LIBYAN JOURNAL OF MEDICINE
2021, VOL. 16, 1910195
https://doi.org/10.1080/19932820.2021.1910195

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ORIGINAL ARTICLE

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CPMPARISON between COVID-19 and MERS demographic data in Saudi Arabia: a retrospective study

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ABSTRACT
The outbreak of corona virus disease (COVID-19) caused by the new severe acute respiratory syndrome corona virus 2 began in Wuhan, China, resulting in respiratory disorders. In January of 2020, the World Health Organization declared the outbreak a pandemic owing to its global spread. Because no studies have investigated COVID-19 in Saudi Arabia, this study investigated similarities and differences between demographic data during the COVID-19 and Middle East respiratory syndrome (MERS) outbreaks in Saudi Arabia. A retrospective trend analysis was performed to assess demographic data of all laboratory-confirmed MERS and COVID-19 cases. Patients' charts were reviewed for data on demographics, mortality, citizenship, sex ratio, and age groups with descriptive and comparative statistics; the data were analyzed using a non-parametric binomial test and chi-square test. Of all COVID-19 patients in Saudi Arabia,78%were male patients and 22% were female patients. This proportion of male COVID-19 patients was similar to that of male MERS patients, which also affected male patients more frequently than female patients. The number of COVID-19-positive Saudi cases was lower than that of non-Saudi cases, which were in contrast to that of MERS; COVID-19 appeared to be remarkably similar to MERS with respect to recovered cases. However, the numbers of critical and dead COVID-19 patients have been much lower than those of MERS patients. The largest proportion of COVID-19 and MERS cases (44.05% and 40.8%, respectively) were recorded in the Western region. MERS and COVID-19 exhibited similar threats to the lives of adults and the elderly, despite lower mortality rates during the COVID-19 epidemic. Targeted prevention of and interventions against MERS should be allocated populations according to the areas where they inhabit. However, much more information regarding the dynamics and epidemiology of COVID-19 in Saudi Arabia is needed.
Abbrevation : MERS: Middle East Respiratory syndrome; COVID-19: Corona Virus Disease 2019.

ARTICLE HISTORY
Received 21 September 2020
Accepted 25 March 2021

KEYWORDS
COVID-19; MERS; Saudi Arabia; respiratory illness

1. Background

Middle East respiratory syndrome (MERS) is a viral infection caused by Middle East respiratory syndrome coronavirus (MERS-CoV) that is part of a wide family of viruses called beta corona viruses [1]. MERS-CoV infects humans and animals (camels and bats). Only two coronavirus strains have been found to infect humans: MERS-CoV and severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [2]. MERS-CoV induces upper respiratory illnesses that range from mild to moderate severity in humans [3].

In December 2019, an outbreak of the beta coronavirus disease known as coronavirus disease (COVID-19) and caused by SARS-CoV-2 arose in the city of Wuhan, China. China reported the outbreak to the World Health Organization (WHO). Soon after the outbreak in China, the virus disseminated globally to such an extent that the WHO declared COVID-19 a pandemic during the first months of 2020 [4].

Despite the large percentages of self-recuperating cases, approximately 20% of cases have serious signs and symptoms, grading from mansion of respiration to trauma and numerous organ failures [4,5]. Such cases demand emphatic concern and require specific supplies and equipment for treatment, such as breath-sustaining instruments [4]. It is assumed that the incubation period is approximately 14 days, but most patients exhibit symptoms 4–5 days after exposure [6,7]. The disease's fatality rate approached 2.3% of recorded infected persons, which was lower than that of MERS (34.4%) [8]. Furthermore, certain cases have an extreme hazard of death owing to distinct demographic factors, co-morbidities, and differences in immune responses among populations [9].

