

# Middle East respiratory syndrome in Al Ahsa, Saudi Arabia, 2015-18: a lingering epidemic

Hanan Al Shaikh, Balaji Rama Naik,  
Ahmed Saleh Alsaad, Abdullah Ali Albinsaleh

Directorate of Health Affairs,  
Ministry of Health,  
Al Ahsa,  
Kingdom of Saudi Arabia

10.3396/ijic.v16i2.012.20

## Abstract

Middle East respiratory syndrome (MERS), an emerging disease with fatal outcomes, has limited information on regional variations and their impact on the control measures. The aim of this study was to describe data on distribution of and possible association of risk factors for the disease and poorer outcomes, and recommendations for better control of the disease. Data were collected for 2015-2018 in Al Ahsa, the largest region (population 1.2 million) in the eastern part of Saudi Arabia.

In total, 103 cases were reported during the study period with fever and cough as predominant presenting symptoms. The majority were male, >50 years old, and Saudi nationals. One third of patients had comorbid conditions (diabetes and cardiac predominantly). Occupation profiles of the patients varied, with camel owners and security personnel constituting 40% of the study population.

In conclusions, older age, nationality, extracorporeal membrane oxygenation (ECMO) treatment, and associated comorbid conditions were found to be probable risk factors for poor outcomes. The mortality rate (59%) was distinctly higher in patients aged >60 years. The study highlights probable risk factors for poor outcomes in MERS patients, and discusses scope for further intervention and better management.

**Keywords:** Middle East respiratory syndrome, risk factors, mortality, Saudi Arabia

## Corresponding Author

Dr. Balaji Rama Naik;

Infection Control Specialist, Infection Prevention and Control Administration. Directorate of Health Affairs, Al Ahsa, Ministry of Health, Saudi Arabia.

E-mail: drbalajinaik@gmail.com

## Introduction

Middle East respiratory syndrome (MERS), caused by the MERS-Corona Virus (MERS-CoV), is one of the top 10 emerging diseases listed by the World Health Organization (WHO), based on case fatality rate and transmissibility. MERS has entered the human population because of human contact with infected dromedary camels.<sup>1</sup>

Initial reports of MERS were published in 2012 from Saudi Arabia; research continues to improve scientific understanding of the virus.<sup>1,2</sup> Globally, outbreaks of MERS have been reported periodically;<sup>3</sup> smaller regional outbreaks occur, which can develop into epidemics. Understanding these variations in disease presentation will help prevent further outbreaks. Here we describe socio-demographic features of MERS cases in Al Ahsa (population: 1.2 million; largest region in the eastern part of Saudi Arabia) from a four-year (2015-2018) dataset.<sup>4</sup>

## Methods

Setting: Ministry of Health (MoH) and private health care facilities of Al Ahsa, the largest governorate in the eastern province of Saudi Arabia.

## Study design

Descriptive study based on routinely collected program data. Data collected by Infection Control Administration and the Regional Center for Command and Control (CCC) of Al Ahsa region for 2015 to 2018 for all confirmed cases of MERS Co-V were used; all included MERS cases were treated in hospitals designated by the MoH. Data were extracted from the rapid response team (RRT) reports prepared by RRT members as and when the cases were notified. The key variables included in the study were age, sex, nationality, history of contact with camels, extracorporeal membrane oxygenation (ECMO) treatment, comorbid conditions (Table I). Data were analyzed for socio-demographic characteristics, primary/ secondary status of the cases, presenting complaints, existing comorbidities, time delays during the course of management, presence of pneumonia on chest X-ray, history of contact with camels/ camel products, and patient outcome. The case definition for confirmed cases was as per MoH regulations.<sup>5</sup>

## Statistical Analysis

Data were analyzed using the EpiData analysis software (Version V2.2.2.185; EpiData Association, Odense, Denmark). Frequencies and proportions were calculated. Differences between groups were compared using Chi square tests and 95% confidence intervals (CIs). A p-value of  $\leq 0.05$  was considered as statistically significant.

## Results

Over a four-year period (2015-2018), 103 confirmed MERS cases were reported. The majority (69%) were men, median age (inter quartile range - IQR) was 53 years (37.3-63.5), with a higher proportion (58%) of patients aged > 50 years. The socio-demographic and clinical characteristics are shown in Table I. The median (IQR) duration from symptom onset to death and from admission to death was 16 days (6 to 22) and 17 days (8 to 26), respectively.

Bivariate analyses with death as outcome are shown in Table II. Among comorbidities, diabetes mellitus alone or in combination with other diseases was found in 47 (63%) out of 75 comorbid patients. Ischemic heart disease with or without other conditions was reported in 44% patients and hypertension was found in 66% patients. Thirteen patients were smokers and nine had renal issues. There were seven patients with multiple comorbidities. The overall death rate was 46%. Death rate among patients aged 60 years and above was 64% with the highest rate of 86% among patients aged more than 80 years. Of the 10 patients on ECMO, nine died during treatment. A high proportion (56%) of patients who died had a history of contact with camels, but the finding was statistically insignificant ( $p=0.14$ ).

Fever and cough were the most common presenting symptoms (75% cases). Other symptoms included shortness of breath (33%), vomiting (17%), chest pain (10%), abdominal pain (8%), constipation (7%), and diarrhea (7%). The job profiles of the patients were: security officer (20%), camel owner (20%), and the remaining were driver, retired personnel, construction worker, house wife, feed market vendor and nurse. For those who died; the job profiles were: camel owner (30%), construction worker (15%) and the rest constituted retired personnel, security officer, feed market vendor, and house wife.

