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Epidemiological Characteristics of Coronavirus Disease 2019 (COVID-19) Patients in IRAN: A single Center Study

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Highlights

• The majority of cases were in the age group of 50 to 60 years of old.

•A total of 2964 cases of COVID-19 were investigated.

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•The male-to-female ratio was 1.93:1.

• A significant effect of age, gender and comorbidities on the mortality.

•The Case Fatality Rate among understudy cases was 8.06%.

1. Background

For the first time in late December 2019, cases of pneumonia with an unknown cause were reported in Wuhan, China, and later in January 2020, a new type of coronavirus was identified as the cause of those pneumonia cases [1]. The World Health Organization (WHO) chose the official name of COVID- 19 (stand for coronavirus disease 2019), for the disease, as well as the term SARS-COV-2(severe acute respiratory syndrome coronavirus 2) for the virus[2]. A similar to SARS and Middle East Respiratory Syndrome (MERS) coronaviruses trend has been seen in the epidemiology of this emerging disease[3]. In March 11, 2020, the WHO announced COVID-19 as a pandemic[4]. The disease is highly contagious and each infected person could infect at least 3 other people on average[5]. As of, April 15, 2020, 76389 patients with COVID- 19 have been identified in Iran, of which 4777 deaths have been occurred by the virus. According to statistics, Iran ranks sixth after the United States , Italy, Spain, , France and the United Kingdom in the number of deaths due to COVID- 19   [6]. The first deaths from COVID-19 reported officially on Feb 19, 2020[7]. Identifying the epidemiological characteristics of this disease will help to make appropriate decisions and thus control the epidemic. Certain epidemiological features of COVID-19 have been previously reported [8-11]. However, these studies were based on relatively small sample sizes, and mostly from China. The aim of this study was characterization of the epidemiological features of COVID-19 in Iran as a country with a population of more than 83 million people [12]in the Middle East and the Persian Gulf region. Here, we report the results of an epidemiological analysis

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of all cases hospitalized in Baqiyatallah Hospital, affiliated to Baqiyatallah University of Medical Sciences (BMSU), in Tehran ,Iran.

2. Method

2.1. Study design and data collection

The present study was a retrospective, epidemiological study that has been performed on hospitalized cases of COVID-19 in Baqiyatallah hospital in Tehran. According to hospital data, patients were admitted from 19 February 2020, to 15 April 2020. All patient information is kept confidential. Patients were confirmed by RT-PCR (Reverse transcription-polymerase chain reaction) using throat and nose swab specimens from the upper respiratory tract or clinically diagnosed based on lung imaging features specially Chest CT(Computed tomography) scan ground glass pathognomonic features consistent with coronavirus pneumonia, depending on the physician's orders. All registered cases at the hospital had a national unique code, so there were no duplicates. The study variables were as follows: gender, age, final outcome (including death or survival), type of comorbidities.

2.2. **Statistical Analysis**

Descriptive analyses of the variables were expressed as mean (±Standard Deviation=SD), median (with an interquartile range $=IQR=Q_1-Q_3$), or number (%). The analyses were based on non-missing data, and missing data were not imputed. The age and sex distribution were examined and relevant charts were drawn. Sex ratio (male to female) and the case fatality rate (CFR) were calculated. To investigate the effect of age, gender, and comorbidities on mortality, a multiple logistic regression model was used. Adjusted Odds Ratio (OR) with 95% Confidence Interval (CI)

was calculated. The α: 0.05 was considered as a significance level. The data were analyzed using the STATA version 11.0 and Excel version 2010.

3. Results

From February 19, 2020 to April 15, 2020, a total of 12870 patients referred to the hospital emergency department, of which 2968 were hospitalized with COVID-19 diagnosis. The mean of age was 55.50 ±15.15 years and the median of age was 56(46-65) years. The majority of cases were in the age group of 50 to 60 years (Fig 1). Also, most cases (66%) were male. The male-to-female ratio was 1.93:1. CFRs are shown in Table 1. Totally 239 deaths occurred during the entire study period, so the overall CFR was calculated to be 1.85% based on the total number of patients (both outpatient and inpatient) and also CFR was calculated to be 8.06% among hospitalized patients.

