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Research Article

Risk Factors of Severity and Health Outcomes in COVID-19 in Ajman

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A B S T R A C T

Background: Coronavirus disease 2019 (COVID-19) is an ongoing pandemic that has affected people from all over the world within the span of a few months.

Objective: To assess the association between sociodemographic factors and risk factors with disease severity and health outcomes of patients with COVID-19.

Design: This was an observational, cross-sectional and record-based study that involved 148 patients admitted to Thumbay Hospital Ajman during May-July 2020.

Results: Of the 148 participants, 39.9% were above 40 years old and 81.1% were males. 25% of the participants had diabetes mellitus and 14.2% had hypertension. Older patients (39%, n = 23) as well as those with diabetes mellitus (40.5%, n = 15) or hypertension (57.2%, n = 12) experienced significantly more severe disease courses. The same groups also experienced worse health outcomes (12.5%; n = 7, 16.7%; n = 6 and 20%; n = 4 respectively). However, there was no significant association between other sociodemographic variables such as gender, marital status and alcohol intake or smoking with disease severity or health outcomes. Similarly, the disease severity was not found to be higher among patients with dyslipidaemia or pre-existing lung conditions and they had similar health outcomes to those without these comorbidities.

Conclusion: Old age, diabetes mellitus, and hypertension are associated with significantly higher disease severity and worse health outcomes following COVID-19. Further studies are suggested to provide a clearer picture regarding the factors that predict COVID-19 outcome.

Keywords: COVID-19, Sociodemographic, Lifestyle, Chronic Disease, Healthcare Outcome

Introduction

COVID-19 is caused by infection with SARS-CoV-2, a virus that belongs to the Coronavirus group consisting of highly diverse, enveloped, positive-sense and single-stranded RNA viruses.[1] As of July 22, 2020, 15.7 million cases had been reported, of which 9.05 million had recovered and 640,253 had died. In the United Arab Emirates, 58,249 cases had been reported of which 51,235 had recovered and 343 had died.[2]

Studies show that elderly patients are at risk for more severe symptoms, longer disease courses and worse prognosis when compared to younger patients. Children usually present with milder symptoms.[3-5] Males also experience more severe cases when compared to females and have higher mortality rates.[6-8]

Researchers have found that having a comorbid illness can increase the risk of having complications. A study from New York City found that obesity was associated with an increased risk of critical illness from COVID-19.[9] The severity and mortality rate of SARS-CoV-2 infection in hypertensive patients was found to be much higher than in non-hypertensive cases in multiple studies.[10-13] Similarly, patients with diabetes mellitus were observed to be at higher risk for contracting SARS-CoV-2 infection and experienced more severe disease courses.[14-18]

Investigation of each case report on a deeper level will increase our understanding of the clinical picture of COVID-19 in the UAE. The objective of this study is to assess the association between the history of comorbidities and sociodemographic characteristics of patients and the severity and health outcome of COVID-19.

Method

Study Design and Participants

The study design of our research is an observational, cross-sectional, record-based study. We reviewed the records of all patients who had tested positive for COVID-19 and were admitted to Thumbay hospital between May and July 2020 and data from all 148 patients were used for the study.

Study Tool

Data collection form was used to retrieve recorded information. The form included information about age, gender, marital status, DM, hypertension, dyslipidaemia, lung problems, smoking, alcohol consumption, obesity, health outcome and classification of disease severity.

Classification of disease severity was based on the treating physicians' clinical judgment of the cases that were based on the WHO guidelines. The disease was categorised as mild, moderate, severe and critical.[17,18]

Anonymity and confidentiality of the information were maintained. Waiver for the requirement for informed consent was obtained from the Institutional Review Board (IRB) and MOHAP Ethics Committees.

Study Procedures

Independent variables of our study are sociodemographic variables including age, gender, pregnancy and marital status, as well as risk factors including smoking, alcohol consumption, obesity, hypertension, diabetes, dyslipidaemia and pre-existing lung conditions. Dependent variables were disease severity and health outcome.

After getting approval from the IRB, and MOHAP Ethics Committees we proceeded with the data collection after taking approval from the site as well.

Data Entry

Data from every patient file was entered into a table on Excel. BMI was calculated using the formula function.

Data Analysis

The data was coded and imported into IBM SPSS version 25 and analysed. The results were displayed in descriptive statistics such as frequency, percentage, mean and SD. To assess the association, the Chi-Square test, Fisher's exact test were used. Binary and multiple logistic regression analysis was performed to assess predictors of the disease outcome. For all tests p-value < 0.05 was considered significant.

