Studying risk factors associated with coronavirus and the relationship between vaccination and study variables among patients examined in Royal Medical Services, Jordan

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ABSTRACT

Introduction: Following exposure to coronavirus, studies showed varying results regarding risk factors such as diabetes, smoking, gender, and age.

Study objectives: The main objective of the study was to explore the risk factors such as gender, age, smoking, and medical history associated with COVID-19 patients treated in Royal Medical Services, Jordan.

Methods and subjects: A retrospective study design was conducted, collecting data from the electronic archives of 245 patients with COVID-19. Several variables were studied, such as age, gender, presence of comorbidities, vital signs, and vaccination. Descriptive statistical analysis was used to describe the data, including frequency, percentages, means and standard deviation. The relationships between variables were evaluated using the Chi-Square test.

Results: The mean age of the participants was 61.26 ± 15.80 years. There were similar numbers of males and females, most were not smokers, about 80% had previous diseases, about 80% developed general symptoms and all patients showed different patterns of vital signs. Patients who were smokers were more likely to receive vaccination. Patients who received vaccination were less likely to have disturbed vital signs.

Conclusion: Most patients were elder, and non-smokers. About 11% of patients received the vaccine against COVID-19. Smoking was significantly associated with vaccination against COVID-19. The most prevalent risk factor included having previous diseases (two or more).

Keywords: COVID-19; risk factor; vital signs; vaccination; smoking; diabetes.

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Introduction

The coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has spread throughout the world [1]. On 24 May 2021, there were 166,346,635 confirmed cases and 3,449,117 deaths, with numbers continuing to rise worldwide [1].

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COVID-19 is a highly infectious virus spread mostly by respiratory droplets and close contact. Long-term exposure to a relatively closed high-concentration aerosol environment has been linked to propagation of the virus via aerosols [2]. The World Health Organization reported more than 41.3 million COVID-19 cases detected globally as of 22 October 2020, with a mortality toll of over 1,134,000. Even though most COVID-19 cases are mild or moderate, the proportion of severe cases reached 14%, with a fatality rate of 6.9% [3]. COVID-19 had affected more than 200 countries, areas, or territories as of 20 June 2020, according to Li et al. [4], since its inception on 31 December 2019, and was labeled a pandemic by the World Health Organization [5].

COVID-19 has a wide range of clinical characteristics and according to a recent study at least one-third of SARS-CoV-2 infections are asymptomatic [6]. The disease's clinical severity ranges from mild to severe [7-9]. Several research studies have investigated the risk factors linked to the severity of COVID-19 [10]. For severe COVID-19 outcomes, age and male gender are well-established risk factors [11-14]. The median age of hospitalized patients was observed to range from 49 to 56 years in several studies [10, 15]. Furthermore, several investigations have found that males account for a disproportionately large number of patients with severe symptoms [16, 17]. Diabetes, hypertension, and cardiovascular illnesses have all been linked to severe sickness and mortality [18, 19].

Dyspnea and hypoxemia are common symptoms in severe patients [20]. Acute respiratory distress syndrome (ARDS), septic shock, difficult-to-correct metabolic acidosis, coagulopathy and multiple organ failure can all occur quickly in critically unwell patients [21]. Antiviral medications (interferon, lopinavir/ritonavir, chloroquine phosphate, etc.), ventilator-assisted treatment and circulatory support are frequently required for severely unwell patients. Severely affected patients have a longer hospital stay (often up to 40 days), with an average cost of hundreds of thousands of dollars, which poses a significant financial burden on society [22]. Screening the risk factors for severe illness and death in COVID-19 patients, as well as detecting prospective or highly susceptible patients, is therefore critical in clinical practice. These initiatives can better allocate medical resources and alter treatment regimens more quickly, resulting in improved treatment efficacy and a lower risk of death [23].

