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Factors affecting the recovery of Kurdistan province COVID-19 patients: a cross-sectional study from March to June 2020

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Abstract

Objectives: The Coronavirus disease 2019 (COVID-19) is a new viral disease of the coronavirus family that has a close relationship with SARS species. This study aims to identify factors affecting the recovery of COVID-19 patients in a population with a majority of Kurdish residents.

Methods: For this purpose, all clinical and demographic parameters were collected from patients with COVID-19 who were outpatients or hospitalized in Kurdistan province (located in western Iran) from March to June 2020. We used the binary logistic regression model to recognition affecting factors to recovery in the COVID-19.

Results: According to the results of this study, age, sex, coronary heart disease (CHD), cancer, and using antiviral drugs were associated with the chance of recovery.

Conclusions: Based on the findings of this study, it can be concluded that the chances of recovery of COVID-19 patients who are elderly or have underlying diseases such as CHD or cancer are low. On the other hand, viral drugs are effective in increasing the chances of recovery.

Keywords: antiviral drug; binary logistic regression model; COVID-19; coronary heart disease (CHD); recovery.

Introduction

The COVID-19 is a new viral disease of the coronavirus family that has a close relationship with SARS species. The first cases of this disease were identified on December 8, 2019, in Wuhan, China (Zandkarimi, Moradi, and Mohsenpour 2020). Researchers claim that half of the COVID-19 patients who have recovered from a mild symptomatic infection can still have SARS-COV-2 in their system, which can make the spread of the disease even more difficult (Balachandar et al. 2020). The World Health Organization (WHO) has declared this outbreak a global health emergency and from December 2019 to 14 September 2020, more than 28 million people have been reported with the virus, of which more than 1 million have died of this disease. The first case of COVID-19 was identified on February 20, 2020, in Qom province. Iran experienced two COVID-19 peaks in March and August 2020 and applied social distance policy and travel restrictions to control the disease. According to statistics released by the Iranian Ministry of Health, by the end of September 2020, more than 400,000 people were infected, of which 23,453 died and 349,984 recovered (Zandkarimi, Moradi, and Mohsenpour 2020). In some studies, it has been shown that COVID-19 patients with comorbidities diseases such as cancer, diabetes, heart disease, hypertension, kidney disease, and respiratory disease have a high risk

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of disease severity or death (Balachandar et al. 2020; Cheng et al. 2020; Ruan et al. 2020; Zandkarimi, Moradi, and Mohsenpour 2020; Zheng et al. 2020; Zhou et al. 2020). This study aim is to model the factors affecting the recovery of patients infected with COVID-19 in Kurdistan province (with the majority of the Kurdish population), located in the west of Iran, using the binary logistic regression model. The novelty of this study, identifying the factors affecting recovery in COVID-19 patients in a Kurdish population.

Methods

In this study, we use the information of Kurdistan province COVID-19 patients, western Iran, who are either hospitalized or under treatment at home. The swab samples are taken from the pharyngeal or nasal of suspicious cases and sent to the central laboratory located in the Sanandaj (center of the province) for examination by the RT-PCR method. In this study, we used data from COVID-19 patients identified between February 22, 2020, and June 18, 2020. Of the 1856 available samples, 142 died, 943 recovered, and 771 were under treatment, that in this study, we use the information of deceased and recovered people for modeling. In this study, the effect of treatment (antiviral, antibiotic, and no treatment) on the chances of recovery is investigated that the antiviral drugs include treatment with the hydroxychloroquine, oseltamivir, caspofungin, lopinavir, and Kaletra. Also, we mean antibiotics are azithromycin, ceftriaxone, imipenem, meropenem, vancomycin, and amoxiclav. Also, we mean of CLD the following diseases:

Asthma

Chronic obstructive pulmonary disease (COPD)

Chronic pneumonia

In this study, we analyze all types of cancer (include both solid tumors and hematological malignancies), also, we mean diabetes in both types I and II. In this study, the clinical retrospective data including demographic variables, treatment status, and the patient's clinical background in terms of comorbidities diseases such as diabetes, cancer, and CHD, chronic lung disease (CLD), chronic kidney disease (CKD) and use of antiviral drugs, antibiotics and no-treatment for the type of treatment and also the status of hospitalization were extracted from patients' medical records.

