Original Article

TANAFFOS

Clinical Characteristics and Outcomes of COVID-19 Patients in Mazandaran Province, Iran

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Background: The problem issue of coronaviruses is one of the most serious problems in the world. The present study aimed to investigate and describe the clinical characteristics, risk factors of fatality rate, and length of hospital stay in patients with COVID-19 in Mazandaran province.

Materials and Methods: In this epidemiological study, data from COVID-19 patients admitted to hospitals in Mazandaran province from July 22 to August 21, 2020, were reported. Multivariate logistic regression methods and the Cox proportional hazards model were used to determine the risk factors of fatality.

Results: Out of the 6759 hospitalized patients, 3111(46.03%) patients had comorbidity; 19.77% of them had diabetes, 19.97% had hypertension, and 15.28% had heart failure. Cox regression model on COVID-19 patient data showed that risk factors for fatality including having age over 60 years (HR: 1.93; P< 0.001), intubation (HR: 4.22; P<0.001), $SpO_2 \le 93\%$ (HR: 2.57; P=0.006), comorbidities of cancer (HR: 1.87; P=0.006), chronic blood diseases (HR: 1.83; P=0.049), heart failure (HR: 1.63; P<0.001), and chronic kidney disease (HR: 1.98; P<0.001).

Conclusion: Paying much attention to risk factors for fatality can help identify patients with a poor prognosis in the early stages. More assessments should also be performed to examine the underlying mechanisms of these risk factors. Highlighting death-related risk factors is crucial to increase preparedness through appropriate medical care and prevention regulations.

Keywords: COVID-19; Cox regression; Outcome

INTRODUCTION

The problem of coronaviruses is one of the most serious challenges in the world (1). Coronaviruses are advanced single-stranded RNA viruses infecting not only humans but also a wide range of animals. These viruses are very common and usually cause cold symptoms in people with defective immune systems (2-4). The new coronavirus (COVID-19) caused by acute respiratory syndrome Coronavirus 2 (SARS-CoV-2), is the third major coronavirus family, after Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS),

which was observed in late 2019 in Wuhan State, China. It spread throughout the world within a few months (5-7). The World Health Organization (WHO) announced its outbreak as a public health emergency and international concern On January 30, 2020, and announced its global epidemic on March 11, 2020 (8, 9).

With the widespread outbreak of the new virus, Chinese health officials conducted urgent studies for diagnosing and controlling this disease including isolating suspected people, accurately monitoring contacts, collecting epidemiological and clinical patient data, and

examining diagnostic and therapeutic methods (10-12). The virus is an animal virus and is transmitted through particles, fluids, and mucous droplets through sneezing and coughing during unprotected close contact from an infected person to a healthy person. It has an incubation period of 0 to 14 days. Based on preliminary studies, coronavirus disease is a severe inflammatory reaction that affects mainly the respiratory system and leads to acute lung damage or acute respiratory distress syndrome in certain cases. Clinical symptoms of this disease range from mild to severe, including fever, cough, shortness of breath, pneumonia, and respiratory, liver, digestive, kidney, skin, and neurological complications, and can ultimately lead to death in severe cases (13-17). Most patients with COVID-19 show mild to moderate symptoms, but about 15% experience severe pneumonia, and about 5% experience acute respiratory distress syndrome (ARDS), septic shock, or multiple organ failure (5). Respiratory failure caused by acute respiratory distress syndrome (ARDS) is the leading cause of death in COVID-19 patients (18). Although the general fatality rate of this virus is 3.4 %, reports suggest that older people, especially those with a history of diabetes, cardiovascular disease (CVD), acute respiratory disease, cancer, and hypertension, are at higher risk of COVID-19 disease and death (16, 19, 20).

Due to an increase in COVID-19 patients and a lack of equipment to admit all patients, essential medical care is provided only for patients who are more likely to survive. The probability of survival and the effect of each of the characteristics such as symptoms on the probability of survival is calculated using survival analysis (1). Scientific reports suggest that the Cox proportional hazard model, as a semi-parametric method, is an accepted approach to survival modeling and predicting (21-23).