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Since SARS-CoV-2 comes from the same family of coronaviruses as MERS-CoV, Some studies showed that MERS and COVID-19 are similar where both cause pneumonia and respiratory disorders [10,11].

current genetic and epidemiological information suggests that SARS-CoV-2 is a zoonotic virus with conceivable transmission directly from wild animals or via middle hosts or at least via materials they produce [8]. Potential human-to-human transmission has been recorded in China, where many healthcare providers have become infected in healthcare facilities that have reported admitted cases and deaths [12].

However, there is not much information regarding SARS-CoV-2 to draw definitive conclusions about the transmission mode, clinical presentation, or extent to which it has spread. Additionally, as of the date of writing this manuscript in August 2020, no studies have investigated COVID-19 in Saudi Arabia. Therefore, this study will provide new insights into the risk factors and co-morbidities of COVID-19 in Saudi Arabia.

2. Objective

This study aimed to compare the demographic data of COVID-19 and MERS outbreaks in Saudi Arabia. The specific objectives were to determine emerging risk factors associated with COVID-19 and MERS in Saudi Arabia and provide a baseline model to differentiate between COVID-19 and MERS surveillance, prevention, and intervention in healthcare and community settings.

3. Methods

3.1. Ethical approval

The study was approved by the institutional review board of the Princess Nourah Bint Abdulrahman University (IRB Approval Number: 20–0217).

3.2. Study parameters

This study analyzed MERS- and COVID-19-positive cases as reported in the websites of the Saudi Ministry of Health (SMOH), the Saudi Center for Disease Prevention and Control (Wegaya), and World Health Organization (WHO) from February 2015 to August 2015 and from December 2019 to June 2020, respectively.

3.3. Study design

A retrospective analysis was performed to identify demographic data of all laboratory-confirmed MERS and COVID-19 cases. Patients' charts were reviewed for data on demographic information, mortality, citizenship, sex ratio, and age groups with descriptive and comparative statistics, and the data were analyzed using a non-parametric binomial test and chi-square test.

3.4. Inclusion criteria for MERS and COVID-19 confirmed cases

The main inclusion criterion was the appearance of certain signs and symptoms adopted by the SMOH and WHO, such as fever and respiratory disorders (acute respiratory infection), including cough, restriction of breath, and pneumonia. Patients with moderate signs and symptoms were excluded from the study according to the recommendations of the SMOH and WHO [13].

A confirmed case was defined as a suspected case that received laboratory confirmation of COVID-19 [2,13].

3.5. Definition of patients with acute respiratory infection

Both the SMOH and WHO define 'patients with acute respiratory infection' as patients experiencing sudden onset of at least one of the following symptoms: fever or a recent history of fever, cough, sore throat, or shortness of breath. Additionally, in the 14 days prior to the onset of symptoms, the patient must have met at least one of the following epidemiological criteria: had a history of travel to areas with presumed ongoing community transmission of COVID-19 (China, Iran, South Korea, Japan, Singapore, Hong Kong, or any updated information added on the WHO website).

3.6. Sample size

During the study period (March to June 2020) 1823 cases of COVID-19 has been reported while 281 cases of MERS has been reported between March to June 2019. These cases could be generalized to Saudi Arabia because they represented patients from the different regions of Saudi Arabia.

3.7. Statistical analysis

SPSS software version 19.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analyses. Data were analyzed using a non-parametric binomial test and chi-square test [14].

4. Results

4.1. Comparison of fatality rates during COVID-19 and MERS outbreaks

When fatality rates during the two outbreaks were compared over a period of approximately 3 months, statistical analysis (considering conventional criteria) revealed insignificant differences when results were analyzed using a two-tailed T-test where the p-value was 0.2260 ($p < 0.05$). The confidence interval for the mean of Group One minus Group Two was 385.50, and the 95% confidence interval for this difference was from −313.63 to 1084.63. Intermediate values used in calculations were as follows: $t = 1.3492$, $df = 6$, and standard error of difference = ±285.720 (Table 1, Figure 1).

4.2. Comparison of the distribution of positive cases between Saudi and non-Saudi patients during the two outbreaks

When the number of positive Saudi cases was plotted against that of positive non-Saudi cases during the two outbreaks, the chi-square test revealed a significant difference ($p < 0.05$) with a chi-square value of 117.1188 and chi-square value with Yates correction of 115.6269 (Table 1, Figure 2).