Previous studies analyzed the data of COVID-19 patients and discovered several mortality risk factors, including older age, pre-existing cardiovascular or cerebrovascular diseases, low CD3+CD8+ T cell levels, high cardiac troponin I levels, higher Sequential Organ Failure Assessment (SOFA) scores and high d-dimer levels [24, 25]. Unfortunately, only a few studies have looked into the risk variables associated with COVID-19 infection. Recent investigations in Shenzhen (1286 close contacts, 98 of whom were infected with SARS-CoV-2) and Guangzhou (2098 close contacts, 134 of whom were infected with SARS-CoV-2) have investigated the risk factors for COVID-19 infection, such as older age, trips to Hubei, etc. [26, 27]. Another recent study in Taiwan found exposure to index patients with severe symptoms as a risk factor among 2761 close contacts of 100 selected index cases. However, the small sample size may limit the ability to conduct extensive analysis and also diminish the potential to uncover significant risk factors. Furthermore, data from a single city or a small sample may limit the potential to generalize the findings [28].

Study objectives

The main objective of the present study was to explore the risk factors associated with COVID-19 patients treated in Royal Medical Services, Jordan.

Methods and subjects

Study design and setting

a retrospective study design was conducted to collect data from the electronic archives of patients with COVID-19 in Royal Medical Services, Jordan. Queen Alia Military Hospital was the setting from which the patient's files were examined. Study period extended from 15-8-2021 to 15-10-2021. IRB approval was taken by the IRB committee of Royal Medical Services, Jordan.

Study sample

A total of 300 patient's files were reviewed and 245 valid profiles with complete data were included. The research team collected data; they reviewed the electronic files of patients with COVID-19. The researchers tried to take all suitable files at that time, a total of 300 patient's files were found of which 245 files had complete data.

Study variables

Several variables were studied: being confirmed for positivity using the polymerase chain reaction test (PCR test); age; gender; predisposing variables, including smoking, diabetes, cardiac diseases, respiratory diseases, and neurological diseases; symptoms; vital signs; and vaccination.

Inclusion and exclusion criteria

Any file with complete related information used in the study was included. Any file with missing information related to the study was excluded.

Handling of data

Age was treated as a continuous variable and expressed as the mean and standard deviation. For further analysis, it was retreated as a categorical variable and expressed as <61 years and >62 years. The age was categorized as described because of two reasons: it is the mean of age and represents about 50% of participants. The remaining factors were categorical variables.

Statistical analysis

All data were organized in an Excel spreadsheet prior to analysis by SPSS version 20. Descriptive statistical analysis was used to describe the data, including frequency, percentages, means and standard deviation. The chi-square test was used to investigate the relationship between vaccination and other study variables, with significance considered at $p \leq 0.05$.

Results

General characteristics of participants

The mean age of participants was 61.26 ± 15.80 years, with similar numbers of males and females (approximately 50% each). Most patients (80%) were not smokers, about 28% had no previous medical history and about 72% of patients had one disease or more. Previous surgery was reported by about 15% of patients. Respiratory symptoms were shown in 40 (16.3%) patients, whereas abdominal symptoms were exhibited in 7 (2.9%) patients. A total of 39 (15.9%) patients developed neurological symptoms such as headache in 21 (8.6%), myalagia in 15 (6.1%), and both headache and myalagia in 3 (1.2%) patients. Mixed symptoms were exhibited by 159 (64.9%) patients.
Disturbed vital signs were exhibited by 70.20% of patients. Vaccinations against coronavirus were received by 11.40% of patients **(Table I).**

Table I: General characteristics of participants (N=245)

Item	Description
Age (M ± SD) years	61.26 ± 15.80
Gender (N, %):	
- Female	123 (50.2%)
- Male	122 (49.8%)
Smoking (N, %)	
- Smoker	25 (10.20%)
- Nonsmoker	196 (80.00%)
- Ex-smoker	24 (9.80%)
Previous medical history (N, %)	
- None	
- One disease	69 (28.20%)
- Two or more diseases	46 (18.80%)
	130 (53.0%)
Previous surgery (N, %)	
- Yes	36 (14.70%)
- No	209 (85.30%)
Symptoms (N, %)	
- Respiratory	40 (16.30%)
- Abdominal	7 (2.9%)
- Neurological symptoms:	39 (15.9%)
Headache	
Myalagia	21 (8.6%)
Headache and myalagia	15 (6.1%)
- Mixed symptoms	3 (1.2%)
	159 (64.9%)
Disturbed vital signs (N, %)	
- Yes	172 (70.20%)
- No	73 (29.80%)
Vaccination (N, %)	
- Yes	28 (11.40%)
- No	217 (88.60%)