**Table I. Socio-demographic and key clinical characteristics of confirmed Middle East Respiratory Syndrome cases in Al Ahsa, Saudi Arabia (2015-2018).**

Characteristic	MERS* Cases (N=103) No (%)
<b>Age</b>	
<50 years	42 (41)
≥50 years	61 (59)
<b>Sex</b>	
Male	75 (73)
Female	28 (27)
<b>Nationality</b>	
Saudi	75 (73)
Non-Saudi**	28 (27)
<b>Type of case</b>	
Primary	36 (35)
Secondary	61 (59)
Unknown	6 (6)
<b>Health care worker</b>	
Yes	19 (18)
No	84 (82)
<b>Contact with camel</b>	
Yes	34 (33)
No	69 (67)
<b>Contact with human case - probable or confirmed</b>	
Yes	53 (52)
No	50 (48)
<b>Associated comorbidity</b>	
Yes	75 (73)
No	28 (27)
<b>Patient on ECMO††</b>	
Yes	10 (10)
No	93 (90)
<b>Duration between admission and death (days)</b>	
<7 days	17 (38)
≥7 days	28 (62)
<b>Duration between onset of symptoms and death (days)</b>	
<7 days	13 (29)
≥7 days	31 (71)

\* MERS: Middle East respiratory syndrome

\*\* Non-Saudi: Philippine, Indian, Egyptian, Bangladeshi, Pakistani, Sudanese, Syrian and Jordanian

ECMO: Extracorporeal membrane oxygenation

Table II. Risk factors for death from MERS.

Characteristic	Number (%) of MERS* patients who died (n=47)	Number (%) of MERS patients who survived (n=56)	P value
<b>Age (years)</b>			
20-39	6 (25)	18 (75)	0.0125
40-59	18 (42)	25 (58)	
60-79	17 (59)	12 (41)	
80-99	6 (86)	1 (14)	
<b>Sex</b>			
Male	28 (48)	30 (52)	0.4035
Female	10 (39)	16 (61)	
<b>Type of case</b>			
Primary	10 (59)	7 (41)	0.4133
Secondary	25 (41)	36 (59)	
Unknown	3 (50)	3 (50)	
<b>Nationality</b>			
Saudi	34 (56)	27 (44)	0.0016
Non-Saudi**	4 (17)	19 (83)	
<b>Comorbidity<sup>§</sup></b>			
Present	34 (56)	27 (44)	0.0016
Absent	4 (17)	19 (83)	
<b>Patient on ECMO<sup>§§</sup></b>			
Yes	9 (90)	1 (10)	0.0030 <sup>¶</sup>
No	38 (41)	55 (59)	
<b>Contact with MERS case</b>			
Yes	22 (43)	29 (57)	0.5413
No	16 (49)	17 (51)	
<b>Contact with camel</b>			
Yes	19 (56)	15 (44)	0.1426
No	28 (41)	41 (59)	

\* MERS: Middle East respiratory syndrome

\*\* Non-Saudi: Philippine, Indian, Egyptian, Bangladeshi, Pakistani, Sudanese, Syrian and Jordanian

**Comorbidity:** Associated conditions like diabetes mellitus, hypertension, ischemic heart disease, obesity, smoker, renal disease

§§ ECMO: Extracorporeal membrane oxygenation

¶ Fishers exact p value

## Discussion and Conclusion

The study highlights older age, nationality, ECMO treatment, and associated comorbid conditions as probable risk factors for poor outcomes. Excluding health care workers (21% of the cases), the majority of patients were elderly. The mortality rate was distinctly higher in patients aged >60 years in our study, compared to previous studies.<sup>6</sup> Systematic reviews have strongly linked associated comorbidities with poorer outcomes.<sup>7</sup> Male sex was not a risk factor for death, which was not in agreement with findings from other studies.<sup>7</sup> Though not statistically significant in our study, relationship between exposure to camels and MERS has been reported to be strong. Being a Saudi national was strongly associated with death, similar to Aleanizy *et al.*<sup>8</sup> Though the reasons for this association are yet unclear; cultural issues and the intimacy of the people with camels might be a plausible area of exploration (personal communication).

Our study has few limitations. It was out of scope to capture cultural and personal behavior of the patients. We did not analyze the extent and type of contact with camels or camel products, which may have impacted study outcomes.

The occupational profiles of the patients need exploration. More than 50% of patients who died were involved in occupations with close contact with camels, camel products, or probable MERS-infected patients. The list of job profiles can be considered in designing cost-effective interventions for prevention, early detection and timely management.

Ninety percent patients on ECMO died, in agreement with findings from a study by Al Ghamdi *et al.*,<sup>9</sup> indicating that severity of illness at admission prognosticates poor outcomes irrespective of age. Overall mortality was higher in patients aged >60 years, but patients on ECMO were 41 years on average. There was no evidence of treatment delay in these cases. Patients with compromised lung capacity, ECMO treatment, the elderly, and those with associated comorbidities showed adverse outcomes as shown in other studies too.<sup>10</sup> Among patients who died, 90% had comorbidities, suggesting possible immunosuppressive state and susceptibility to infections. Information about the treatment modalities of the patients was not collected.

The above-mentioned risk factors need to be considered in patient management and necessary modifications adopted. A strong surveillance system for early identification of cases may help save lives. Infection control practices in hospitals need to be strengthened for early detection and effective management, to help prevent occurrence of cases among health care providers and further spread leading to nosocomial outbreaks.

## Ethics approval

National program data were used in this study; no individual patient consents were obtained. Necessary approval for using the data was obtained from the Directorate of Health Affairs, Al Ahsa, Saudi Arabia.

## Acknowledgements

We are grateful to the Al Ahsa Command and Control Centre, Directorate of Health Affairs, Saudi Arabia, for allowing us to access the national program data.

## Conflicts of interest:

None.

## Funding

None.

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