Among the 239 deaths, the mean of age was 65.38 ±13.67 years and the median of age was 65(57-75) years. A majority (160 = 66.94%) were ≥60 years of age and 38(15.89%) had comorbidities. Patients over 80 years of age had the highest CFR among the age groups (19.27%). The CFR was 8.54% and 7.13% for men and women, respectively. A total of 323(10.89%) of patients had chronic underlying diseases. As shown in Fig 2, Diabetes, chronic respiratory diseases, hypertension, cardiovascular diseases, chronic kidney diseases and cancer were the most common comorbidities with 3.81, 2.02, 1.99, 1.25, 0.60 and 0.57 %, respectively. While patients who reported no comorbidity had a CFR of 7.61%, patients with comorbid conditions had higher rates (9.73% for diabetes, 10.81% for those with cardiovascular disease, 15% for those with chronic respiratory disease, and 13.55% for those with hypertension, 16.66% for chronic Kidney diseases and 5.88% for patients with cancer. Fig3 indicates the number of cases as well as deaths based on the date of

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admission from February 19, 2020 to April 15, 2020. The results of logistic regression showed that male gender significantly increased odds of death by 45 % (OR=1.45, 95% CI: 1.08-1.96). Also, for a one-year increase in the age, the odds of death increases by 5% (OR=1.05, 95% CI: 1.04-1.06). Having underlying disease also increases the odds of mortality by 53% (OR=1.53, 95% CI: 1.04-2.24) this was also statistically significant (Table 2).

4. Discussion

The present epidemiological study on 2964 COVID-19 hospitalized cases between 19 February 2020 to 15 April 2020 , provides information about the disease and the outbreak in Iran.   As shown in Figure 1, the increasing trend of hospitalized cases over a short period of time (19 February to March 11) is clear. This finding could confirm the rapid spread of the disease in the population. The peak of hospitalization occurred on March 11, and since March 17, the number of hospitalized cases has decreased slightly. The data appear to indicate a propagated source pattern of spread. Estimates suggest that around 14% of people infected with COVID-19 have severe disease, and 6% are critically ill [13], hence, about 20% of all cases of the disease are usually need to be hospitalized. Since Baqiyatallah Hospital is a referral center in Tehran, so, it can be concluded that there is probably a similar trend in the general population. Among the 239 deaths, a majority (160 = 66.94%) has been ≥60 years of age and 38(15.89%) had comorbidities such as diabetes, hypertension and chronic respiratory diseases and etc. According to the results of our study, overall CFR was calculated to be 1.85% based on the total number of patients (both outpatient and inpatient). Other studies have been reported CFR ranged from 2.5% to 3%,[14, 15]. CFR was also calculated to be 8.06% among hospitalized patients, it is not surprising that the CFR among hospitalized patients was high as patients with a better general condition who were not hospitalized and therefore not included in the denominator. A recently published systematic review and meta-

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analysis reports a CFR of over 13% in 7 studies describing 632 hospitalized patients[16]. Also, two studies from China, reported a CFR of 15% [8]and 11% [9], respectively. Besides, in a study the CFR has been reported to be as high as 49% among critical hospitalized cases[17]. The results of logistic regression showed the significant effects of age , male gender and underlying diseases on risk of death in patients with COVID-19. In line with other studies[18, 19] the regression analysis in our study revealed that older age is associated with higher risk of mortality. Some studies showed that older age is associated with declined immune system ability[20]. Previously, older age has been reported as an associated factor for mortality in SARS [21] and MERS[22]. The present study showed that male gender significantly increases mortality (OR=1.45, 95% CI: 1.08-1.96). We also observed a greater number of males than females in the 2964 cases of COVID-19 infection. MERS-CoV and SARS-CoV have also been found to infect more men than women[23, 24]. This finding is consistent to other studies [9, 25]. The less susceptibility to infection among women could be attributed to the X chromosome and sex hormones, which have been reported to play role in innate and adaptive immunity[26]. Furthermore, according to our results, 10.89% of patients had chronic underlying diseases, mainly diabetes, chronic respiratory diseases , hypertension and cardiovascular diseases; this is similar to MERS-CoV [24]. In line with other studies[27-29] , our result also showed that, having comorbidities had a statistically significant effect on Mortality (OR=1.53, 95% CI: 1.04-2.24). A study suggested that compared to patients with no comorbidities, the risk of death in patients with influenza is more than in those who had cardiovascular disease and hypertension[30]. As far as our knowledge shows, the present study is the first descriptive study of the COVID-19 outbreak in Iran, with a large sample size. Although the sample size in the present study is a major advantage, unfortunately, more detailed patient information, particularly regarding clinical outcomes and early symptoms was unavailable