Results

148 participants were involved in the study. 120 (81.1%) of them were males and 28 (18.9%) of them were female. 89 (60.1%) of the participants were below the age of 40 years and 59 (39.9%) of the participants were 40 years old or older. 55 (37.2%) were married, 91 (61.5%) were unmarried and 2 (1.4%) did not specify their marital status. 18 participants (12.2%) smoked, 13 (8.8%) drank alcohol and 74 (50%) were either overweight or obese (Table 1).

Table 1.Distribution of COVID-19 according to Sociodemographic and Other Variables

Socio-demographics		Frequency (n)	Percentage (%)
Age (years)	< 40	89	60.1
	≥ 40	59	39.9
Gender	Male	120	81.1
	Female	28	18.9
Marital status	Single	55	37.2
	Married	91	61.5
Smoking	Yes	18	12.2
	No	130	87.8
Alcohol	Yes	13	8.8
	No	135	91.2
Overweight/ obese	Yes	74	50.0
	No	31	20.9

Table 2 shows that 37 (25%) of the participants had diabetes, 21 (14.2%) had hypertension, 16 (10.8%) had dyslipidaemia, 8 (5.4%) had some kind of lung problem (including asthma, TB, pleural effusion, pulmonary oedema) and 15 (10.1%) of the participants had some other chronic disease e.g. ischemic heart disease, cerebrovascular accident.

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Table 2.Distribution of Participants with COVID-19 by History of Chronic Diseases

Chronic Diseases		Frequency (n)	Percentage (%)
Diabetes	Yes	37	25.0
	No	111	75.0
Hypertension	Yes	21	14.2
	No	111	75.0
Dyslipidaemia	Yes	16	10.8
	No	132	89.2
Lung problem	Yes	8	5.4
	No	140	94.6
Others	Yes	15	10.1
	No	133	89.9

Table 3.Association between Disease Severity and Various Sociodemographic Variables, Lifestyle and Chronic Diseases

Variables		Disease Severity				p value
		Mild/ Moderate		Severe/ Critical		
		No.	%	No.	%	
Age (years)	< 40	73	82.0	16	18.0	0.005
	≥ 40	36	61.0	23	39.0	
Gender	male	86	71.7	34	28.3	0.257
	female	23	82.1	5	17.9	
Marital status	single	44	80.0	11	20.0	0.154
	married	63	69.2	28	30.8	
Smoking	yes	14	77.8	4	22.2	0.671
	no	95	73.1	35	26.9	
Alcohol consumption	yes	7	54	6	46.1	0.09
	no	102	75.5	33	24.4	
Overweight/ Obesity	yes	55	74.3	19	25.7	0.738
	no	24	77.4	7	22.6	
DM	yes	22	59.4	15	40.5	0.024
	no	87	78.4	24	21.6	
HT	yes	9	42.8	12	57.2	< 0.001
	no	100	78.8	27	21.2	
Dyslipidaemia	yes	9	56.2	7	43.8	0.094
	no	100	75.7	32	24.3	
Lung problem	yes	5	62.5	3	37.5	0.435*
	no	104	74.2	36	25.8	

*Fisher's exact test was used.

Table 3 shows that 39.0% (n = 16) of patients who were ≥ 40 years old developed severe/ critical disease compared to 18.0% (n = 23) of the patients who were < 40 years (p = 0.005). No significant association was found between gender, marital status, smoking, alcohol consumption and overweight/ obesity with disease severity.

A significant association was found between diabetes and disease severity. Among patients with diabetes, 59.4% (n = 22) had mild/ moderate disease and 40.5% (n = 15) were severe/ critical.

A significant association was found between hypertension and disease severity. Among patients with hypertension,

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57.2% (n = 12) had severe/ critical disease. No significant association was found between dyslipidaemia and lung problems with disease severity.

There were 8 deaths among the 148 patients, which amounts to 5.4% of the patients involved in the study.

Table 4 shows that a significantly higher proportion of patients who were ≥ 40 years old expired (n = 7, 12.5%) compared to those who were < 40 years old (n = 1, 1.1%). No significant association was found between gender, marital status, smoking, alcohol consumption and overweight/ obesity with healthcare outcome. A significant association was found between diabetes and disease outcomes. Among patients with diabetes, about 83.3% (n = 30) improved/ recovered completely and 16.7% (n = 6) expired. A significant association was found between hypertension and disease severity. Among patients with hypertension 80% (n = 16) improved/ recovered completely and 20% (n = 4) expired. No significant association was found between dyslipidaemia and lung problems and disease outcome.