Given the high prevalence of COVID-19 and the lack of equipment to admit all patients, the present study was an attempt to identify the factors affecting the survival of hospitalized patients so that it can identify the most important symptoms (characteristics) affecting the probability of patient survival to help decision-makers to take suitable measures to improve the health of people or the community and develop proper plans and policies. Thus, the present study aimed to investigate and describe the clinical symptoms, risk factors for fatality rate, and length of hospitalization in patients with COVID-19 in Mazandaran province.

MATERIALS AND METHODS

Study design and data collection

The present study was a longitudinal epidemiological research conducted to investigate the clinical symptoms and outcomes of COVID-19 patients and to evaluate patients from their admission to discharge or death. This study assessed the records of all COVID-19 patients, admitted from July 22 to August 21, 2020, at 36 hospitals in 17 cities of Mazandaran province. The Ethics Committee of Mazandaran University of Medical Sciences approved it (No.: IRMAZUMS.REC.1399.7247). Demographic characteristics such as age, gender, length of hospital stay, outcome (recovery or death), symptoms, comorbidities, the need for oxygenation, the need for hospitalization in the intensive care unit (ICU), and the severity of the disease were determined using patients' medical records. This information was analyzed after data preparation for modeling according to the set goals and hypotheses.

Participants

Inclusion criteria were people of all ages admitted to one of 36 hospitals in 17 cities of Mazandaran province and their RT-PCR test was positive, which is defined as SARS-CoV-2. We also included patients who had been admitted for a separate condition but had tested positive for COVID-19 during their hospital stay. Otherwise, they were excluded from the study.

Definition

The patients were evaluated regarding the severity of the disease, and patients with mild to critical COVID-19 who needed hospitalization enrolled in the study. The illness severity scores were re-classified as follows:

1) Mild: the presence of any symptoms in patients with $SpO_2 \geq 94\%$, 2) Moderate: patients with $SpO_2 \leq 93\%$ or need

for supplemental oxygen, but no need to enter the intensive care unit, 3) severe: a severe case is defined as tachypnea (≥30 breaths/min) or oxygen saturation ≤93% at rest, need for supplemental oxygen or need to enter the intensive care unit, 4) critical: Patients who required intubation at any time during admission or died before 48 hours (24-26).

Statistical analysis

Continuous variables were expressed as mean± standard deviation or median (Interquartile range or IQR). The classification of variables was summarized in terms of number and percentage in each group. Missing data was removed from the analysis.

Classification variables were compared using the Chi-squared test or Fisher's exact test. The Kolmogorov-Smirnov test was used to assess all interval variables in terms of normality of distribution. Sampled values of non-normal distributions were compared using the nonparametric Mann–Whitney-U test.

In the present study, univariate and multivariate logistic regression methods were used to identify fatality-related risk factors, and a semi-parametric regression model of the Cox proportional hazard model was used to determine the effect of variables on the outcome of treatment of COVID-19 patients. Variables that their inter-group differences were not significant and the number of events was too small to calculate the odds ratio were excluded from univariate analysis. Patients were also followed up from admission time to discharge or death. If sufficient information was not available on patients' survival time, patients were not discharged until the end of the study, and the information of patients discharged from the hospital with personal consent was censored. All tests were considered statistically significant with a P-value of less than 0.05. Statistical analysis was performed using SPSS-24 and R-4.0 software.

RESULTS

In the present study, 6759 laboratory-confirmed patients with COVID-19 were admitted to 36 hospitals in 17 cities of Mazandaran province from July 22 to August 21, 2020. The median age of all patients was 56 years (IQR: 41-69), the median age of the death group was 70 years (IQR: 58-80), and the median age of the non-death group was 55 years (IQR: 40-67). Among the total number of patients, 3475 (51.41%) were female and 2963 (43.84%) were over 60 years old. The median length of hospital stay was 5 days (IQR: 3-7) (Table 1).