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at the time of analysis. Importantly, this may limit the conclusions from this data. However, the data in this study permit an early assessment of the epidemiological characteristics of COVID-19 cases in Tehran, Iran. Further studies in outpatient, primary care, or community settings would help to get a full picture of the clinical presentation, natural history, risk factors and the spectrum of clinical severity of the disease. In addition, further efforts should be made to compensate for the above mentioned limitation in future studies. Rapid, reliable and feasible diagnostic tests are important, as well as differential diagnoses based on clinical descriptions by physicians. Careful national surveillance is essential to monitor the disease and its epidemiological characteristics including infectivity, host adaption, viral evolution, transmissibility, and pathogenicity. Efforts and initiatives at the national, regional and global levels need to be made to cut off the disease transmission chain.

5. Conclusion

The results of this study emphasize the significant effect of older age , male gender and underling diseases on the risk of mortality among COVID-19 patients, which has been mentioned previously in other studies. So it is recommended to take preventative measures more seriously in the elderly patients. Also regarding medical care, it is important to pay special attention to elderly patients who also have underlying diseases. As COVID-19 is considered a global health threat, it still needs to be investigated deeply.

Ethical Approval

This study has been approved by the ethics committee of BMSU (Registration code: **IR.BMSU.REC.1399.057**). Data records were anonymous, so informed consent was waived.

Availability of data and material

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The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

CRediT authorship contribution statement

Mohamad Nikpouraghdam: Conceptualization, Data cleaning, Formal analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing - original draft, Writing - review & editing. **Alireza Jalali Farahani**: Data cleaning, Writing - review & editing. **GholamHossein Alishiri**: Writing - review & editing. **Soleyman Heydari:** Data cleaning, Writing - review & editing. **Mehdi Ebrahimnia**: Data cleaning and validation, Writing - review & editing. **Hossein Samadinia**: Writing - review & editing. **Mojtaba Sepandi**: Conceptualization, Data cleaning, Formal analysis, Investigation, Methodology, Project administration, Software, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing. **Nematollah Jonaidi Jafari**: Writing - review & editing. **Morteza Izadi**: Writing - review & editing. **Ali Qazvini**: Writing - review & editing. **Ruhollah Dorostkar**: Writing - review & editing. **Mahdi Tat**: Writing - review & editing. **Alireza Shahriary:** Writing - review & editing. **Gholamreza Farnoosh:** Writing - review & editing. **Seyed Reza Hosseini Zijoud**: Writing - review & editing. **Maryam Taghdir**: Data collection, Writing - review & editing. **Yousef Alimohamadi**: Writing - review & editing. **Sepideh Abbaszadeh:** Writing - review & editing. **Hadi Esmaeili Gouvarchin Ghale**: Writing - review & editing. **Mahdi Bagheri**: Writing - review & editing.

Declaration of Competing Interest

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The authors declare that there are no competing interests.

