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Epidemiological and clinical features of COVID-19 patients in Saudi Arabia



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ABSTRACT

Background: The aim of this study is to describe the clinical and demographic characteristics of COVID-19 patients, and the risk factors associated with death in Saudi Arabia to serve as a reference to further understand this pandemic and to help in the future decisions and control of this global crisis.

Methods: This multicenter, retrospective, observational, cross-sectional study was conducted on 240,474 patients with confirmed COVID-19 in Saudi Arabia. Data was collected retrospectively through the Health Electronic Surveillance Network at the Ministry of Health. Patients were classified based on their outcome as recovered, dead, or active with no definite outcome. We must specify the date period.

Results: As of 20th of June 2020, 79.7% of COVID-19 cases were young and middle-aged, ranging between 20–59 years. There was evidently a difference in the sex ratio, where males constituted 71.7% of cases. The majority were non-Saudi nationals, representing 54.7% of cases. Furthermore, the contraction of COVID-19 was travel-related in 45.1% of cases. Signs and symptoms were reported in 63% of cases, the most common of which were fever; 85.2%, and cough; 85%. Deaths occurred more frequently in patients 40–49 years, 50–59 years, and 60–69 years, representing 19.2%, 27.9%, and 21.3% of deaths, respectively. Additionally, the case fatality rate (CFR) was higher in older age-groups, reaching 10.1% in those ≥80 years. Moreover, the CFR of males was higher than that of females, with 0.95% and 0.62%, respectively. As for nationality, Saudis had a CFR of 0.46% versus 1.19% in non-Saudis.

Conclusion: The total number of positive COVID-19 cases detected constitute 0.7% of the Saudi population to date. Older age, non-Saudi nationalities, being male, travelling outside Saudi Arabia, and the presence of symptoms, as opposed to being asymptomatic were considered risk factors and found to be significantly more associated with death in patients with COVID-19.

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Introduction

The Coronavirus disease 2019 (COVID-19) is a severe acute respiratory syndrome (SARS) caused by the SARS-CoV-2 virus. It was

initially marked as a cluster of viral pneumonia cases of unknown cause, originating in Wuhan, China. [1,2]. Following its discovery, the virus spread globally and was officially declared a pandemic by the World Health Organization (WHO) on the 11th of March 2020, with more than 118,000 confirmed cases worldwide, and 4292 deaths at the time of the declaration [3,4]. The number of globally confirmed cases have exceeded 26,726,982, with more than 876,152 deaths on the 6th of September 2020 [5].

Most of the early recorded cases involved people living in or visiting Wuhan, which confirmed the human to human transmission of the virus [2,6]. Human to human transmission was found to

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be primarily caused by respiratory droplets [7]. However, according to a study by van Doremalen et al., SARS-CoV-2 has the ability to remain viable and infectious on surfaces for up to days and for hours in aerosols; therefore the aerosol and fomite transmission of the virus is plausible [8]. The virus is presumed to be highly contagious and more prone to spread in the first three days after showing symptoms [2,9,10], although it should also be noted that the spread does not cease at all stages of the disease [11]. Furthermore, studies show that the incubation period of the virus is on average 5–6 days, though it can last up to 14 days [12,13]. The type and severity of symptoms vary from case to case, starting from influenza-like symptoms to acute respiratory disorders. The time to recovery also differs among patients, ranging from two to six weeks, depending on the symptoms [14,15].

Since its spread, the virus continues to affect more than 213 countries worldwide, including the Kingdom of Saudi Arabia (KSA) [16]. The geographic location, expatriate population, rapidly growing foreign investment, and both religious and recreational tourism contributed greatly to its spread. However, as a result of its past epidemic experiences, including the SARS-CoV, as well as being the epicenter of the Middle East respiratory syndrome coronavirus (MERS-CoV), the Kingdom has gained experience in preparedness and management in case of an outbreak [17,18].

Measures taken by the Saudi government to curb the COVID-19 outbreak included forming a high-level committee with multiple governmental bodies, suspending religious and recreational tourism, limiting international travel [16], implementing mandatory quarantine for individuals who visited affected countries, closure of schools and universities, raising capacity and designating hospitals for COVID-19 treatment, raising public awareness, disinfecting and limiting access to the two holy mosques, banning mass gatherings, reinforcing curfews or total lockdowns on the most affected cities, and limiting local flights and other means of travel [19,20].