Out of the total number of hospitalized patients, 3111 patients (46.03%) had comorbidity while 19.77% of them had diabetes, 19.97% had hypertension, and 15.28% had heart failure. Also, 25.99% of patients were hospitalized in the isolated ward and 11.63% in the intensive care unit (Table 1).

Out of the total patients, 4454 (65.90%) were mild, 1293 (19.13%) were moderate, 911 (13.48%) were severe and 101 (1.49%) were critical (Figure 1). In the death group, 82 patients (17.41%) were mild, 124 (26.33%) were moderate, 202 (42.89%) were severe, and 63 patients (13.38%) were critical. In the non-death group, 4176 patients (70.92%) were mild, 1073 patients (18.22%) were moderate, 613 patients (10.41%) were severe and 26 patients (0.44%) were critical (Table 1).
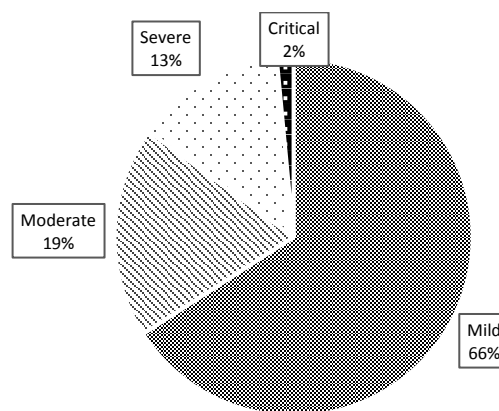

Figure 1. Distribution of severity (four categories) of patients with COVID-19 in Mazandaran province from July 22 to August 21, 2020 (n = 6,759)

In the whole group of patients, the most common symptoms were fever (46.44%), respiratory distress (45.14%), cough (41.91%), myalgia (27.09%), nausea and vomiting (11.76%), and anorexia (8.66%) (Figure 2).
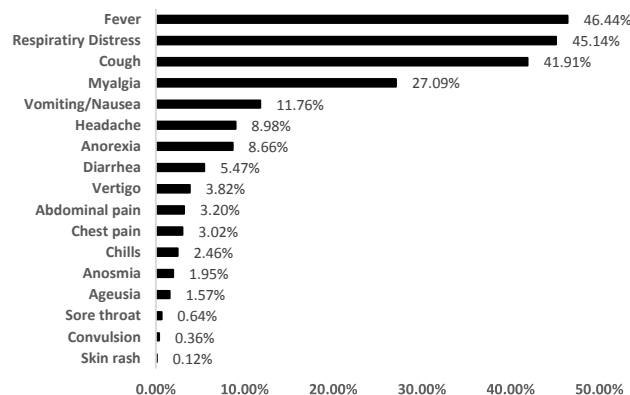
Figure 2. Distribution of symptoms and signs of patients with COVID-19 in Mazandaran province from July 22 to August 21, 2020
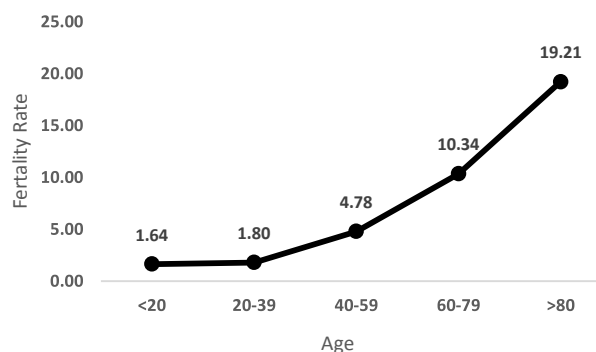

Figure 3. The case fatality rate of patients with COVID-19 according to age distribution in Mazandaran province from July 22 to August 21, 2020.

The total fatality rate was 7.41% (Table 1). Fatality rate based on age was 1.64%, 1.80%, 4.78%, 10.34%, and 19.21% for the age groups of less than 20, 20-39, 40-59, 60-79, and over 80 years old, respectively (Figure 3).

Multivariate logistic regression was performed using clinically important variables and variables with P <0.05 were included in the univariate analysis. Significant risk factors for fatality were age over 60 years, intubation, SpO_2 less than 93%, cancer, heart failure, chronic kidney disease, and chronic neurological diseases (Table 2).