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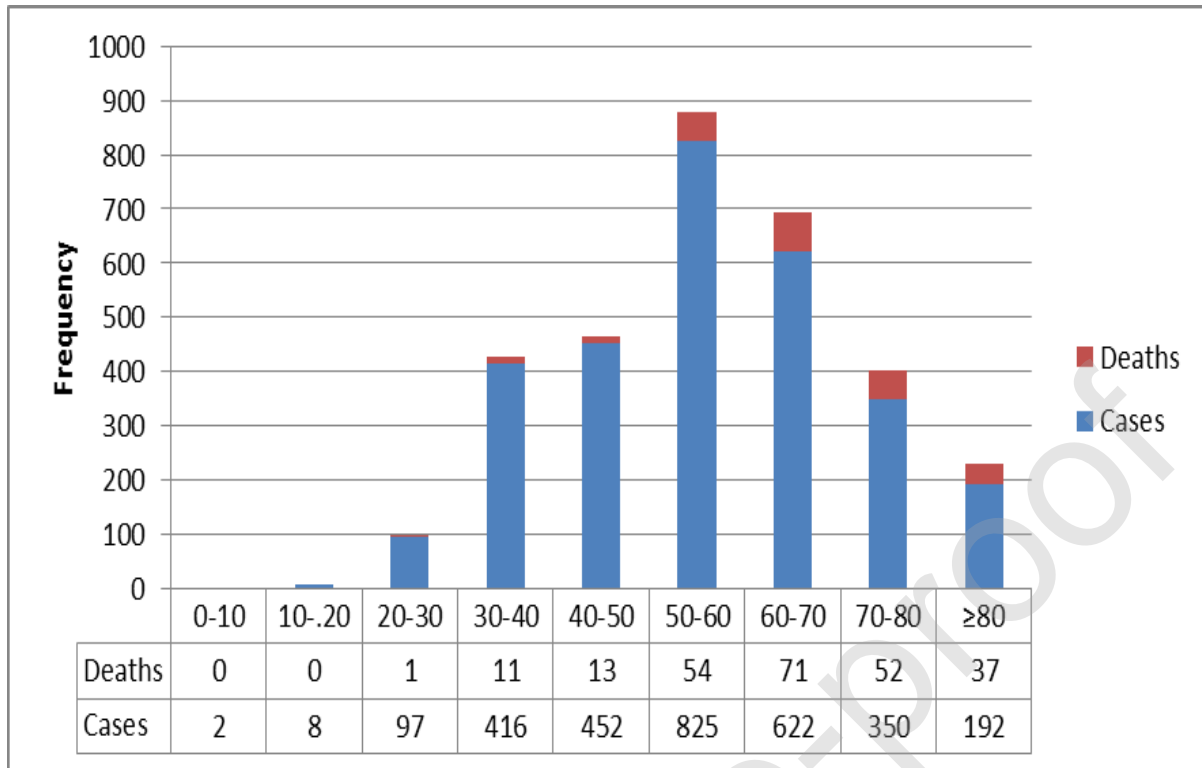
	0-10	10-.20	20-30	30-40	40-50	50-60	60-70	70-80	≥80
Deaths	0	0	1	11	13	54	71	52	37
Cases	2	8	97	416	452	825	622	350	192

Fig1. The distribution of all cases and deaths in each age group (n=2964)

