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Prevalence and Risk Factors Associated with Mortalities in COVID-19 Patients in Jeddah, Kingdom of Saudi Arabia

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ABSTRACT

Background: Since the declaration of COVID-19 as a pandemic, researchers have been trying to discern the risk factors that determine the mortality of the disease. This study aims to explore the risk factors associated with mortalities among COVID-19 patients in Jeddah governorate, Kingdom of Saudi Arabia.

Methodology: Through a record-based retrospective study, laboratory-confirmed cases were included.

Results: Out of all respondents (n=381)Most of them were symptomatic (82.9%); mainly cough (44.4%), fever (41.2%), sore throat (22.0%), and runny nose (13.1%). The case mortality rate (CMR) accounted for 19(5.0%); it was higher in males (6.0%), non-Saudis (6.1%), and symptomatic patients (5.4%); however, these differences are not statically significant $p>0.05$ $p<0.05$. The binary logistic regression revealed that age was the only significant predictor for mortality, and being old age almost doubles the likelihood of mortality with odds ratio (OR=2.318; 95% CI= 1.806-6.672; p=0.007)

Conclusion: The current findings add more evidence to the risk factors of mortality in COVID-19 patients. Age is a significant predictor of mortality, which emphasizes the necessity for targeted care for elderly people to reduce their risk of complications, facilitate recovery, and protect their health and well-being during the pandemic.

Keywords: Covid-19, Mortality, Risk Factors, Saudi Arabia, pandemic

INTRODUCTION

In December 2019, the emergence of the coronavirus disease (COVID-19) outbreak in China swiftly escalated into a global pandemic. Symptoms of this novel coronavirus include fever, cough, difficulty breathing, fatigue, muscle pain, headache, loss of taste or smell, sore throat, congestion, runny nose, nausea, vomiting, and diarrhea.(1) By February 2021, the global tally exceeded 106 million confirmed cases with over 2 million reported deaths, equating to a mortality rate of approximately 2%.(2) Globally, the crude mortality rate (CMR) for COVID-19 was recorded at 10.4 deaths per 100,000 population. Notably, the countries with the highest rates were Belgium (84.9), Andorra (67.5), United Kingdom (64.3), Spain (60.6), Italy (57.3),

Sweden (49.6), France (44.3), and the United States (36.7). In stark contrast, China reported a death rate of 0.33, while Iran's rate was 11.8 per 100,000.(3) When examining correlations on a country level, a significant relationship was found between the total number of confirmed cases and total COVID-19 deaths, as well as between confirmed cases and CMR.(3,4) Male, older age, individuals with hypertension, those with diabetes mellitus, and patients residing in the Americas were identified as independent risk factors for mortality among individuals with COVID-19.(4) A systematic review of the literature pointed out that individuals who have underlying cardiometabolic disease and present with evidence of acute inflammation and end-organ conditions are at a greater risk of mortality due to infection with COVID-19, and should therefore receive more intensive management.(5) Furthermore, patients who died had consistently higher levels of creatinine and blood urea nitrogen at the time of hospital admission, indicating poorer kidney function, which was associated with an increased risk of mortality.(6) Mortality was also linked to a lower platelet count and elevated levels of D-dimer, suggesting the presence of a possible coagulopathy in these patients.(7) Additionally, patients who did not survive were more likely to have a higher white blood cell count and lower levels of lymphocytes and CD4+/CD8+ T cells.(8) Among the clinical risk factors, there were positive associations with CMR observed for Alzheimer's disease ($r = 0.36$), lung cancer ($r = 0.39$), and a weaker correlation with asthma.(3) Ultimately, tracking the mortality of COVID-19 is essential for guiding public health responses, assessing individual risk, informing vaccine development and distribution, planning healthcare resources, raising public awareness, and understanding the long-term health impact of the pandemic.(9) Therefore, the current study aims to explore risk factors linked to mortalities of COVID-19 patients in laboratory-confirmed cases in Jeddah, Saudi Arabia.