Patterns of vital signs among study participants

Vital signs mainly included blood pressure, temperature and oxygen saturation, in eight different patterns **(Table II):** normal blood pressure, normal temperature and normal oxygen saturation (29.8%); normal blood pressure, normal temperature and low oxygen saturation (13.9%); normal blood pressure, increased temperature and low oxygen saturation (7.3%); abnormal blood pressure, increased temperature and low oxygen saturation (9.8%); abnormal blood pressure, normal temperature and normal oxygen saturation (10.2%); normal blood pressure, increased temperature and normal oxygen saturation (9.4%); abnormal blood pressure, increased temperature and normal oxygen saturation (5.7%); and abnormal blood pressure, normal temperature and low oxygen saturation (13.9%).

Table II: Patterns of vital signs among study participants (N=245)

Vital signs	Frequency (*N*)	Percentage (%)
Normal blood pressure, normal temperature, normal oxygen saturation	73	29.8%
Normal blood pressure, normal temperature, low oxygen saturation	34	13.9%
Normal blood pressure, increased temperature, low oxygen saturation	18	7.3%
Abnormal blood pressure, increased temperature, low oxygen saturation	24	9.8%
Abnormal blood pressure, normal temperature, normal oxygen saturation	25	10.2%
Normal blood pressure, increased temperature, normal oxygen saturation	23	9.4%
Abnormal blood pressure, increased temperature, normal oxygen saturation	14	5.7%
Abnormal blood pressure, normal temperature, low oxygen saturation	34	13.9%
Total	245	100%

Relationship between COVID-19 vaccination and study variables

As shown in **Table III**, the relationship between vaccination against COVID-19 and the study variables was investigated. Age was not significantly associated with vaccination (p = 0.415) but patients under the age 61 years were more likely to receive vaccination (OR = 1.23, 95% CI = 0.597–2.92). Gender was not significantly associated with vaccination (p = 0.705) but females were slightly more likely to receive vaccination (OR = 1.17, 95% CI = 0.529–2.56). Previous medical history was not significantly associated with vaccination. Patients without previous medical history (14.5%) were more likely to receive vaccination compared with patients with medical history (10.2%) (OR=1.49, 95% CI=0.649–3.41, P=0.345). Previous history of surgery was not significantly associated with vaccination. Patients who had no history of surgery were less likely to receive vaccination (OR = 0.767, 95% CI = 0.271-2.17, p=0.615). Smoking was significantly associated with vaccination. Non-smoking patients (9.2%) were less likely to receive smoking compared with smoking patients (20.4%) (OR = 0.394, 95% CI = 0.169–0.920, p=0.027). Smoking participants were categorized as smokers and non-smokers for better statistical calculations, so that the number of smokers was 49.

Symptoms of the disease were not statistically significantly associated with vaccination (p = 0.538).

Table III: Relationship between COVID-19 vaccination and study variables (N=245)

Variable	Vaccination				df	95% CI	Odds ratio	*p*	X^2
	Yes		No						
	N	%	*N*	%					
Age									0.474
- <61 years	16	12.8%	109	87.2%	1	0.597–2.92	1.23	0.415	
- >62 years	12	10%	108	90%					
Gender									1.43
- Male	13	10.7%	109	89.3%	1	0.529–2.56	1.17	0.705	
- Female	15	12.2%	108	87.8%					
Previous medical history									0.891
- No	10	14.5%	59	85.5%	1	0.649–3.41	1.49	0.345	
- Yes	18	10.2%	158	89.8%					
Previous surgery									0.252
- Yes	5	13.9%	31	86.1%	1	0.271–2.17	0.767	0.615	
- No	23	11%	186	89%					
Smoking									4.897
- No	18	9.2%	178	90.8%	1	0.169–0.920	0.394	0.027	
- Yes	10	20.4%	39	79.6%					
Symptoms of patients									2.168
- Respiratory	4	10.0%	36	90.0%	3	-	-	0.538	
- Abdominal	2	28.6%	5	71.4%					
- Neurological	4	10.3%	35	89.7%					
- Mixed symptoms	18	11.3%	141	88.7%					

Patterns of vital signs by vaccination

As demonstrated in **Figure 1**, disturbance of vital signs among COVID-19 patients was shown to be more prevalent among those who did not receive a vaccination.