Table 4.Association between Disease Outcome and Various Sociodemographic Variables, Lifestyle and Chronic Diseases

Variables		Disease Outcome				p value
		Improved/ recovered completely		Expired		
		No.	%	No.	%	
Age (years)	< 40	86	98.9	1	1.1	0.007*
	≥ 40	50	87.4	7	12.5	
Gender	male	112	94.8	6	5.1	0.636*
	female	24	92.3	2	7.6	
Marital status	single	49	92.2	4	7.6	0.471*
	married	85	95.5	4	4.4	
Smoking	yes	18	100	0	0	0.596*
	no	118	93.6	8	6.4	
Alcohol consumption	yes	12	62.3	1	7.6	0.540*
	no	124	94.7	7	5.3	
Overweight/ Obesity	yes	69	94.3	4	5.5	1.000*
	no	27	93.	2	6.8	
DM	yes	30	83.3	6	16.7	0.003*
	no	106	98	2	2	
HT	yes	16	80	4	20	0.013*
	no	120	96.7	4	3.3	
Dyslipidaemia	yes	14	93.4	1	6.6	0.595*
	no	122	94.5	7	5.5	
Lung problem	yes	7	87.5	1	12.5	0.374*
	no	129	95	7	5	

* Fisher's exact test was used; DM: Diabetes Mellitus; HT: Hypertension.

Table 5.Logistic Regression for Predictors of Disease Outcome

Variables		No	COR* (95%CI)	P value	AOD** (95%CI)	P-value
Age (years)	< 40	87	1	0.022		
	≥ 40	57	12.04 (1.439 - 100.717)			
Diabetes Mellitus	Yes	36	10.60 (2.034 - 55.240)	0.005	5.982 (1.067 - 33.541)	0.042
	No	108	1		1	
Hypertension	Yes	20	7.50 (1.706 - 32.974)	0.008		
	No	124	1			

COD: Crude Odds Ratio; AOD: Adjusted Odds Ratio.

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According to Table 5, patients with diabetes mellitus significantly increased their risk for having a more severe disease outcome [AOD 5.982 (95% CI 1.067 - 33.541), p = 0.042]. Interaction was found between the three variables (age, DM and hypertension). Backward elimination was used to include only DM and age, and we found that the results were only statistically significant for the DM variable.

Discussion

The COVID-19 pandemic has caused a stir all around the world and with the limited data available on its impact on the human body, developing more personalised treatment protocols appropriate to individuals with different risk factors is a challenge. Through our research, we aimed to investigate the variation of disease severity and healthcare outcomes with respect to various socio-demographics. We also wanted to look into how certain chronic diseases would affect the same.

The percentage of death among the studied sample was found to be 5.4%. A review of literature shows that different publications have reported varying estimates of the mortality rate among hospitalised patients. In an observational study conducted in Germany involving 1904 COVID-19 patients hospitalised between February 12 and June 12, 2020, the mortality rate was found to be 17%. However, the median age of the study population is 73 years compared to the younger population involved in our study at the median age of 38.[19] Another nationwide study from China involving 1590 hospitalised cases reported the mortality rate to be 3.2%.[20] According to the Abu Dhabi Department of Health, the case fatality rate among all confirmed cases of COVID-19 in the United Arab Emirates was 0.33% as of December 8, 2020.[21] Since our study only involves hospitalised patients who had likely experienced relatively more severe disease courses, the percentage of death among those involved in our study is expected to be higher. Furthermore, the sample of cases selected for our study are from the initial months of the pandemic and treatment protocols for COVID-19 had changed since then, with accumulating evidence, that had led to better outcomes.[22]

Old age patients had a significantly higher disease severity and worse outcome. Current data showed that 39.0% (n = 16) of older age patients developed severe/ critical disease compared to 18.0% (n = 23) of the younger age group (p = 0.005). Similarly, a significantly higher proportion of older age patients expired (n = 7, 12.5%) compared to the younger age patients (n = 1, 1.1%). This is consistent with a study from China involving 221 COVID-19 patients which found that patients who were ≥ 60 years old experienced more severe symptoms, longer disease courses and worse prognosis when compared to patients who were < 60 years old.[4] Another study that was conducted in the United States found that 79.6% of those who died due to COVID-19 were aged ≥ 65 years.[5] The increased risk among the elderly can be explained by the well-established association between old age and decreased immunity secondary to diminished B and T cell production as well as reduced lymphocyte function.[23,24]

Our study did not find a significant association between gender and disease severity, and a similar proportion of patients from each group showed improvement or recovered completely from the infection. This is in contradiction with data published by another study conducted in China involving 43 hospitalised patients, where men were found to experience more severe cases when compared to women.[6] Similarly, Wang et al. observed that the ratio of male to female death was 3.25:1.[7] Another study from New York reported that the mortality rate was higher among males at every 10-year age interval above 20 years.[9]