In the face of these measures, KSA recorded a total of 319,932 confirmed cases on the 6th of September 2020, with a total of 4049 recorded deaths and a 1.26% fatality rate [21]. Peer-revised publications on COVID-19 cases in KSA are lacking. Characterization of the epidemiological features of COVID-19 is crucial for developing and implementing effective control strategies. Here, we report the results of a descriptive and exploratory analysis of all cases until the 20th of June 2020.

Materials and methods

Study design

This is a multicenter, retrospective, observational, cross-sectional study conducted on all confirmed cases of COVID-19 in KSA between the 1st of March 2020 and the 20th of June 2020. Data was collected retrospectively at one point in time, through the Health Electronic Surveillance Network (HESN) at the Ministry of Health (MoH); the authority responsible for documenting all suspected and confirmed COVID-19 cases in KSA. The last date for the inclusion of confirmed cases was 20th of June 2020. Data were collected at a one-time point, and there was no follow-up for the patients' clinical outcomes beyond 20th of June 2020.

The retrospective construction of epidemic curves (Epi curve) was built using the Reverse transcription-polymerase chain reaction (RT-PCR) test as an established onset date for all documented patients. The study included two classifications for cases; confirmed and suspected. Confirmed cases were identified through the RT-PCR results, using a throat swab. Symptoms in patients and tracked exposures were the determining factors in suspected cases.

Asymptomatic COVID-19 cases were identified using RT-PCR. Additionally, comorbidities in the medical history were obtained.

Population

A total of 240,474 positive COVID-19 cases were included in the study. The inclusion criteria encompassed subjects from all age-groups, requesting a laboratory test concurring with a COVID-19 infection. There were no exclusion criteria.

Study variables

Socio-demographic characteristics

We aimed to measure several variables, including the socio-demographic and baseline characteristics of COVID-19 patients, encompassing the time to diagnosis (TTD), epidemiological assessments, and the date of entry into the HESN. The assigned variables also included occupation, travel history, medical history, and case severity. The occupation for patients working in the medical field was not limited to healthcare practitioners only, but rather all employees working in a healthcare setting. Furthermore, travel history included those who haven't physically travelled in the last 14 days but came into contact with those who had.

Symptoms and laboratory variables

Symptoms and laboratory variables included the symptomatic or asymptomatic nature of the case, the presence of fever, cough, sore throat, and runny nose, as well as, the date of receiving the requisition and the date of the requisition result.

Clinical outcomes

The clinical outcomes measured were the type of outcome, such as recovery, death, or active cases with no definite outcome; and the date of the outcome.

Statistical analysis

Descriptive statistics were used to describe the baseline demographic data and clinical characteristics. Categorical variables were presented by counts and percentages, whereas continuous variables were presented by the median and interquartile range (IQR). Numerical data were explored for normality using the Kolmogorov-Smirnov test and Shapiro-Wilk test. Univariate and multivariate logistic regressions with Cox proportional hazard function were used, with death as the event of choice.

Graphical representations of some important variables were done using a Microsoft Excel worksheet. A geographical representation of the cases by geographical location was employed, using the CDC Epi Info™ Version 7.2.3.1.

All median values and their measures of variability, as well as all percentages, were rounded to one decimal place. The significance level was two-sided with a type 1 error of 5%. The analysis was done using the Statistical Package for Social Sciences version 24 (SPSS-24).

Results

Patients' disposition

Individuals who are at risk of contracting COVID-19, in terms of showing symptoms, travelling, having contacted a primary case, were screened. Based on the data announced by the Saudi MoH from the beginning of the pandemic until the 20th of June 2020, PCR tests were performed for 2,436,683 individuals out of the total Saudi population (34,218,169), constituting 7.12% of the population. This is equivalent to 71,210 tests per 1,000,000 individuals. A