Statistical analyses

Variables such as the underlying disease and age are confounders, and by including them in the model, we controlled their effect, and assuming that other variables are constant, the effect of these variables was interpreted. The response variable is the recovery or death status of COVID-19 patients (recovered 1: dead 0). Also predictor variables include sex (male 1: female 0), age (continuous), CHD (yes 1: no 0), cancer (yes 1: no 0), diabetes (yes 1: no 0), CKD (yes 1: no 0), CLD (yes 1: no 0), use of antibiotics (yes 1: no 0), use Antiviral drugs (yes 1: no 0) and hospitalization status (yes 1: no 0). To model data, the binary logistic regression model was used and statistical analysis using software SPSS version 16 with a conducted 0.05 significant level.

Results and discussion

The mean age of deceased COVID-19 patients was 66.25 ± 15.78 and the mean age of recovered patients was 50.7 ± 21.43 (Table 1). Table 1 shows the frequency and relative frequency of the two dead and recovered groups for each of the qualitative variables. The binary logistic regression model was fitted for variables related to the patient's demographic characteristics, history of the underlying disease, type of treatment received, and hospitalization or outpatient treatment status (Table 1). The Hasmer–Lemshow test in the last step shows the goodness of fit the model (p -value = 0.02) and the Nagelkerke R Square statistics (0.22) shows that the logistic regression model was able to explain the changes related to the dependent variable (Table 2). The results of Table 1 show that the variables of age ($p < 0.0001$), sex ($p = 0.012$), history of chronic heart disease ($p = 0.03$), cancer ($p < 0.0001$), treatment with antiviral drugs ($p = 0.02$), and hospitalization status ($p = 0.03$) were significant. Therefore, according to the results of Table 1, the chance of recovery of COVID-19 patients decreases 0.04 with increasing one year and the chance of recovery of COVID-19 patients in men is 1.7 for women. Also, the chance of recovery in COVID-19 patients with heart disease is 0.59 people without this

Table 1: Frequency, relative frequency and logistic regression results of demographic variables and clinical features in patients with COVID-19 in Kurdistan province in western Iran.

Variable	Deceased 142 (13.1%)	Recovered 943 (86.9%)	OR	CI (95%)	p-Value
Intercept	–	–	218.59		$p < 0.0001$
Age, year	66.25 ± 15.78	50.7 ± 21.43	0.96	(0.95–0.97)	$p < 0.0001$
Sex					
Female (RC)	45(5.5%)	423(52.1%)	–	–	–
Male	97(9.5%)	520(51%)	1.70	(1.12–2.58)	0.012
Status of underlying diseases					
Diabetic	23(13.5%)	99(58.2%)	0.81	(0.46–1.40)	0.45
WIS	1(12.5%)	5(62.5%)	0.94	(0.10–8.87)	0.96
CHD	53(14.3%)	171(46.1%)	0.59	(0.38–0.94)	0.03
CLD	12(10.9%)	60(54.5%)	0.72	(0.34–1.5)	0.38
CKD	5(10.4%)	22(45.8%)	0.56	(0.17–1.84)	0.34
Cancer	9(28.1%)	15(46.9%)	0.13	(0.04–0.39)	$p < 0.0001$
Type of treatment					
Antiviral drug	70(49.3%)	344(51.6%)	1.62	(1.07–2.48)	0.02
Antibiotic drug	12(8.5%)	76(11.4%)	1.76	(0.85–3.65)	0.13
No treatment (RC)	60(42.2%)	247(37%)	–	–	–
Hospitalization status					
Hospitalization	139(97.9%)	584(87.6%)	0.27	(0.08–0.89)	0.03
Outpatients (RC)	3(2.1%)	83(12.4%)	–	–	–

WIS, Weak Immune System; CHD, Coronary Heart Disease; CLD, Chronic Lung Disease; CKD, Chronic Kidney Disease; RC, reference category; OR, Odds Ratio.

Table 2: Results Summary of logistic regression model.