4.3. Comparison of the distribution of MERS and COVID-19 between male and female patients

When the distribution of infection between the two sexes was compared during the two outbreaks, statistical analysis using a chi-square test showed significant differences with a chi-square value of 45.4315 ($p < 0.05$). In contrast, the chi-square value with Yates correction was 44.4324 ($p < 0.05$) (Table 1, Figure 2).

4.4. Distribution of MERS and COVID-19 among three age groups

When the distribution of infection among children, adults, and elderly was compared between the two outbreaks, statistical analysis showed a significant difference with a chi-square statistic of 155.474 ($p < 0.05$) (Table 1, Figure 2).

4.5. Distribution of COVID-19 and MERS cases in the five regions of Saudi Arabia

When the distributions of positive cases during the two outbreaks in the five regions of Saudi Arabia (Central, Western, Eastern, Southern, and Northern regions) were compared, the chi-square value was16.3496 and p-value was 0.002584 ($p < 0.05$) (Map 1).

Table 1. Demographic characteristics of COVID-19 and MERS outbreaks in Saudi Arabia from March to June 2020 and March to June 2019.

Outbreak Demographic Characteristics (No. of)		COVID-19 (n = 1823)	MERS (n = 281)
Situation of cases	Total recovered cases	1,210 (66.4%)	188 (66.9%)
	A active cases	571 (31.3%)	16 (5.7%)
	Critical cases	27(1.48%)	22 (7.83%)
	Dead cases	15(0.82%)	55 (19.57%)
Citizenship of cases	Citizen patients (Saudi)	491 (26.9%)	166 (59.1%)
	Non-citizen patients (non-Saudi)	1332 (73.1%)	115 (40.9%)
Sex of patients	Males	1422 (78%)	167(59.4%)
	Females	401 (22%)	114 (40.6%)
Age groups	Children	146 (8.01%)	9 (3.2%)
	Adults	1605 (88.04%)	206 (73.31%)
	Elderly	72 (3.95%)	66(23.49%)

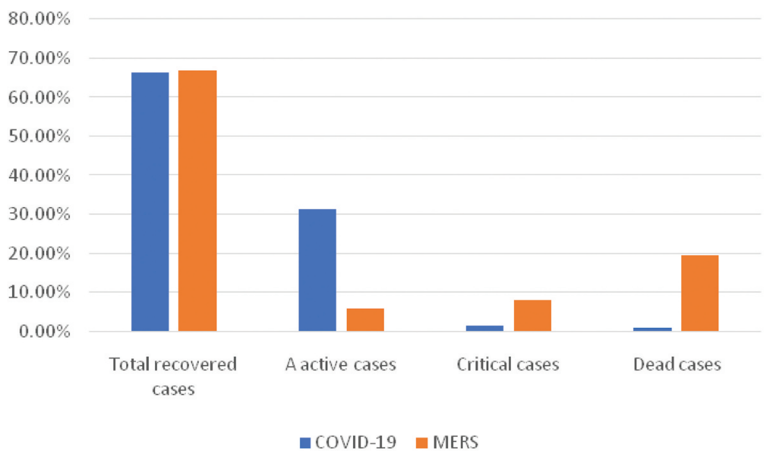


Figure 1. CFR of COVID-19 in Saudi Arabia from 2 March 2020 to 15 June 2020.

Table 2. Epidemiological distribution of COVID-19-positive cases in Saudi Arabia from December 2019 to June 2020.