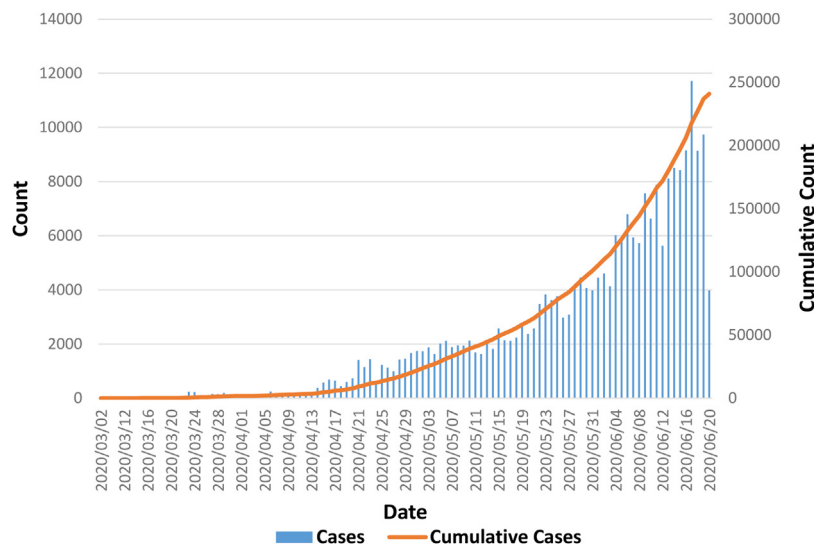


Fig. 1. Number of confirmed COVID-19 cases during the outbreak.

total of 240,474 positive cases were detected, with a percentage of 9.87% of the total PCR tests. These were further classified based on their outcome as recovered (183,048), dead (2325), or active cases with no definite outcome (55,101) [21].

Epidemic curve

According to the data we gathered through the Saudi MoH, the first cases of COVID-19 were detected on the 2nd of March and continued to increase on a daily basis, with an average of 52 cases per day. By the end of April, cases started to increase exponentially with an average of 751 cases per day, reaching 2033 cases per day in May. This trend continued, with daily cases reaching 3570 cases per day by the end of June. In July, the average rate slightly decreased to 3303 cases per day. The cumulative cases of COVID-19 reached 240,474 on the 20th of June (Fig. 1) [21].

The first case of death was reported on the 24th of March 2020; about three weeks after the first case was identified. Cases of death continued to rise with an average of 5.3 cases per day in April, 11.5 cases per day in May, 39 cases per day in June, and 45 cases per day in July (till the 14th of July), with a total of 2325 deaths [21].

Baseline characteristics

Demographics

Demographic characteristics were collected for 240,474 positive COVID-19 cases, with various responses and missing data across different variables. About 79.7% of the cases were young and middle-aged, with 71.7% of cases being males. The dominant nationality among the cases was non-Saudi, representing 54.7%. Additionally, cases came from different parts of KSA, mainly Riyadh; 37.5% (Table 1).

Age-groups stratified by gender and nationality

When we examined the distribution of COVID-19 cases per gender and nationality, we found that Saudi female patients were younger in age, with 11.9% and 13.4% being in the age-groups 0–9 years and 10–19 years, respectively, versus 6.4% and 6.7% in non-Saudis. Additionally, cases in the middle-aged group were higher in non-Saudi female patients, with 48.8% compared to 33.3% in Saudis. Similarly, among males, Saudi patients tended to be younger in age with 9.6% and 11.9% in the age-groups 0–9 years and 10–19 years, respectively, versus 1.9% and 1.6% in non-Saudis. Alterna-

tively, among the workforce (20–59 years), 90.9% of non-Saudi male patients tested positive for COVID-19, compared to 70.4% of Saudi male patients (Table 2).

Symptoms and laboratory findings

Signs and symptoms were reported in 63% of cases, the most common of which were fever; 85.2% (54,073 out of 63,474), cough; 85% (50,650 out of 59,602), sore throat; 65.5% (15,749 out of 23,994), and runny nose; 44.3% (6492 out of 14,644).

Laboratory performance was assessed using time variables. The median time from the requisition date to the time of receiving the sample, and from receiving the sample to the date of the PCR result were one day with an IQR of 1. This indicates a fast track for screening and detecting cases (Table 3).

Observation time and incidence density

Cases were monitored for their outcomes, which varied between recovery and death, while those not reporting outcomes were considered active with no definite outcome.

