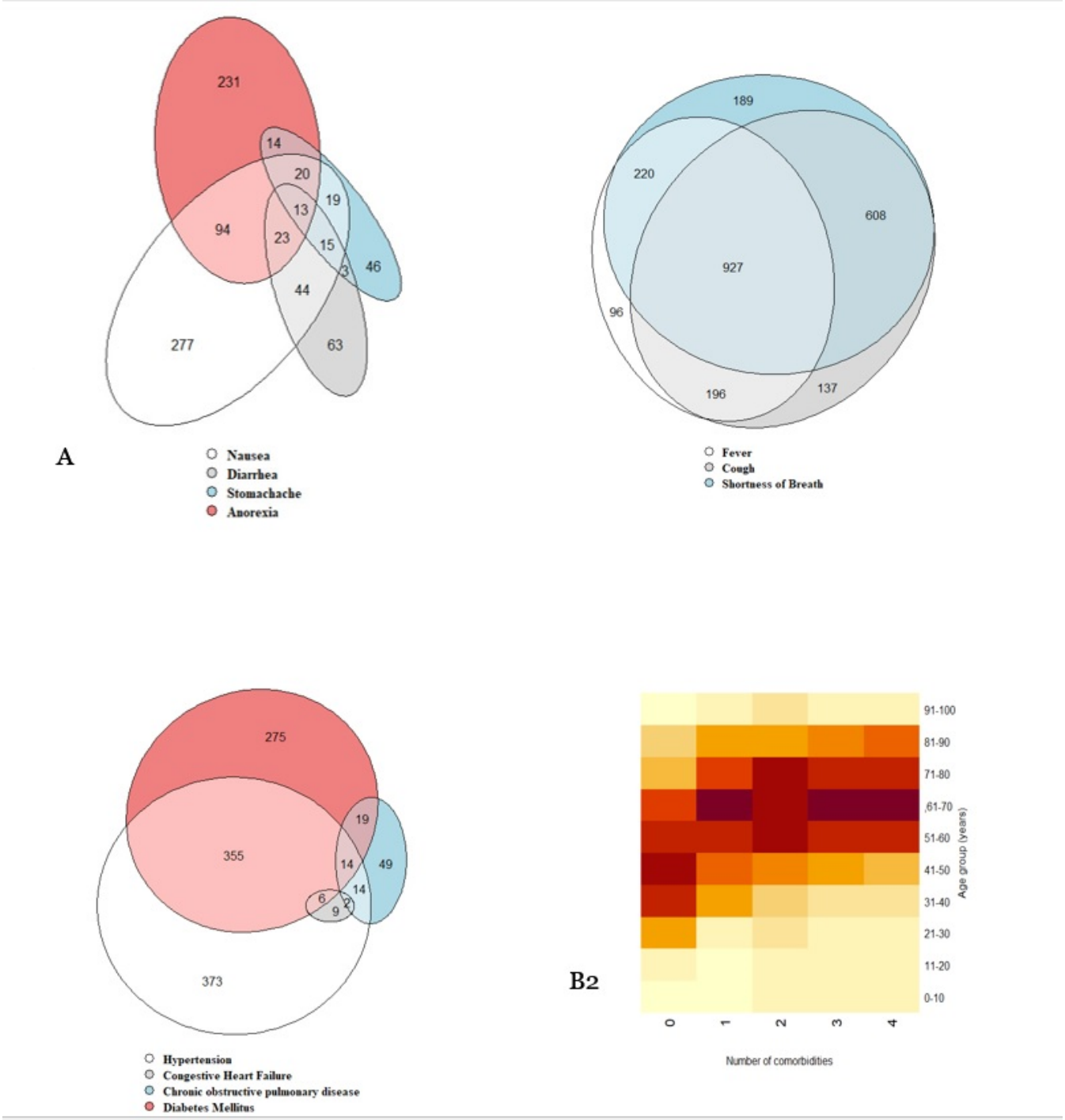

Figure 1

(A). Euler diagram of overlapped symptoms. (B):1. Euler diagram of overlapped comorbidities, 2. Heatmap of number of comorbidities among different age groups.