Among patients with hypertension, 57.2% suffered a severe disease course and 16.7% had expired. Literature review shows that patients with hypertension have higher levels of ACE2, an enzyme that has been linked with increased disease severity.[10,11] A meta-analysis study showed that the severity rate of SARS-CoV-2 infection in hypertensive patients was much higher than in non-hypertensive cases (37.58% vs 19.73%, pooled OR: 2.27, 95% CI: 1.80–2.86). According to a meta-analysis conducted on 6 studies, it was seen that the fatality rate was higher in hypertensive patients (17.72%) than in non-hypertensive patients (4.22%).[12] Another study conducted in China among 110 patients showed that the crude mortality rate was higher in the hypertensive group [7 (19.4%)] vs the non-hypertensive patients [2 (2.7%)].[13]

Diabetic patients had a significantly higher risk of having a severe disease outcome. Among patients with diabetes, 16.7% expired and 40.5% were severe/ critical. For a diabetic patient, the estimated odds of death are 5.982 (95% CI 1.067 - 33.541) times the estimated odds of a non-diabetic patient. A similar association between diabetes and disease course was seen in studies conducted in China where it was observed that about 13.8% of the patients with severe disease were diabetic[15] and in another study mortality rate was 20% among diabetics.[25] In a study that included 1099 patients with positive COVID-19, 16.2% of the 173 participants who had severe disease had diabetes mellitus.[16]

Our study found that participants who had dyslipidaemia had a more serious disease course, but results were not statistically significant. A meta-analysis involving 6922 patients found that participants with dyslipidaemia had a more severe disease course.[26] Another umbrella review which included 7,951 patients also concluded that the

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available data shows that dyslipidaemia can increase the disease severity but more research is needed to make a definite association.[27]

In one study, patients of any age with chronic obstructive pulmonary disease (COPD) or asthma were found to be at increased risk for a severe disease course.[28] However, in another study, patients with asthma did not have a more severe outcome. Only a small percentage of the admitted patients with asthma [37.6% (n = 274)] required ICU admission [9.3% (n = 68)].[29] In our study, the majority 87.5% of patients with lung problems including asthma recovered/ improved and 62.5% of them had a mild/ moderate disease course.

There was no association found between disease severity and disease outcomes with patients who were overweight or obese. However, data from other studies have shown an increased risk of obesity. A study from New York City involving 5279 patients less than 60 years of age found that obesity was associated with an increased risk of critical illness from COVID-19. Individuals with a BMI between 30 to 34 kg/m^2 were 1.8 times more likely to end up needing critical care than participants who had a BMI of less than 30 kg/m^2. Individuals who had a BMI of more than 35 kg/m^2 were 3.6 times more likely to require critical care.[9] It has been well established in literature that individuals who are obese are at greater risk for impaired immunity. The pathophysiology of obesity is highly complex and multifactorial in nature, but possible mechanisms proposed include disruption of primary lymphoid organs secondary to fat accumulation and increased number of leukocyte subsets with proinflammatory phenotypes.[30,31]

In our study, no significant association was seen between patients who smoked and disease severity/ outcome. About 77.8% of smokers had mild/ moderate disease and the majority of them improved/ recovered completely. On the contrary, it was observed in various studies that smoking was an independent risk factor for severe disease progression and unfavourable outcome in patients with COVID-19.[32-35] In a meta-analysis conducted by Salah et al. the mortality was twice as high in participants who were current smokers or had smoked in the past.[36]

Our study showed no significant association between alcohol consumption and disease severity/ outcome. Among patients who consumed alcohol, 54% had mild/ moderate disease and 62.3% improved/ recovered completely. Various studies have shown an association between alcohol consumption and weakened immune system.[37] Taking into consideration the multisystemic effects of alcohol consumption and COVID-19, alcohol increases the risk of cardiac injury, ARDS, pulmonary fibrosis and liver damage which is in synergy with the effects of COVID-19; thereby worsening disease prognosis and outcome.[38]

Strengths and Limitations

This study included an adequate sample size of 148 patients. Most of the data were clear and very little information was missing. Limited data on COVID-19 is available, and our study is one of the few conducted in the UAE looking at the characteristics of COVID-19 patients admitted to local hospitals. Limitations include the lack of capacity to generalise the findings among the country's population since the data was taken from one hospital. Furthermore, our research is a cross-sectional study that only identifies the association between the selected variables and does not establish a cause and effect relationship.

Conclusion

Old age, diabetes mellitus and hypertension are associated with significantly higher disease severity and worse health outcomes following COVID-19. Further studies are suggested to provide a clearer picture regarding the factors that predict COVID-19 outcome.

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Conflict of Interest: None

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