METHODS

Through a record-based retrospective study, all laboratory-confirmed COVID-19 cases who were diagnosed at healthcare facilities in Jeddah governorate in the period from 7th March to 31st May 2020 were included in the study (inclusion criteria). The data were extracted from the database of the Health Electronic Surveillance Network (HESN) which was originally designated for registering and reporting communicable diseases in the Kingdom of Saudi Arabia. The data included demographic characteristics, clinical and laboratory findings of the cases, besides outcomes (died or recovered). After getting the approval for conducting the research, the researchers accessed the relevant data and retrieved it in an Excel sheet. The dependent variable was the outcome (mortality); while the independent variables included socio-demographic characteristics of the patients (age, gender, nationality), and clinical findings. Data were coded and analyzed using Statistical Package for Social Sciences (SPSS) version 21. Qualitative variables are summarized and presented as frequency distribution. The chi-square test was used to verify the significance of differences of mortality rates in the subgroups, and binary logistic regression was done to identify significant independent predictors for mortality. A confidence level of 95% (CI 95%) was adopted throughout the study, p-value less than 0.05 was considered as a level of significance.

RESULTS

Out of all the recorded cases (n=381), there was a significant prevalence of male cases (74.0%) compared to females. The mean age of the cases was 38.0±13.8 years, ranging between one year and 82 years old. There were relatively more cases in the older ages (40+ years) (40.9%). Furthermore, there was a higher proportion of non-Saudis (64.0%) compared to Saudis (36.0%), who were mostly from Bangladesh (17.8%), Yemen (8.1%), India (7.9), Pakistan (6.3%) and Philippine (6.3%); the healthcare workers accounted for 9.3% of the cases who were mostly in administrative jobs (3.9%) **[Table 1]**. The majority of the cases (83.5%) were classified as cases, while the remaining cases were contacts (16.5%). The majority of the cases exhibited symptoms (82.9%), primarily including cough (44.4%), fever (41.2%), sore throat (22.0%), runny nose (13.1%), and difficulty breathing (7.6%). The average viral load was determined to be 26.1±5.4, with a range between 9.44 and 37.49 **[Table 2]**.

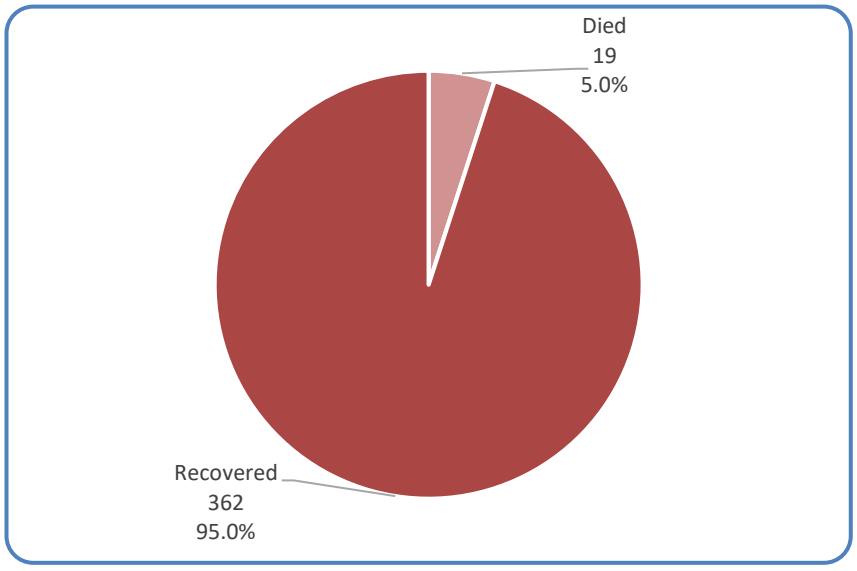

Figure 1: Mortality rate in COVID-19 cases.