Region	Riyadh	Makkah	Madinah	Eastern Province	Qassim	'Asir	Al Bahah	Jizan	Najran	Tabuk	Northern Borders	Jawf	Ha'il
Percentage of cases %*	29.5	34.3	9.6	20.3	1.16	1.5	0.16	1.17	0.38	0.86	0.25	0.1	0.4

*(Total number of cases = 1823)

4.6. Distribution of positive COVID-19 cases in the different cities of Saudi Arabia

The distribution of positive COVID-19 cases in different cities in Saudi Arabia showed that the largest proportion of cases was recorded in Makkah (34.3%) followed by Riyadh (29.5%), while Jouf had the smallest proportion of cases (0.1%) (Table 2, Figure 3).

5. Discussion

Key results: MERS-COV was significantly harmful and fatal compared to COVID-19, besides in contrast to COVID-19; MERS-COVS tended to affect Saudi citizens more than non-Saudi residents.

5.1. Interpretations

The global COVID-19 pandemic was initially reported in China in December 2019, with the first cases being diagnosed as virus-borne pneumonia.SARS-CoV-2 was isolated from biologic samples then sequenced until it was identified as a beta corona virus [15]. Because of this, the virus has compared been to the other beta corona viruses such as SARS-CoV and MERS-CoV. The COVID-19 pandemic (as of the time of writing this paper in August 2020) has caused 10,922,324 cases and 523,011deaths worldwide [2].

Like many other countries, Saudi Arabia experienced outbreaks of MERS during between 2009–2019. Many researchers and health care providers have been uncertain whether the dynamics and risk factors of COVID-19 are similar to those of MERS [16]. However, similarities between MERS and COVID-19 have been recorded in some studies regarding the key signs and symptoms, mode of transmission, diagnosis, containment, and prevention [10].

Understanding the demographic data of COVID-19 would provide evidence regarding the current situation of the epidemic depending on the disease severity. Therefore, this study provides a trend analysis of demographic data of COVID-19 compared with those of MERS in Saudi Arabia.

The case-fatality ratio (CFR) is defined as the ratio of total deaths to total positive cases. This ratio is mostly variable among countries where patients differ with respect to age, sex, and health fitness [17]. Results of this study showed that the CFR of MERS significantly exceeded that of COVID-19, and this finding agreed with that of another published research that reported that COVID-19 seems similar to SARS with regard to its clinical features but is less fatal than MERS [8].This current study revealed that the CFR of COVID-19 was 0.82%, which is closer to the findings of another study that found that 0.65% of COVID-19 patients died [3]. The lower mortality rate of COVID-19 patients in Saudi Arabia