The results of the Cox regression model fit on COVID-19 patient data are presented. The model fit showed that the variables of age, intubation, SpO_2, and comorbidities affect the length of hospital stay (P <0.05). People with an age over 60 years (HR: 1.93; P< 0.001), intubation (HR: 4.22; P< 0.001), SPO_2 less than 93% (HR: 2.57; P= 0.006), cancer (HR: 1.87; P= 0.006), chronic blood diseases (HR: 1.83; P= 0.049), heart failure (HR: 1.63; P< 0.001) and chronic kidney disease (HR: 1.98 (P< 0.001) were more at risk of death (Table 3).

Table 1. Clinical characteristics and outcomes of patients hospitalized for the treatment of COVID-19 in Mazandaran province from July 22 to August 21, 2020

Characteristics	Total (n = 6759)	Alive (n = 6288)	Dead (n = 471)	P-value
Duration of hospitalization[*]	5 [2 - 7]	5 [3 - 7]	6 [3 - 10]	< 0.001
Age[*]	56 [41.0 - 69.0]	55 [40.0 - 67.0]	70 [58 - 80]	< 0.001
Age, ≥ 60 years[**]				< 0.001
No	3796 (56.16)	3471 (58.95)	130 (27.61)	
Yes	2963 (43.84)	2417 (41.05)	341 (72.39)	
Gender[**]				0.003
Female	3475 (51.41)	3046 (51.73)	210 (44.59)	
Male	3284 (48.59)	2842 (48.27)	261 (55.41)	
Cities in Mazandaran province[**]				< 0.001
Amol	1582 (23.41)	1446 (24.56)	93 (19.75)	
Sari	1460 (21.60)	1204 (20.45)	141 (29.94)	
Qaem Shahr	926 (13.70)	770 (13.08)	74 (15.71)	
Behshahr	679 (10.05)	659 (11.19)	0 (0.00)	
Tonekabon	330 (4.88)	274 (4.65)	32 (6.79)	
Ramsar	324 (4.79)	289 (4.91)	28 (5.94)	
Chalus	245 (3.62)	199 (3.38)	29 (6.16)	
Neka	245 (3.62)	227 (3.86)	12 (2.55)	
Nowshahr	229 (3.39)	201 (3.41)	17 (3.61)	
Fereydunkenar	136 (2.01)	106 (1.80)	18 (3.82)	
Nur	125 (1.85)	75 (1.27)	7 (1.49)	
Juybar	101 (1.49)	92 (1.56)	4 (0.85)	
Babolsar	97 (1.44)	90 (1.53)	2 (0.42)	