Figure 1 displays that 19(5.0%) of the patients died; **Table 3** describes the mortality rate according to the characteristics of the patients, it shows that the mortality rate was higher in males (6.0%), non-Saudis (6.1%) and symptomatic patients (5.4%), however, these differences are not statically significant p>0.05. On the other hand, the mortality rate steadily and significantly increased towards older ages, as it was evident that while there was no mortality in those aged <30 years, it accounted for 3.9% in those aged 30-<40 years and reached up to 9% in those aged 40 years or older p<0.05. Notably, it was found that the mean viral load was higher among deceased cases (27.7±5.53) than the survived case (24.7±5.1); however, this difference is not statistically significant p>0.05. The binary logistic regression revealed that age was the only significant predictor for mortality, and being old age almost doubles the likelihood of mortality with odds ratio (OR=2.318; 95% CI= 1.806-6.672; p=0.007) **Table 4.**

Tables:

Table 1: Socio demographic characteristics of the study group (n=381).

Characteristics	No.	Percentage
Gender:		
Male	282	74.0
Female	99	26.0
Age:		
<30 years	96	25.2
30-<40 years	129	33.9
≥40 years	156	40.9
Nationality:		
Saudi	137	36.0
Non-Saudi	244	64.0
Specific nationalities of non-Saudis:		
Bangladesh	68	17.8
Yemen	31	8.1
India	30	7.9
Pakistan	24	6.3
Philippines	24	6.3
Sudan	16	4.2
Egypt	13	3.4
Turkey	10	2.6
Others	28	7.3

Job:		
Health care worker	36	9.4
Others	345	90.6
Specific jobs of health care workers:		
Administrative	15	3.9
Nurse	8	2.1
Lab technician	5	1.3
Physician	5	1.3
Pharmacist	2	0.5
Dentist	1	0.3

Table 2: Clinical characteristics of the positive COVID-19 cases.

Clinical characteristics	No.	Percentage
Primary diagnosis:		
Case	318	83.5
Contact	63	16.5
Symptomatic:		
Yes	316	82.9
No	65	17.1
Symptoms:		
Fever	157	41.2
Cough	169	44.4
Sore throat	84	22.0
Dyspnea	29	7.6
Runny nose	50	13.1
Sustained respiratory distress	1	0.3
Viral load:		
Mean±SD	26.1±5.4	
Range	9.44-37.49	

Table 3: Comparing the mortality rate among COVID-19 patients according to their characteristics.

Characteristics	Mortality				X^2	P*
	Yes		No			
	n	%	n	%		
Gender:						
Male	17	6.0%	265	94.0%	Fisher	0.089
Female	2	2.0%	97	98.0%		
Nationality:						
Saudi	4	2.9%	133	97.1%	1.929	0.165
Non-Saudi	15	6.1%	229	93.9%		
Age:						
<30 years	0	0.0%	96	100.0%	10.610	0.005**
30-<40 years	5	3.9%	124	96.1%		
≥40 years	14	9.0%	142	91.0%		
Job:						
Healthcare workers	0	0.0%	37	100.0%	Fisher	0.165
Others	19	5.5%	362	94.5%		

Primary diagnosis:					Fisher	0.165
Cases	18	5.7%	300	94.3%		
Contacts	1	1.6%	62	98.4%		
Symptomatic:						
Yes	17	5.4%	299	94.6%	Fisher	0.341
No	2	3.1%	63	96.9%		
Symptoms:						
Fever	10	6.4%	147	93.6%	1.077	0.299
Cough	11	5.2%	201	94.8%	0.041	0.839
Sore throat	3	3.6%	81	96.4%	Fisher	0.364
Runny nose	1	2.0%	49	98.0%	Fisher	0.260

*Based on chi-square **Statistically significant

Table 4: Binary logistic regression for the factors predicting mortality among COVID-19 patients.

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Gender	.898	.773	1.351	1	.245	.407	.090	1.852
Patient Symptomatic	.429	.773	.308	1	.579	1.536	.337	6.989
Nationality	.079	.594	.017	1	.895	1.082	.337	3.468
Age	1.841	.539	2.431	2	.007	2.318	1.806	6.672
Constant	3.012	.775	15.091	1	.000	20.325		