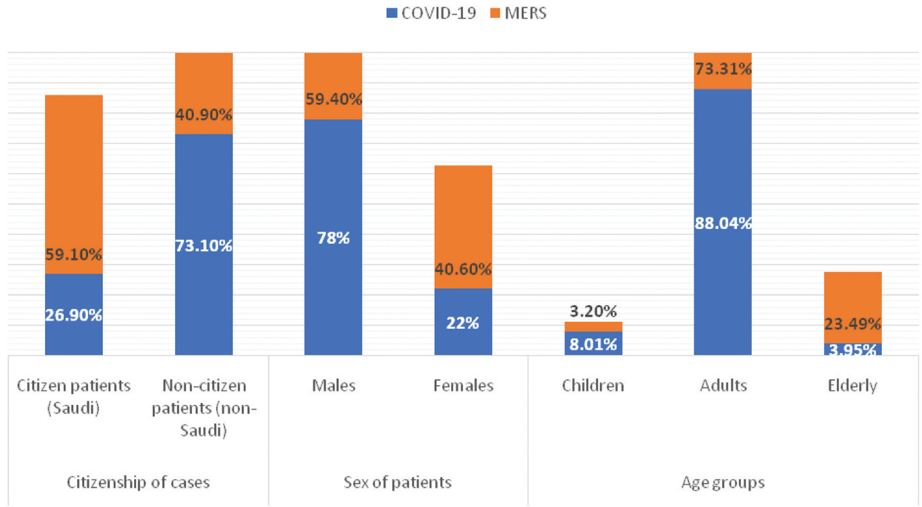
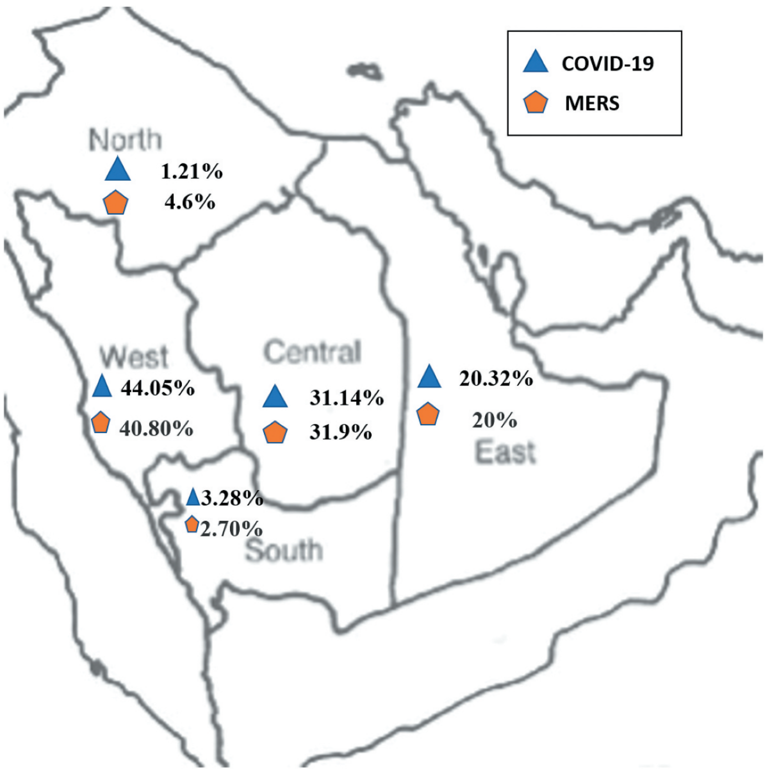


Figure 2. Distribution of MERS and COVID-19 among Saudi and non-Saudi cases, gender of patients and age groups.

may be attributed to the perfect interventions during the outbreak. This finding coincides with the results of another study reported that New Zealand has the lowest mortality of COVID-19 due to their strict containment of the disease [18].

The current results showed that the number of non-Saudi patients (73.1%) significantly exceeded that of Saudi patients (26.9%). These findings contrast those of a similar study conducted in Saudi Arabia [3], which showed that the number of Saudi patients was significantly higher than that of non-Saudi patients (53.4% and 46.6%, respectively). This difference may be explained by the dates of the two investigations: the current study was conducted between December 2019 and June 2020 and another study was conducted during one month (March 2020), after the disease was established in the Saudi community [19]. The distribution of the disease between the two sexes revealed that male individuals were significantly more infected with COVID-19 than female individuals. This finding is consistent with that of a previous study that also



Map 1. Epidemiological distribution of COVID-19 and MERS in Saudi Arabia during the last outbreaks (6-month duration each).

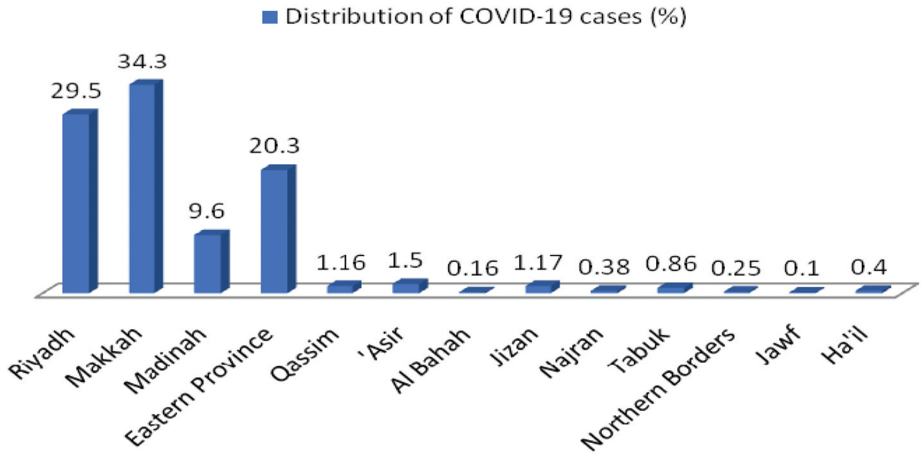


Figure 3. Epidemiological distribution of COVID-19-positive cases in Saudi Arabia from December 2019 to June 2020.