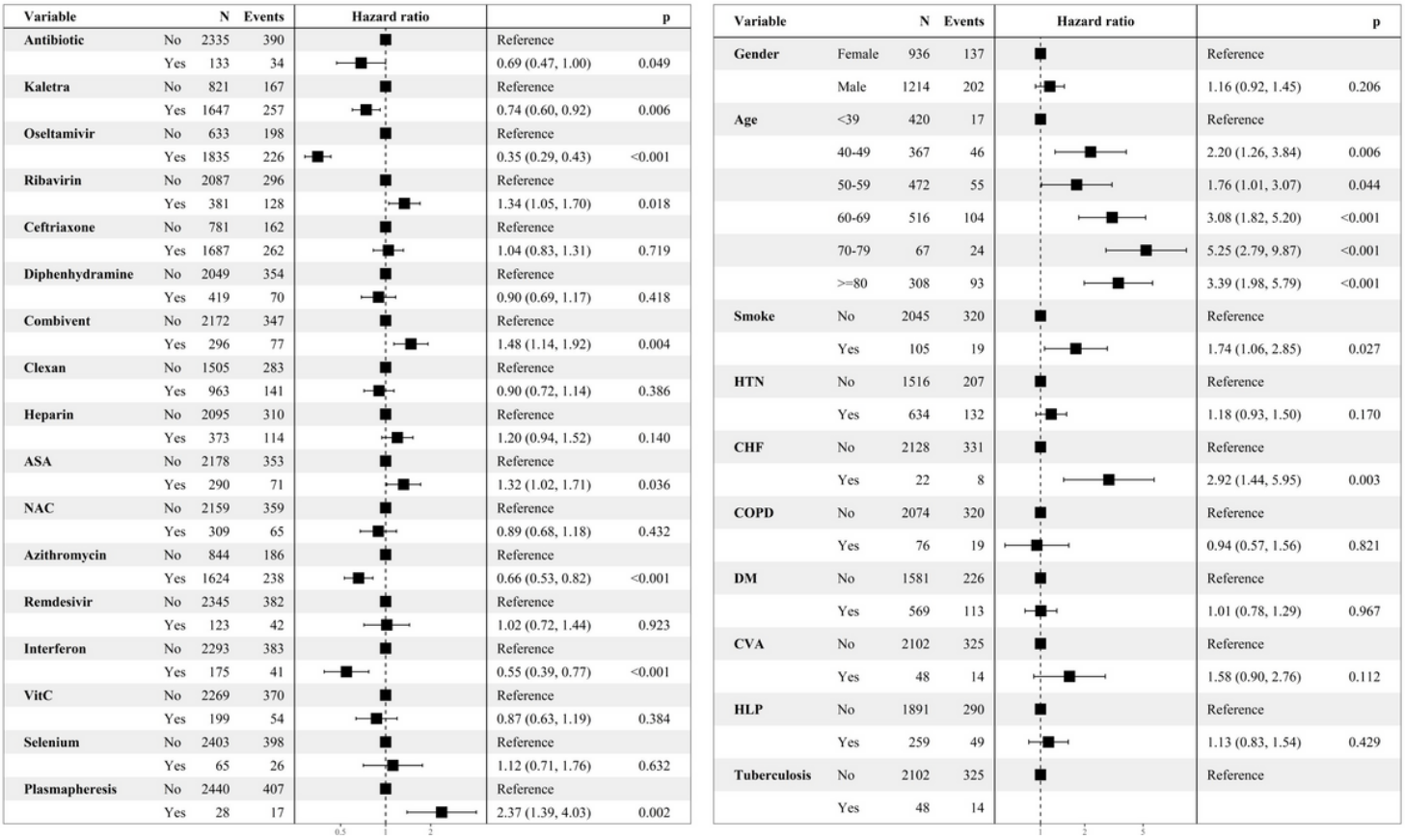

Figure 2

Hazard of death due to SARS-CoV-2

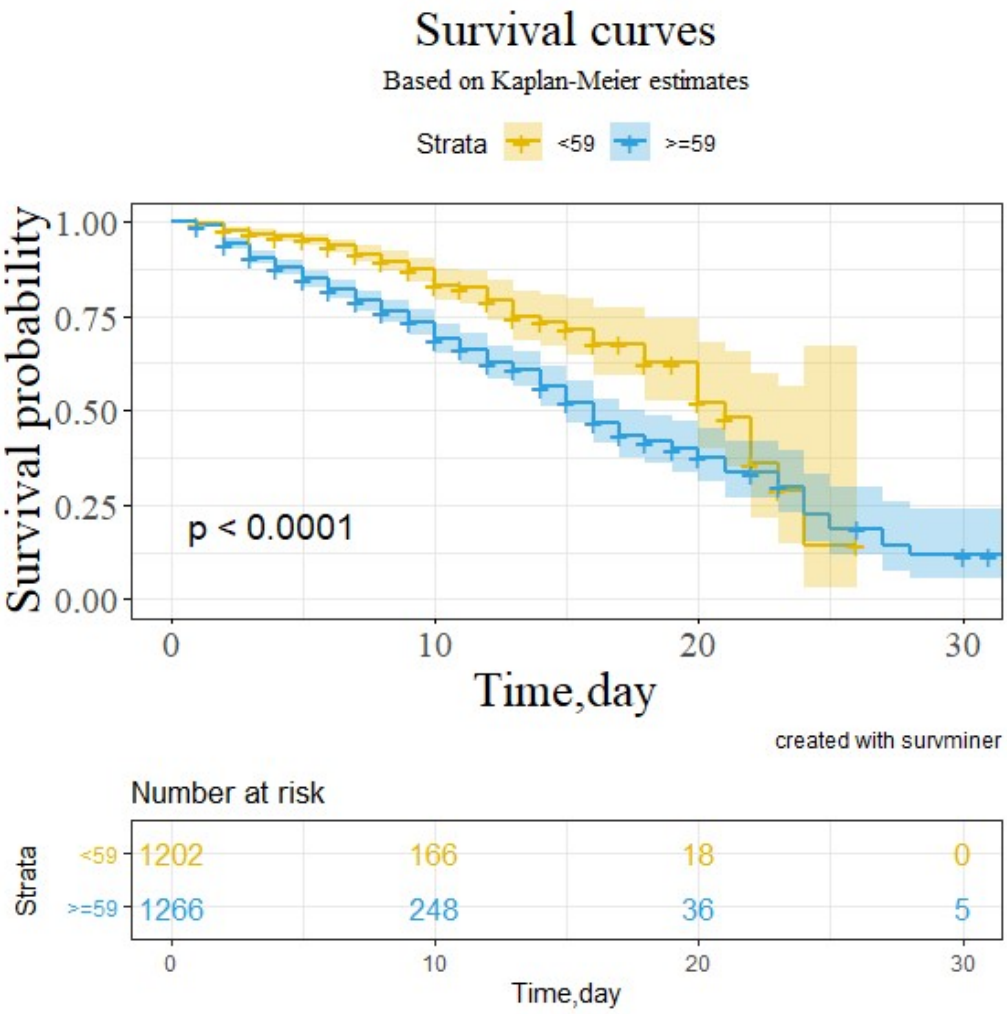

Figure 3

Kaplan-Meier based survival curve according to hospital admission due to COVID-19 among two age groups.

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