The observation time was calculated in days to yield person-days (PD) by subtracting two dates; the definitive outcome date, and that of initially receiving the case. The median PD of all cases was 14 days, with an IQR of 7.0 and an incidence density (ID) of 7.1 per 100 PD. Different age-groups and genders had PD ranging between 13–14 days, with an ID ranging between 6.7 and 7.7 per 100 PD. Non-Saudis had higher PD (IQR) than Saudis; 15(8) and 13(6), respectively. Healthcare workers also reported higher PD than average, with 16(12) and an ID of 6.3. Regional differences existed in PD and ID, where some regions showed lower ID and longer PD than the average cases (Table 1).

Recovery and death

By the 20th of June 2020, 101,992 cases had reported definitive outcomes. Of those, 2% were death cases, while the rest recovered. Among the different age-groups, deaths occurred more frequently in the middle and slightly older age-groups (Table 1).

Furthermore, the case fatality rate (CFR) was higher in older age-groups, reaching 10.05% in the age-group ≥ 80 years (Fig. 2; Table 1). We also found that the CFR for males was higher than that of females with 0.95% and 0.62%, respectively. This was also the case with nationality, as the CFR in Saudis was 0.46% which is lower than

Table 1
Epidemiological features of COVID-19 cases in Saudi Arabia per demographical characteristic.

Demographic features	# Confirmed	Person-days (PD) (MD, IQR)	Incidence density per 100 PD	# Died	CFR (%)	
Total	240,809	14 (7.0)	7.1	2064 (2.0)	0.86	
Age(years) N = 240,723	0–9	14,995 (6.2)	13 (6.0)	10 (0.5)	0.07	
	10–19	16,858 (7.0)	14.9 (5.0)	4 (0.2)	0.02	
	20–29	50,333 (20.9)	14 (7.0)	45 (2.2)	0.09	
	30–39	70,446 (29.3)	14 (7.0)	179 (8.7)	0.25	
	40–49	44,280 (18.4)	14 (7.0)	396 (19.2)	0.89	
	50–59	26,742 (11.1)	14 (7.0)	575 (27.9)	2.15	
	60–69	11,362 (4.7)	13 (7.0)	439 (21.3)	3.90	
	70–79	4046 (1.7)	13 (7.0)	249 (12.1)	6.15	
	≥80	1661 (0.7)	13 (7.0)	167 (8.1)	10.05	
Sex N = 240,738	Male	172,721 (71.7)	14 (7.0)	1639 (79.4)	0.95	
	Female	68,017 (28.3)	13 (7.0)	425 (20.6)	0.62	
Nationality N = 240,809	Saudi	109,127 (45.3)	13 (6.0)	503 (24.4)	0.46	
	Non-Saudi	131,682 (54.7)	15 (8.0)	1561 (75.6)	1.19	
Occupation N = 126,364	HealthCare Worker	9733 (7.7)	16 (12.0)	29 (1.6)	0.30	
	Non- HealthCare Worker	116,631 (92.3)	13 (7.0)	1790 (98.4)	1.53	
Region N = 240,809	Riyadh	90,200 (37.5)	13 (5.0)	263 (12.7)	0.29	
	Jeddah	27,315 (11.3)	12 (8.0)	701 (34.0)	2.60	
	Eastern Region	33,229 (13.8)	16 (6.0)	91 (4.4)	0.27	
	Makkah	28,553 (11.9)	15 (7.0)	617 (29.9)	2.16	
	Medina	17,662 (7.3)	14 (13.0)	261 (12.6)	1.48	
	Al Ahsa	13,734 (5.7)	16 (15.0)	13 (0.6)	0.09	
	Taif	6291 (2.6)	15 (6.0)	40 (1.9)	0.64	
	Jazan	3755 (1.6)	13 (8.0)	16 (0.8)	0.43	
	Tabuk	3404 (1.4)	14 (3.0)	11 (0.5)	0.33	
	Al Qassim	3790 (1.6)	21 (10.0)	4.8	13 (0.6)	0.34
	Aseer	5022 (2.1)	10 (3.0)	10.0	8 (0.4)	0.16
	Northern Borders Region	1318 (0.5)	16 (9.0)	6.3	8 (0.4)	0.61
	Hail	1394 (0.6)	12 (4.0)	8.3	7 (0.3)	0.50
	Najran	1559 (0.6)	11 (7.0)	9.1	–	–
	Al Qunfudhah	446 (0.2)	10 (4.0)	10.0	5 (0.2)	1.12
	Al Bahah	871 (0.4)	13 (11.0)	7.7	3 (0.1)	0.34
	Bisha	695 (0.3)	13 (7.0)	7.7	–	–
	Hafar Al Batin	1186 (0.5)	18.5 (14.0)	5.4	6 (0.3)	0.50
	Al Qurayyat	153 (0.1)	10 (3.0)	10.0	1 (0.0)	0.65
	Al Jawf	232 (0.1)	13.5 (2.0)	7.4	–	–
Travel related exposure N = 25,073	Yes	11,307 (45.1)	16.7 (8.0)	6.0	220 (89.1)	1.95
	No	13,766 (54.9)	16 (7.0)	6.3	27 (10.9)	0.20
Signs and symptoms N = 53,100	Yes	118,193 (63.0)	13.0 (7.0)	7.7	1603	1.36
	No	69,516 (37.0)	14.0 (6.0)	7.1	125	0.18