showed that men were more likely to be infected than women [20]. Previous studies likewise revealed that the number of men infected exceeded the number of women infected during the MERS epidemic [19,21].

Regarding age groups, the current results revealed that both MERS and COVID-19 affect mostly adults, followed by the elderly and then children. These results agree with those of another study that recorded that 19.4% of patients were aged between 36 and 45 years, while 15.9% (n = 241) were aged between 46 and 55 years and 11.1% (*n* = 169) were aged between 56 and 65 years, with the smallest proportion of patients (5.9%, *n* = 90) being aged 66 years and above [3,21].

Referring to raw data, patients were similarly distributed among the Saudi regions during the two epidemics, with most cases occurring in the Western region followed by the Central, Eastern, Northern, and Southern regions, in that order. Results also showed that most COVID-19 cases were from Makkah, followed by the capital of Saudi Arabia- Riyadh, while the lowest number of cases was recorded in Jawf. This result is consistent with the findings of another studies conducted in Saudi Arabia [19,22–24]. These results may provide important evidence of where to prioritize and adjust prevention and intervention strategies during future respiratory illness outbreaks. The main limitation of this study is that it has compared the demographic data of the two outbreaks during a limited period of time. Further studies are required to compare the entire periods of the two outbreaks.

6. Limitations

This study investigated the demographic data recorded during the last MERS-COV and COVID-19 in Saudi Arabia during limited period of time so the main limitation is that

the number of new cases recorded after writing this paper was neglected. In addition, certain risk factors were studied according to the available data.

7. Conclusions

This research studied and analyzed the demographic data associated with MERS and COVID-19 in Saudi Arabia because the two infections more likely exhibited similar signs, symptoms and mode of transmission. Dissemination of COVID-19 was rapid around the world to the extent that it has been considered a pandemic in a short time after the infection has initially flared up in China. The study findings indicated that targeted preventions and interventions should be allocated to particular populations according to the areas where they inhabit. Findings of this study also provided useful information that may help in preventing supplementary epidemics of COVID-19 by highlighting the risk factors associated with this disease in Saudi Arabia. The study also raised an important question: Does the lessons learned from the previous MERS epidemics in Saudi Arabia were the best ways to combat emergent new global pandemic like COVID-19? However, much more information regarding the dynamics and epidemiology of COVID-19 in Saudi Arabia are required to answer this question.

Acknowledgments

This research was funded by the Deanship of Scientific Research at Princess Nourah bint Abdulrahman University through the Fast-track Research Funding Program.

Disclosure statement

The authors declare no conflict of interest.

Ethics approval and consent to participate

The data were obtained from the Saudi Ministry of Health and World Health Organization records and the study conducted under the approval of the Regional Directorate of Primary Health according to ethical standards with the maintenance of anonymity of each patient. Thus, all the data of patients was recorded without patients details, it was not necessary to obtain the personal consent of the study participants. The study was ethically approved by the institutional review board of the Princess Nourah Bint Abdulrahman University (IRB Approval Number: 20–0217).

Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Disclosure statement

No potential conflict of interest was reported by the author.

Authors' contribution

RAM designed the study, obtained MERS- COV data, wrote – edited- and revised the manuscript, and made the submission to the journal. FATH obtained the ethical approval, shared writing the manuscript, made the statistical analysis, and edited the references.

Funding

This research was funded by the Deanship of Scientific Research at Princess Nourah bint Abdulrahman University through the Fast-track Research Funding Program.

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