Step	–2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	635 ^a	0.13	0.22

^aEstimation terminated at iteration number 6 because parameter estimates changed by less than 0.001.

underlying disease, and the chance of recovery in COVID-19 patients with a history of cancer in 0.13 patients without the disease (Table 1). Also, the chance of recovery in COVID-19 patients who were hospitalized in 0.27 patients who are treated on an outpatient basis. The COVID-19 patients who received antiviral medication had a 0.26 higher chance of recovery than COVID-19 patients who did not receive treatment (Table 1). Table 3 shows the results of the correct classification percentage by the logistic regression model. Based on the results of Table 3, the ability of this model to predict the recovery of COVID-19 patients according to the available predictors in this model is 97.3% and the ability of the logistic regression model to predict the mortality of COVID-19 patients is 11.3%. The total ability of the model to predict the recovery and death of COVID-19 patients is 82.2% (Table 3). The bar plot shows that antiviral drugs increase the chance of recovery in patients with Covid-19 by 0.62, while patients with Covid-19 who are also cancerous, have the lowest chance of recovery (Figure 1).

According to the results of this study, age, sex, CHD, cancer, and using antiviral drugs were associated with the chance of recovery. Some of the previous studies confirmed our findings. The results of this study showed that increased age decreased the chance of recovery in COVID-19 patients so that with increasing age

Table 3: Correct classification results of the two groups using logistic regression with cut value 0.5.

Observed	Predicted			Percentage Correct
	Response			
		Death	Recovered	
	Response	Death	16	126
	Recovered	18	649	97.3
Overall percentage				82.2

Figure 1: The comparison of the chance of recovery in the significant variables by means of the bar plot.

(a year), the chance of recovery decrease by 4%, assuming that other variables are constant. Some of the studies have confirmed that increasing age in COVID-19 patients is associated with increased severity of symptoms or death (Shi et al. 2020; Sohrabi et al. 2020; Wang et al. 2020a; Zandkarimi, Moradi, and Mohsenpour 2020; Zhang et al. 2020). The current study confirmed that the chance of recovery of COVID-19 patients with CHD disease lower (nearly half) than the without CHD disease. Several studies confirmed that COVID-19 patients with a history of CHD associated with a low chance of recovery (Guo et al. 2020; Li et al. 2020; Nishiga et al. 2020; Parohan et al. 2020; Zhang et al. 2020; Zheng et al. 2020). The study confirmed that the chance of recovery for COVID-19 patients with cancer disease was 0.13 patients without cancer. Some of the studies showed that COVID-19 patients with cancer have more severe side effects and a higher fatality rate (Ruan et al. 2020; Xia et al. 2020; Zandkarimi, Moradi, and Mohsenpour 2020; Zhang et al. 2020). The results of this study showed that COVID-19 patients who used antiviral drugs (include hydroxychloroquine, oseltamivir, caspofungin, lopinavir, and Kaletra.) for treatment had a 62% higher chance of recovery. The study by Kai et al. Confirmed that antiviral drugs such as remdesivir, hydroxychloroquine, and a combination of the HIV drugs lopinavir and ritonavir have a positive effect on the recovery of COVID-19 patients (Kupferschmidt and Cohen 2020). The study conducted by Gautret et al. Showed that the addition of azithromycin to hydroxychloroquine resulted in numerical purification of the virus (Gautret et al. 2020). Currently, several studies confirm that remdesivir is a potentially promising treatment for COVID-19 (Al-Tawfiq, Al-Homoud, and Memish 2020; Wang et al. 2020b). One of the weaknesses of this study is the low R index, which can be due to do not considering some unknown variables that affect the prediction of the model. The strengths of this study are the generalizability (due to the high sample size) and high classification power (97.3%) of the model to predict the factors affecting the recovery of COVID-19 patients.

Conclusion

The COVID-19 is an unknown disease and humans have little information about the high-risk groups of this disease and the methods of transmission of the disease. Until the time of written this article, this disease has several specific vaccines but does not the specific treatment. This study identified affecting factors for recovery in the Kurdistan province COVID-19 patients. Based on the findings of this study, it can be concluded that the chances of recovery of COVID-19 patients who are elderly or have underlying diseases such as CHD or cancer are low, but viral drugs are effective in increasing the chances of recovery.

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