Table 2
Gender and Nationality Distribution among Different Age-groups of COVID-19 Cases.

Gender	Age	Nationality		Total (N, %)
		Saudi (N, %)	Non-Saudi (N, %)	
Male	0–9	6051(9.6)	2055(1.9)	8106(4.7)
	10–19	7504(11.9)	1712(1.6)	9216(5.3)
	20–29	15,366(24.5)	20,078(18.3)	35,444(20.5)
	30–39	15,298(24.4)	38,616(35.1)	53,914(31.2)
	40–49	8383(13.3)	26,420(24.0)	34,803(20.2)
	50–59	5131(8.2)	14,809(13.5)	19,940(11.5)
	60–69	2898(4.6)	4856(4.4)	7754(4.5)
	70–79	1471(2.3)	1045(1.0)	2516(1.5)
	>=80	697(1.1)	299(0.3)	996(0.6)
	Female	0–9	5484(11.9)	1392(6.4)
10–19		6190(13.4)	1449(6.7)	7639(11.2)
20–29		10,430(22.6)	4451(20.5)	14,881(21.9)
30–39		9643(20.9)	6864(31.6)	16,507(24.3)
40–49		5735(12.4)	3732(17.2)	9467(13.9)
50–59		4636(10.0)	2163(10.0)	6799(10.0)
60–69		2504(5.4)	1103(5.1)	3607(5.3)
70–79		1110(2.4)	418(1.9)	1528(2.2)
>=80		509(1.1)	156(0.7)	665(1.0)

1.19% in non-Saudis. Regarding occupation, healthcare workers had a lower CFR of 0.3%, compared to 1.53% in non-healthcare workers. Regions also had different CFRs, ranging between 0.09% and 2.6%, with the highest being that of Jeddah. On the other hand, the CFR was 1.95% in those who travelled versus 0.2% in those who did not,

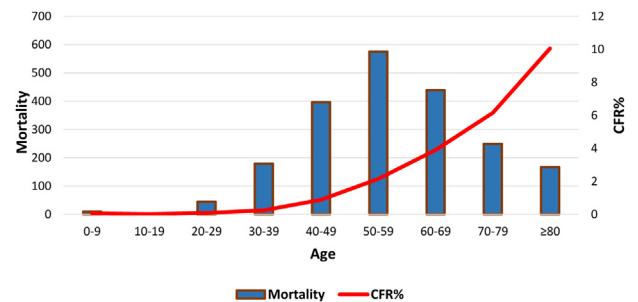


Fig. 2. Death and CFR for COVID-19 cases in Saudi Arabia.

and 1.36% in symptomatic patients versus 0.18% in asymptomatic patients (Fig. 3; Table 1).