DISCUSSION

In March 2020, the World Health Organization (WHO) considered the rapid and aggressive spread of COVID-19 as a pandemic.(10) Since its early beginning and along its progress, the researchers as well as the general community were concerned with the number of cases and deaths, besides methods of prevention and control.(2) The current study showed that the case mortality rate among the confirmed COVID-19 cases was 5%, which comes in congruence with a previous study in Saudi Arabia which reported a mortality rate of 4.3% in hospitalized patients in a tertiary care hospital.(11) Mortality was found to be higher among males which has been explained by a recently released report which affirmed that Angiotensin-converting enzyme 2 (ACE2) facilitates the virus's ability to infect healthy cells, and men exhibit higher levels of ACE2 compared to women; this disparity in ACE2 levels may elucidate why men are more prone to COVID-19 infection than women.(12) Also, the hormonal differences between males and females may play a role in the immune response to COVID-19; for example, estrogen has been shown to have anti-inflammatory effects, which could potentially offer protection against severe illness in females.(13) Mortality was higher among symptomatic patients, which could be attributed to the symptomatic patients are often the most likely to seek medical services, which may indicate a more severe illness.(14) Moreover, symptomatic patients often have higher viral loads, which could lead to more severe disease and a higher risk of transmission to others, contributing to increased mortality rates.(15) The logistic regression revealed that older age was the significant predictor for increased mortality in COVID-19 patients; this phenomenon has been extensively documented in multiple studies, which have sought to elucidate the underlying factors contributing to this elevated prevalence. One of these factors is the weakened immune response; as people age, their immune system tends to weaken. This weakened immune response makes older individuals more susceptible to severe infections, and mortality from COVID-19.(16) Also, older adults may experience an exaggerated inflammatory response to infections, known as a cytokine storm. This excessive inflammation can lead to tissue damage and organ failure, contributing to the severity of COVID-19.(17) Besides, delayed immune response which characterizes aging is associated with a delayed immune response to infections, which can prolong the time it takes to clear the virus from the body. this delayed immune response may contribute to the progression of

COVID-19 to severe illness in older individuals.(18) Moreover, pre-existing health conditions could play an important role; older adults are more likely to have underlying health conditions such as heart disease, diabetes, respiratory disorders, and weakened lung function. These conditions increase the risk of severe illness and complications from COVID-19.(19) In addition, it has been addressed that with age, lung function naturally declines, resulting in reduced lung capacity and efficiency. COVID-19 primarily affects the respiratory system, causing pneumonia and acute respiratory distress syndrome (ARDS), which can be particularly severe in individuals with pre-existing lung conditions or reduced lung function due to aging.(20) Overall, the combination of age-related changes in the immune system, underlying health conditions, reduced lung function, and prolonged exposure to the virus contributes to the higher mortality rate from COVID-19 observed in older age groups.(21,22). The main limitation of the current study comes in line with what is known about the inherited limitations in the record-based study design where the researchers are confined to the available data which are not essentially the optimal data needed for the research, this fact showed itself in the current study that only one reading of the viral load was recorded in the database, it would be more beneficial if several readings were recorded to assess the changes of the viral load along the course of each case.

CONCLUSION:

The current findings add more evidence to the mortality risk factors in COVID-19 patients. Age is a significant predictor of mortality, which indicates that elderly people should be recognized as potentially vulnerable cases for mortality during pandemics, and they should receive focused care to reduce their risk of complications, facilitate recovery, and protect their health and well-being during the pandemic.

Disclosure

Statement:

The authors declare no conflicts of interest.

Funding:

This study is self-funded.

Ethical Consideration:

Ethical approval was obtained from the regional Institutional Research Board (IRB) in Jeddah (Number: A01155). As no direct patient interaction was involved, the requirement for informed consent was waived by the IRB. Confidentiality and anonymity of patient data were strictly maintained by de-identifying and securely storing the records. Access to the data was restricted to authorized personnel involved in the study. All procedures adhered to the ethical standards outlined in the Declaration of Helsinki.

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Table Legends:

Table 1: Socio-demographic characteristics of the study group (n=381).

Table 2: Clinical characteristics of the positive COVID-19 cases.

Table 5: Comparing the mortality rate among COVID-19 patients according to their characteristics.

Table 6: Binary logistic regression for the factors predicting mortality among COVID-19 patients.

Figure Legends:

Figure 1: Mortality rate in COVID-19 cases.