Table 1. Continued

Zirab	91 (1.35)	78 (1.32)	8 (1.70)	
Mahmudabad	91 (1.35)	81 (1.38)	6 (1.27)	
Abbasabad	50 (0.74)	49 (0.83)	0 (0.00)	
Galugah	48 (0.71)	48 (0.82)	0 (0.00)	
Care unit[**]				< 0.001
Other Units	4216 (62.38)	3782 (64.23)	174 (36.94)	
Isolated	1757 (25.99)	1666 (28.29)	49 (10.40)	
Intensive care unit	786 (11.63)	440 (7.47)	248 (52.65)	
Pregnancy[***]				0.364
No	6718 (99.39)	5849 (99.34)	470 (99.79)	
Yes	41 (0.61)	30 (0.66)	1 (0.21)	
Severity[**]				< 0.001
Mild	4454 (65.90)	4176 (70.92)	82 (17.41)	
Moderate	1293 (19.13)	1073 (18.22)	124 (26.33)	
Severe	911 (13.48)	613 (10.41)	202 (42.89)	
Critical	101 (1.49)	26 (0.44)	63 (13.38)	
Smoking[**]				0.605
No	6620 (97.94)	5772 (98.03)	460 (99.66)	
Yes	139 (2.06)	116 (1.97)	11 (2.34)	
Drug abuse[**]				0.005
No	6600 (97.65)	5762 (97.86)	451 (95.75)	
Yes	159 (2.35)	126 (2.14)	20 (4.25)	
Intubation[**]				< 0.001
No	6516 (96.40)	5775 (98.08)	366 (77.71)	
Yes	243 (3.60)	113 (1.92)	105 (22.29)	
SpO$_2$, ≤ 93%[**]				< 0.001
No	4849 (71.74)	4461 (75.76)	156 (33.12)	
Yes	1910 (28.326)	1,427 (24.24)	315 (66.88)	
Cancer[**]				< 0.001
No	6640 (98.24)	5798 (98.47)	450 (95.54)	
Yes	119 (1.76)	90 (1.53)	21 (4.46)	
Chronic liver disease[***]				0.008
No	6732 (99.60)	5869 (99.68)	465 (98.73)	
Yes	27 (0.40)	19 (0.32)	6 (1.27)	
Diabetes[**]				< 0.001
No	5423 (80.23)	4818 (81.83)	324 (68.79)	
Yes	1,336 (19.77)	1,070 (18.17)	147 (31.21)	
Hematological disease[***]				0.007
No	6691 (98.99)	5835 (99.10)	460 (97.66)	
Yes	68 (1.01)	53 (0.90)	11 (2.34)	
HIV[***]				1
No	6755 (99.94)	5885 (99.95)	471 (100.00)	
Yes	4 (0.06)	3 (0.05)	0 (0.00)	
Immunodeficiency[***]				0.396
No	6741 (99.73)	5,871 (99.71)	471 (100.00)	
Yes	18 (0.27)	17 (0.29)	0 (0.00)	
Heart failure[**]				< 0.001
No	5726 (84.72)	5084 (86.35)	323 (68.58)	
Yes	1,033 (15.28)	804 (13.65)	148 (31.42)	
Chronic renal disease[**]				< 0.001
No	6576 (97.29)	5765 (97.91)	431 (91.51)	
Yes	183 (2.71)	123 (2.09)	40 (8.49)	
Asthma[**]				0.502
No	6612 (97.83)	5766 (97.93)	459 (97.45)	
Yes	147 (2.17)	122 (2.07)	12 (2.55)	
Neurological disease[**]				< 0.001
No	6614 (97.85)	5776 (98.10)	448 (95.12)	
Yes	145 (2.15)	112 (1.90)	23 (4.88)	
Hypothyroidism[**]				0.381
No	6634 (98.15)	5775 (98.08)	465 (98.73)	
Yes	125 (1.85)	113 (1.92)	6 (1.27)	
Hypertension[**]				< 0.001
No	5409 (80.03)	4787 (81.30)	318 (67.52)	
Yes	1,350 (19.97)	1,101 (18.70)	153 (32.48)	

[*]Data is shown as median [IQR] and analyzed using a Mann–Whitney-U test; compared between qualitative variables using [**]Chi-squared test or [***]Fisher's exact test.

Table 2. Determining the effective factors on the death of COVID-19 patients hospitalized in Mazandaran province from July 22 to August 21, 2020, using multivariate logistic regression

Variable	Multivariate logistic regression model				
	B*	S.E**	OR†	95% CI ‡	P-value
Age ≥ 60 years	0.891	0.118	2.44	1.94 - 3.07	< 0.001
Drug abuse	0.149	0.278	1.16	0.67 - 2.00	0.592
Intubation	2.236	0.163	9.36	6.79 - 12.89	< 0.001
SpO₂ ≤ 93%	1.470	0.109	4.35	3.51 - 5.38	< 0.001
Cancer	0.830	0.287	2.29	1.31 - 4.03	0.004
Chronic liver disease	0.779	0.558	2.18	0.73 - 6.51	0.163
Diabetes	0.176	0.127	1.19	0.93 – 1.53	0.166
Hematological disease	0.714	0.371	2.04	0.99 - 4.22	0.054
Heart failure	0.653	0.122	1.92	1.51 - 2.44	< 0.001
Chronic renal disease	1.076	0.218	2.93	1.91 - 4.50	< 0.001
Neurological disease	0.495	0.268	1.64	0.97 - 2.77	0.064
Hypertension	0.038	0.129	1.04	0.81 - 1.34	0.766