Univariable and multivariable regression

Age-groups

Baseline characteristics were analyzed using the univariable and multivariable cox regression model with death as the event of choice. In the univariable model, middle and older age-groups were more associated with death, when we used 0–9 years as the reference group. The hazard ratio (HR) increased substantially as we moved from one age-group to another, where the HR and 95% confidence interval (CI) was 3.401 (1.594–7.253) in the age-group 30–39 years, and reached 206.961 (97.020–441.485) in the

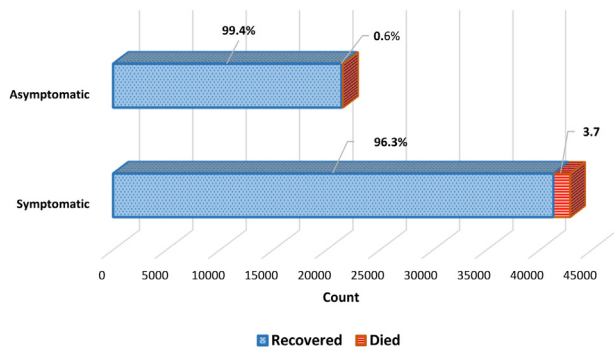


Fig. 3. The rate of recovery and death among both symptomatic and asymptomatic.

Table 3
Symptoms and Laboratory Time Variables of the Confirmed Cases.

		Count	Percent
Symptoms	Fever	54,073/63,474	85.2
	Cough	50,650/59,602	85.0
	Sore throat	15,749/23,994	65.6
	Runny nose	6492/14,644	44.3
Time Variables		Median	IQR
	Average time from requisition date till received date	1.0	1.0
	Average time from received date till result date	1.0	1.0

age-group ≥ 80 years (p-value = 0.00). In the multivariable model, which included all baseline variables, age remained a significant predictor in older age-groups, with an HR and 95% CI of 9.597 (1.308–70.409) in the age-group 60–69 years, while it reached

Table 4
Univariable and multivariable Cox proportional hazard model for risk factors associated with COVID-19 deaths.

Baseline characteristics	Univariable HR	P-Value	Multivariable HR	P-Value	
Age categories	0–9	Reference	–	–	
	10–19	0.387(0.100–1.498)	0.169	0.00	0.961
	20–29	1.423(0.640–3.163)	0.387	0.479(0.057–4.001)	0.497
	30–39	3.401(1.594–7.253)	0.002	0.764(0.101–5.750)	0.793
	40–49	12.940(6.125–27.399)	0.00	2.138(0.290–15.768)	0.456
	50–59	33.259(15.777–70.166)	0.00	6.280(0.866–45.528)	0.069
	60–69	69.789(33.102–147.519)	0.00	9.597(1.308–70.409)	0.026
	70–79	116.662(54.985–247.524)	0.00	18.372(2.486–135.767)	0.004
≥ 80	206.961(97.020–441.485)	0.00	27.620(3.554–214.637)	0.002	
Sex	Male	1.150(1.028–1.287)	0.015	1.486(1.015–2.177)	0.042
Nationality	Saudi	0.674(0.607–0.747)	0.00	0.608(0.426–0.867)	0.006
Occupation	Healthcare Worker	0.124(0.085–0.182)	0.00	1.054(0.582–1.907)	0.863
	Riyadh	0.820(0.115–5.8460)	0.843	0.622(0.078–4.944)	0.653
	Jeddah	2.444(0.344–17.379)	0.372	1.287(0.167–9.907)	0.808
	Eastern Region	0.296(0.041–2.125)	0.226	0.304(0.034–2.730)	0.288
	Makkah	2.133(0.300–15.169)	0.449	0.381(0.045–3.201)	0.374
	Medina	1.749(0.245–12.473)	0.577	1.638(0.204–13.157)	0.643
	Al Ahsa	0.278(0.036–2.124)	0.217	0.622(0.061–6.328)	0.688
	Taif	0.691(0.095–5.034)	0.715	2.258(0.264–19.350)	0.457
	Jazan	0.949(0.125–7.219)	0.960	9.853(1.153–84.205)	0.037
	Tabuk	0.341(0.044–2.666)	0.305	0.00	0.986
	Al Qassim	0.526(0.068–4.076)	0.539	0.00	0.955
	Aseer	1.041(0.130–8.324)	0.970	1.808(0.109–30.109)	0.680
	Northern Borders Region	0.818(0.101–6.654)	0.851	3.096(0.273–35.124)	0.362
	Hail	0.808(0.099–6.564)	0.851	4.684(0.456–48.148)	0.194
	Najran	0.00	0.853	0.00	0.958
	Al Qunfudhah	2.187(0.255–18.716)	0.475	0.00	0.994
	Al Bahah	0.432(0.045–4.154)	0.467	4.560(0.428–48.573)	0.209
Bisha	0.00	0.903	0.00	0.992	
Hafar Al Batin	4.302(0.518–35.740)	0.177	2.340(0.137–39.942)	0.557	
Al Jawf	0.00	0.957	0.00	0.944	
Al Qurayyat	Reference	–	Reference	–	
Travel related exposure	Yes	13.909(9.091–21.280)	0.00	10.213(6.226–16.752)	0.00
	Symptomatic	8.759(7.048–10.887)	0.00	3.459(1.539–7.772)	0.003