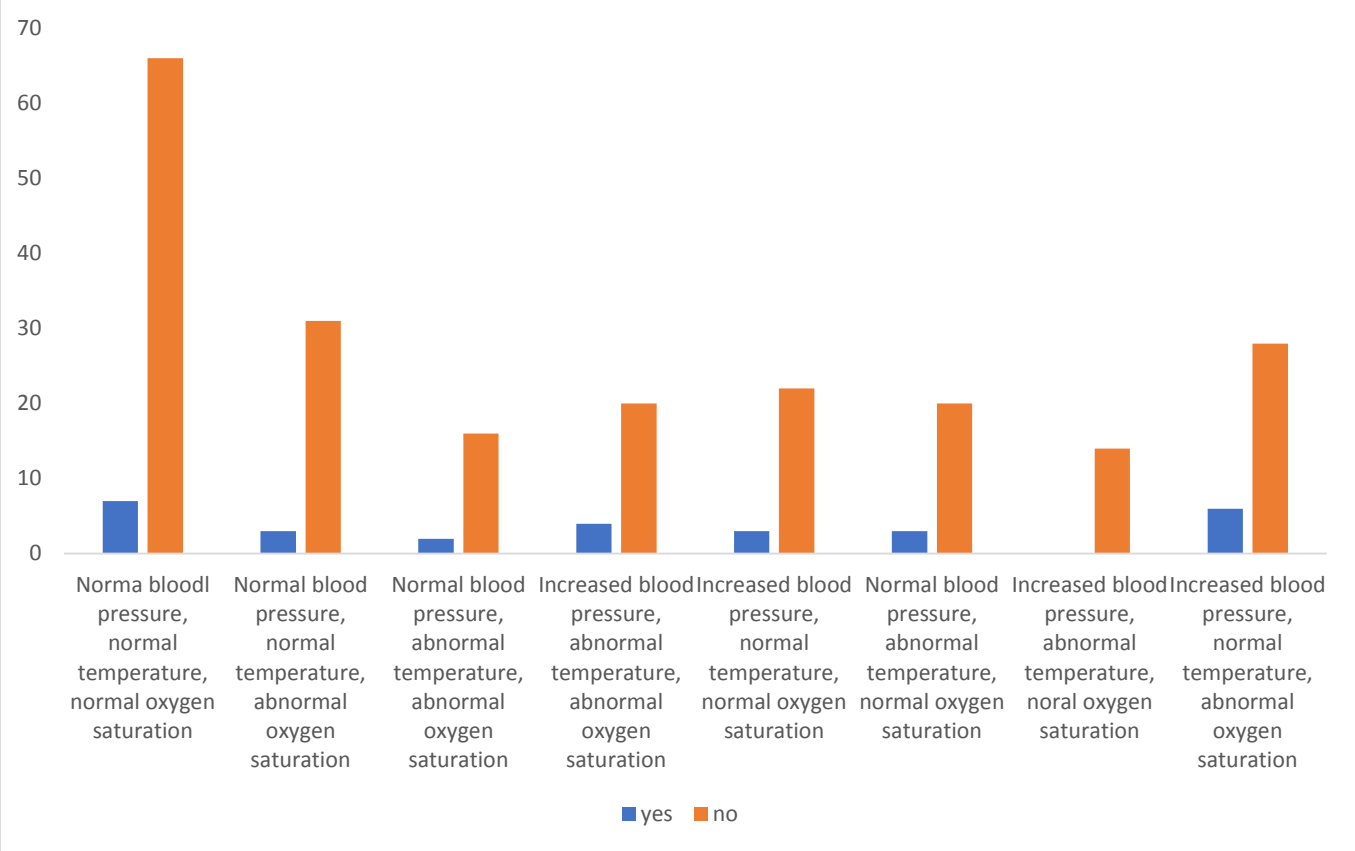

Figure 1: Patterns of vital signs by vaccination

Discussion

The present study aimed to characterize the risk factors associated with COVID-19 patients treated in Royal Medical Services, Jordan. The mean age of the patients was 61.26 ± 15.80 years, and both males and females were found to have similar proportions of infection. This is not consistent with other studies that showed age and male gender as risk factors for COVID-19 [12-14]. Regarding the age, it seems that participants at this age are likely to develop adverse health conditions that make them exposed to infections. However, gender was not a risk factor in this study, a matter that indicates to the consideration of exposure to similar conditions leading to the disease.

Most participants were not smokers but several studies in the literature have reported that smoking was associated with severe onset of the illness [29, 30]. However, following a sensitivity analysis, the conclusion that smoking is a risk factor for COVID-19 is unreliable.
The results showed that 69 (28.2%) patients had no previous medical history whereas most had at least two diseases. Most people in this age group have chronic diseases such as hypertension, diabetes, and neurological diseases. Furthermore, several studies have reported that diabetes, hypertension and cardiovascular illnesses are linked to severe sickness and mortality [18, 19].

Most patients had no previous surgical history. However, this finding is not in agreement with other studies. The study of Bui et al [31] focused on preoperative evaluation and risk assessment, which has always been an important part of safe surgical practice and has become much more so in the wake of the

COVID-19 pandemic. According to that research, surgical treatments in patients who test positive for COVID-19 are linked to poorer clinical results, as well as an increase in postoperative complications and mortality. In addition to managing personal protective equipment (PPE), isolation measures, preoperative SARS-CoV-2 screening and steps to guarantee clinician safety, choosing how to deem COVID-19 patients safe for surgery is a challenge.
The symptoms associated with COVID-19 cover comprehensive systems and include respiratory, abdominal and neurological symptoms. This is in line with other studies in which post-viral symptoms can include extreme fatigue, headaches, memory problems, concentration problems and depression. Chronic post-SARS side effects, such as fatigue, myalgia, weakness, depression and poor sleep, were first reported in 2011 following the 2003 outbreak [32].