* Unstandardized Coefficients Beta   ** Standard Error   † Odds ratio   ‡ Confidence Interval

Table 3. Determining the factors affecting the duration of hospitalization in Mazandaran province Covid-19 patients from July 22 to August 21, 2020, using multivariate Cox regression

Variable	Cox proportional hazard model				
	B*	S.E**	HR †	95% CI ‡	P-value
Age ≥ 60 years	0.655	0.109	1.93	1.56 - 2.39	< 0.001
Drug abuse	0.260	0.231	1.30	0.83 - 2.04	0.260
Intubation	1.440	0.115	4.22	3.37 - 5.29	< 0.001
SpO₂ ≤ 93%	0.945	0.103	2.57	2.10 - 3.15	< 0.001
Cancer	0.626	0.277	1.87	1.20 - 2.92	0.006
Diabetes	-0.054	0.110	0.95	0.76 - 1.78	0.627
Hematological disease	0.605	0.227	1.83	1.00 - 3.35	0.049
Heart failure	0.490	0.104	1.63	1.33 - 2.00	< 0.001
Chronic renal disease	0.682	0.169	1.98	1.42 - 2.75	< 0.001
Neurological disease	0.307	0.216	1.36	0.89 - 2.08	0.156
Hypertension	0.088	0.111	1.09	0.88 - 1.36	0.427

* Unstandardized Coefficients Beta   ** Standard Error   †Hazard ratio.   ‡ Confidence Interval

DISCUSSION

The present epidemiological study conducted on 6759 COVID-19 patients hospitalized in Mazandaran province from July 22 to August 21, 2020, showed information about the clinical characteristics of COVID-19, and the severity distribution of patients with COVID-19 in the epidemic of this province. Moreover, the study found several risk factors for fatality in adults hospitalized due to COVID-19.

Based on the results of the present study, 51.41% of the patients were female and the median age of the patients was 56 years. In a study conducted by Kim et al., the median age of the patients was 58 years, which is consistent with the present study and 64.2% of the patients were female (24). In a study conducted by Nikpouraghdam et al., the median age of patients was 56 years and 66% of patients were male (27). In a study in China, the median age of patients was 47 years and 41.9% of patients were female (28).

Human coronavirus is one of the main pathogens of respiratory infections (29). In the early stages of COVID-19,

the diagnosis is complex due to the diversity in symptoms, imaging findings, and the severity of the disease at the time of onset (28). In the present study, 65.90% were mild, 13.48% were severe, and 1.49% were critical at the time of admission. In some studies, 78.6% of patients were mild or asymptomatic, 14% to 15.7% were severe, and 6% were critical after hospitalization (25, 28, 30).

In the study conducted by Wu and McGoogan, the fatality rate of COVID-19 patients was 2.3% (1,023 of 44,672 cases) (31). A study in Daegu also reported a fatality rate of 2.5% (179 out of 7057 patients) (24). In a study in New York City, the fatality rate was 13.2% (858 of 6493 cases) (32). In the present study, the fatality rate was 7.41%. The fatality rate in the age group over 80 years was 19.21%.

Previous studies have reported that COVID-19 is characterized by a variety of clinical manifestations. The most common symptoms in patients with COVID-19 include fever, chills, cough, shortness of breath, sore throat, myalgia, nausea/vomiting, dizziness, headache, chest pain, diarrhea, and fatigue (24, 29, 30, 33). A meta-analysis of 148 studies from 9 countries found that fever and cough were the most common symptoms, occurring in 78% and 57% of patients, respectively (34). Also, in a study conducted by Brendish et al., fatigue (78.0%), shortness of breath (77.4%), cough (75.3%), reduced appetite (73.7%), fever (63.2%), chills (55.6%), headache (49.0%), and myalgia (41.6%) were more frequently reported in COVID-19 positive patients (35). Docherty et al. reported the symptoms of fever (71.6%), shortness of breath (71.2%), and cough (68.9%) as the most common symptoms (36). The clinical manifestations in the present study are similar to those in the previous reports. The most reported symptoms were fever, respiratory distress, cough, myalgia, nausea/vomiting, headache, and anorexia, with prevalences of 46.44%, 45.14%, 41.91%, 27.09%, 11.76%, 8.98%, and 8.66%, respectively.