27.620 (3.554–214.637) in the age-group ≥ 80 years (p-value = 0.00). Thus, older age is an independent predictor of death among COVID-19 patients (Table 4).

Gender

Regarding gender, males were significantly more associated with death, with an HR and 95% CI of 1.150 (1.028–1.287) (p-value = 0.015). This association remained significant in the multivariable regression. Consequently, the male gender is considered to be an independent risk factor of death among COVID-19 patients (Table 4).

Nationality

Our results show that nationality was significantly associated with death. Non-Saudis were associated with more deaths than Saudis; this is represented by a HR and 95% CI of 0.674 (0.607–0.747). After controlling for all other baseline factors, the Saudi nationality remained independently significant and correlated with a lower risk of death (Table 4).

Occupation

Occupation was also associated with death, where healthcare workers showed lower death cases than non-healthcare workers; being a healthcare worker was associated with a HR and 95% CI of 0.124 (0.085–0.182). This association was rendered non-significant in the multivariable model (p-value = 0.863), accordingly, this variable is not considered independent (Table 4).

Region

There was no significant association with death among different regions in the univariable model, taking Al-Qurayyat as a reference. After adjusting for all other variables, only Jazan had a significant

association with death, represented by a HR and 95% CI of 9.853 (1.153–84.205) (p -value = 0.037) (Table 4).

Travel-related exposure

Travel-related exposure was associated with death in both the univariable and the multivariable models. The unadjusted odds ratio was 13.909 (9.091–21.280) and remained high after adjusting for all other variables with a HR and 95% CI of 10.213 (6.226–16.752). Therefore, travelling outside KSA is an independent risk factor in COVID-19 patients (Table 4).

Symptomatic patients

The presence of symptoms was associated with an increased death rate that was significant in both the univariable and multivariable models. The unadjusted model had a HR and 95% CI of 8.759 (7.048–10.887), which changed to 3.459 (1.539–7.772) after adjusting for all other variables, thus the presence of symptoms is considered an independent risk factor for death in COVID-19 patients (Table 4).

Discussion

Saudi Arabia was one of the first Gulf countries to take preventive measures on a national scale, even before its first confirmed case of COVID-19. The Saudi government underwent actions on both the national and international levels, including suspension of regional and international flights, lockdown of major cities and imposing curfews, and suspending large mass gathering events like Umrah and Hajj. The aim of our study was to understand the clinical and demographic characteristics of COVID-19 patients in KSA, as well as the risk factors associated with mortality. Our results show that the majority of confirmed cases were young and middle-aged, with ages ranging between 20–59 years, which can be related to the generally young population of KSA. Similarly, in a report from the Chinese Centers for Disease Control and Prevention (CDC) that included approximately 44,600 confirmed infections, 87% of patients were between 30–79 years [22]. Additionally, the age distribution of COVID-19 cases in Japan showed the highest number of confirmed cases in the age-group 20–59 years, with a percentage of 57.7% [23]. Furthermore, our results show that there was a difference in the sex ratio, where males constituted 71.7% of cases, while females represented only 28.3% of cases. This may be partly attributed to culture, as it is more common for males to be outdoors, and many females wear a niqab. Contrarily, a study by Sobotka et al. on data from ten European countries, found that among people of working age, women with COVID-19 substantially outnumbered men. Though, after retirement, this pattern was reversed, with the male disadvantage peaking within the age-group 70–79 years [24]. However, the WHO reported a relatively even distribution of COVID-19 infections between females and males; 47% versus 51%, respectively, with some variations across age-groups [25].

Moreover, we found the contraction of COVID-19 to be travel-related in 45.1% of cases. We also found that travelling outside KSA was an independent risk factor associated with death in COVID-19 patients. This is consistent with data stating that travel increases the risks of getting infected and spreading COVID-19 [26,27]. Additionally, health officials in Ireland reported a rise in the number of cases and deaths as restrictions on overseas travel eased [28].