Most patients did not receive vaccination. This may be due to the patients belonging to the older age group that was not targeted to receive the vaccination at the beginning of the vaccine distribution. It was not formally recommended to exclude older people from taking vaccination. But the ones who must take the vaccination are the working people in different sectors. Older people who are not working and not willing to take the vaccination, they have a chance not to take it. According to the Ministry of Health in Jordan, a priority of vaccination was given to a variety of people including those over 60 years, but this was not a must [36].

About 30% of COVID-19 patients did not show any disruption in their vital signs (i.e. blood pressure, temperature and oxygen saturation). The results of this study confirmed previous studies reporting that disturbed vital signs predict and characterize the status of COVID-19 [33].
We investigated the relationship between COVID-19 vaccination and other study variables, including age, gender, previous medical history, previous surgery, smoking and symptoms. No statistically significant variations were observed ($p > 0.05$), except for the smoking variable. The result showed that patients who smoked were more likely to receive vaccination ($p = 0.027$). It seems that smokers may experience respiratory problems more than non-smokers and their awareness of these complications motivates them to receive vaccination. However, it has been reported by Clift et al. [34] that smokers have severe outcomes from coronavirus.

The results of this study showed that patients who received the COVID-19 vaccination were less likely to develop abnormal patterns of vital signs. This implies that vaccination has protective effects and ameliorates the impacts of COVID-19. Recently, Victor et al. [35] reported on the protective effects of COVID-19 vaccination among health workers.

Conclusion

The results of the present study showed that the participants were old, over 61,26 years. Most patients were not smokers. More than half of patients had more than two chronic diseases. Most of the patients had no previous surgery. Respiratory symptoms and neurological symptoms were the most prevalent symptoms associated with COVID-19. About 11% of the patients received the vaccine against COVID-19. Smoking was the only variable to be significantly associated with vaccination against COVID-19.

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