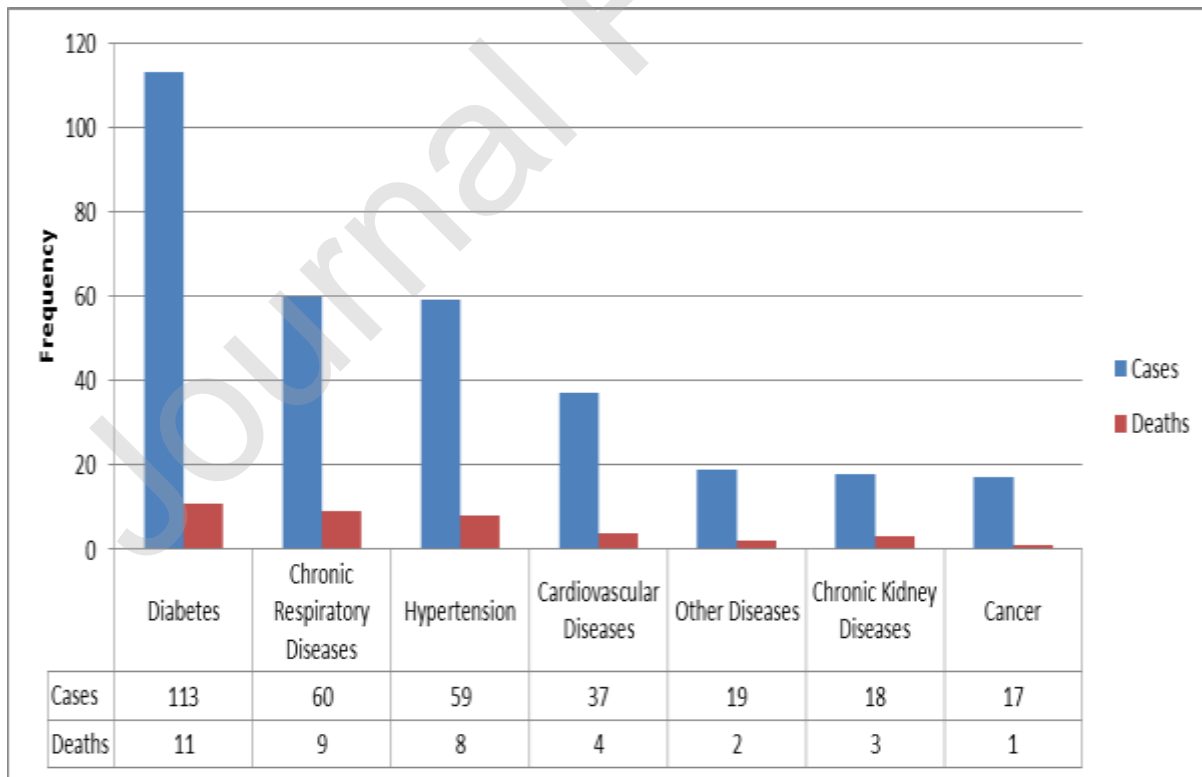|	Diabetes	Chronic Respiratory Diseases	Hypertension	Cardiovascular Diseases	Other Diseases	Chronic Kidney Diseases	Cancer
Cases	113	60	59	37	19	18	17
Deaths	11	9	8	4	2	3	1