Previous studies have indicated that COVID-19 is more common in older patients and people with underlying diseases (37). In some studies, the most common underlying diseases reported in COVID-19 patients were chronic liver disease, heart failure, diabetes, hypertension, and cancer (31, 38). In another study, the most common symptoms were hypertension (25.7%), diabetes (14.4%), dementia (6%), and cancer (3.1%) (24).

Docherty et al. reported chronic heart disease (30.9%), diabetes without complications (20.7%), chronic pulmonary disease excluding asthma (17.7%), and chronic kidney disease (16.2%) as the most common major comorbidities in COVID-19 patients (36). In the present study, as in previous studies, the most common underlying diseases were hypertension (19.97%), diabetes (19.77%), and heart failure (15.28%), respectively.

In the present study, several fatality-related risk factors were identified in hospitalized COVID-19 patients. We analyzed multivariate logistic regression and the Cox proportional hazard model with a relatively large population (6759 patients) and found that having age over 60 years, cancer, chronic blood diseases, heart failure, chronic kidney disease, and chronic neurological diseases were independent risk factors of fatality. This result is similar to previous reports on the most important risk factors of fatality. A meta-analysis of 29909 patients with COVID-19 reported that those over 65 years of age, male gender, hypertension, cardiovascular disease, diabetes, chronic obstructive pulmonary disease (COPD), and cancer were risk factors for death (39). Some studies have also referred to old age, male gender, hypertension, diabetes, heart failure, chronic neurological diseases, and cancer as risk factors for death (24, 40, 41). Docherty et al. reported that increasing age, male gender, and comorbidities including chronic cardiac disease, non-asthmatic chronic pulmonary disease, chronic kidney disease, liver disease, and obesity were associated with higher fatality in hospitals (36). In the present study, intubation, and SpO_2 less than 93% were reported as risk factors for death. Low SpO_2 as a risk factor for fatality in COVID-19 patients has also been reported in some studies (32, 42).

Sayan et al. reported that oxygen therapy with nasal high-flow (NHF) reduced short-term fatality and the need

for intubation among the patients with acute respiratory failure caused by COVID-19 (43).

The present study had some limitations. First, the number of missing data in this study was less than 6%, so missing data were removed from the analysis. Second, some hospitalized patients with a negative test result may have COVID-19, because even testing with very accurate RT-PCR assays for SARS-CoV-2 has sub-optimal sensitivity on upper respiratory tract specimens (44). Third, we did not have patient information about the trials and treatments that COVID-19 patients have received, which may affect clinical outcomes, including mortality; so we cannot comment with certainty on the risk factors that affect mortality in society. Fourth, due to the lack of access to data in some cities of Mazandaran province such as Babol, this study has been analyzed without considering this information.

CONCLUSION

An observational study of 6759 patients with mild, moderate, severe, and critical COVID-19 disease indicated that the most common symptoms were fever, respiratory distress, and cough. The total fatality rate was 7.41% and it increased with age, so its lowest and highest rates related to age groups of <20 and >80, respectively. In addition, we determined comorbidity with renal and heart disease and cancer as factors affecting hospitalization time and death. With increasing COVID-19 cases, there is an increasing need to monitor patterns of infection, disease, and risk factors of fatality to identify gaps and develop strategies to prevent and manage this epidemic. The government and health officials should carefully monitor the evolution of this virus to stop its transmission. Paying much attention to risk factors of fatality can help identify patients with a poor prognosis in the early stages. Further assessments should also be performed to examine the underlying mechanisms of these risk factors. Highlighting death-related risk factors is crucial to increase preparedness through appropriate medical care and prevention regulations.

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