Signs and symptoms were reported in 63% of the cases in our study. The most commonly reported symptoms were fever, cough, sore throat, and runny nose, present in 85.2%, 85%, 65.5% and 44.3% of cases, respectively. Likewise, a systematic review and meta-analysis of 148 studies from nine countries revealed that fever and cough were the most prevalent symptoms, present in 78% and 57% of patients, respectively [29]. Furthermore, a report by the WHO–China Joint Mission on COVID-19 revealed that based on 55,924

confirmed cases, typical symptoms were mainly fever, dry cough, fatigue, and sputum production, present in 87.9%, 67.7%, 38.1%, and 33.4% of patients, respectively [14]. Moreover, a study conducted by Burke et al. on a convenience sample of 199 patients in the United States, revealed that 97% of patients experienced symptoms, the most common of which were cough (84%), fever (80%), chills (63%), and myalgia (63%) [30].

Our study showed that among the different age-groups, deaths occurred more frequently in the middle and slightly older age-groups, where 40–49 years, 50–59 years, and 60–69 years represented 19.2%, 27.9%, and 21.3% of death cases, respectively. Likewise, the U.S. CDC shows that the death toll in America skews significantly younger, as patients 40–60 years account for the majority of COVID-19 deaths [31,32]. Contrarily, the highest number of deaths in Japan was seen among patients aged ≥ 80 years, representing 56.7% of deaths [23]. Similarly, in Italy, one of the worst-hit countries with a fatality rate of 14%, deaths were found to be much higher in older age-groups, where 26.2% of deaths were in the age-group 70–79 years, and 58.9% of deaths were in those ≥ 80 years [33]. This, however, can be attributed to the age structure of the Italian population, as it is the second oldest in the world [34]. Additionally, young age has been generally found to have a protective effect against COVID-19, which could explain the varying death rates in different countries and why COVID-19 related deaths in Arab countries remains far below the rates seen in some Asian and European countries with older populations [35,36].

Moreover, the CFR in our study was higher in older age-groups reaching 3.9% in the 60–69 age-group, 6.15% in the 70–79 age-group and 10.05% in those ≥ 80 years. Consistently, a study by Esteve et al. based on harmonized census data from 81 countries, describing the direct effect of the age structure of the population on the death rate, as evidence shows that the risk of mortality and severe disease increases greatly with age, making it a key factor that can determine the vulnerability of different countries to COVID-19 [37]. We also found that the CFR for males in this study was higher than that of females and that males were significantly more associated with death. This is consistent with data published by the WHO, where a preliminary analysis of 77,000 deaths in the case-based reporting database (approximately 30% of all known deaths), there was a higher number of deaths (58%) in men [25].

Furthermore, our study results show that about 7.7% of patients reporting occupations were healthcare workers. This is consistent with figures released by the International Council of Nurses, based on data from 30 countries, showing that 6% of all confirmed COVID-19 cases are among healthcare workers [38]. Nevertheless, in a study conducted in the US, out of 49,370 confirmed cases, 19% were identified as healthcare workers [39]. Our study showed no significant association with COVID-19-related deaths among the different regions. Though, a study conducted in India found some variability in the number of cases across different regions; their results suggested that comparatively dry and hot regions in lower altitudes of India are more prone to COVID-19 transmission [40].

Conclusion

With the increase in COVID-19 cases in KSA, there is a massive need for further monitoring of the patterns of infection, morbidity, and mortality to identify gaps and prepare strategies for the prevention and management of this pandemic. The Saudi government and health authorities are carefully monitoring the evolution of this virus to halt its transmission. Highlighting risk factors correlated with death was also crucial to enhance readiness through proper medical care and prevention regulations. The large sample size in our study is a major advantage to carefully understand and deal with this pandemic; however, further analysis is still

required including the incubation period, pathogenesis of complicated patients, risk factors for transmission, role of infection control measures, and effective management strategies.

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Competing interests

None declared.

Ethical approval

This study complied with the ethical standards, and with laws and regulations and any applicable guidelines of the Kingdom of Saudi Arabia where the study was conducted.

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