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Fig2. The distribution of comorbidities among all Covid-19 cases as well as cases that have died.
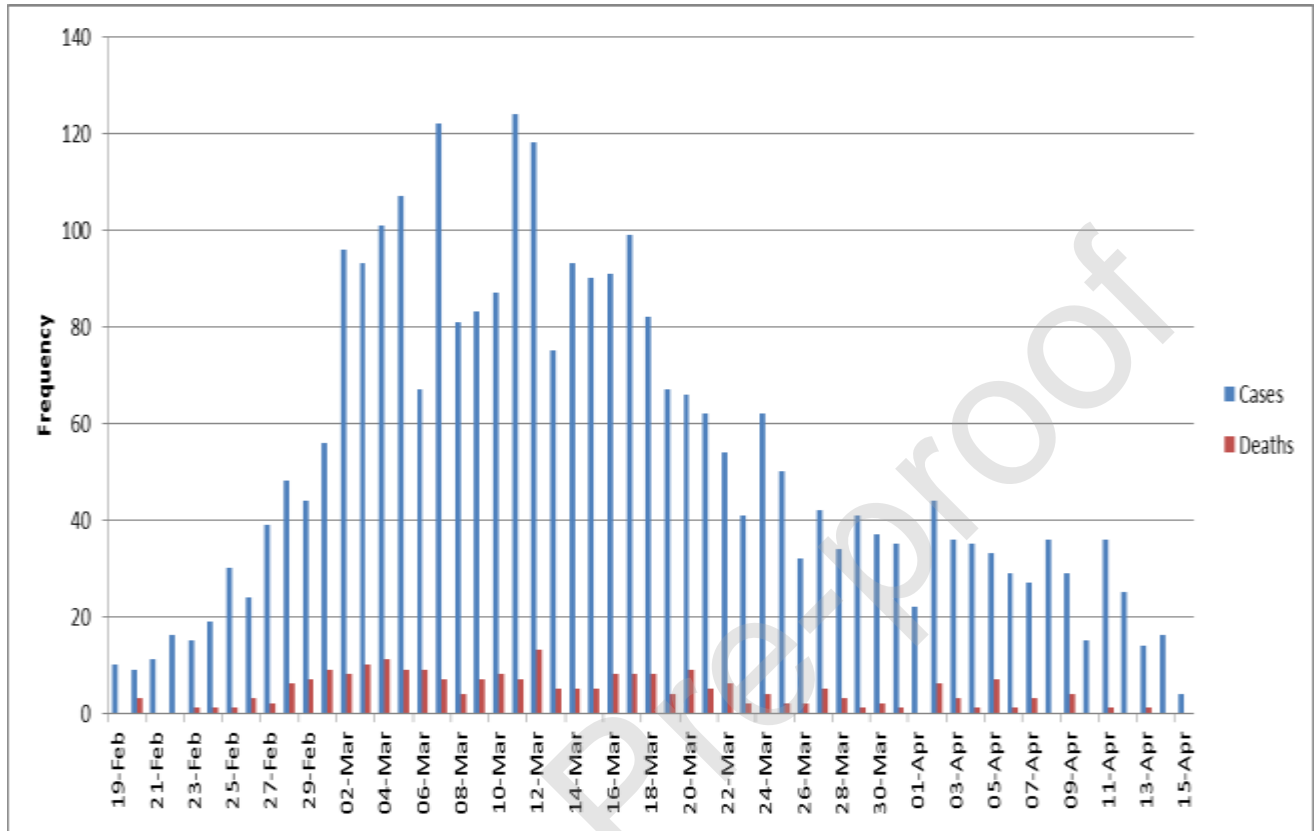

Fig3. The distribution of Covid-19 patients according to date of Hospital admission (n=2964).

Table1. Demographics and characteristics of patients infected with COVID-19

* Other diseases: Liver disorders, chronic rheumatic diseases, Anemia, Immunodeficiency disorders.

†Recovery refers to patients who have recovered and been discharged. Hospitalized patients are patients who are still hospitalized and under care.

Table 2- The effective epidemiological factors on Mortality of Covid-19 Patients

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Variable	Odds Ratio	Standard Error	P-Value	[95% Confidence Interval]
Comorbidity	1.53	0.19	0.03	1.04 - 2.24
Age	1.05	0.005	<0.0001	1.04 - 1.06
Male Gender	1.45	0.15	0.01	1.08 - 1.96

		N (%)	N	Fatality Rate
Overall		2964	239	8.06
Age, years	0–10	2(0.07)	0	-
	10–20	8(0.27)	0	-
	20–30	97(3.27)	1	1.03
	30–40	416(14.03)	11	2.64
	40–50	452(15.25)	13	2.87
	50–60	825(27.83)	54	6.54
	60–70	622(20.98)	71	11.41
	70–80	350 (11.80)	52	14.85
	≥80	192(6.50)	37	19.27
Gender	Female	1009(34.00)	72	7.13
	Male	825(66.00)	167	8.54
Comorbidity	No	2641(89.10)	201	7.61
	Diabetes	113(3.81)	11	9.73
	Chronic respiratory disease	60(2.02)	9	15
	Hypertension	59(1.99)	8	13.55
	Cardiovascular disease	37(1.25)	4	10.81
	Chronic Kidney disease	18(0.60)	3	16.66
	Cancer (any)	17(0.57)	1	5.88
	Other diseases*	19(0.64)	2	10.52
Patient Current Status†	Recovery	2639(89.03)	-	-
	Hospitalized	86(2.90)	-	-
	Death	239(8.06)	-	-

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