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Major Article

Middle East respiratory syndrome coronavirus in the last two years: Health care workers still at risk

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Background: An important emerging respiratory virus is the Middle East respiratory syndrome coronavirus (MERS-CoV). MERS-CoV had been associated with a high case fatality rate especially among severe cases.
Methods: This is a retrospective analysis of reported MERS-CoV cases between December 2016 and January 2019, as retrieved from the World Health Organization. The aim of this study is to examine the epidemiology of reported cases and quantify the percentage of health care workers (HCWs) among reported cases.
Results: There were 403 reported cases with a majority being men (n = 300; 74.4%). These cases were reported from Lebanon, Malaysia, Oman, Qatar, Saudi Arabia, and United Arab Emirates. HCWs represented 26% and comorbidities were reported among 71% of non-HCWs and 1.9% among HCWs ($P < .0001$). Camel exposure and camel milk ingestion were reported in 64% each, and the majority (97.8%) of those with camel exposures had camel milk ingestion. There were 58% primary cases and 42% were secondary cases. The case fatality rate was 16% among HCWs compared with 34% among other patients ($P = .001$). The mean age ± SD was 47.65 ± 16.28 for HCWs versus 54.23 ± 17.34 for non-HCWs ($P = .001$).
Conclusions: MERS-CoV infection continues to have a high case fatality rate and a large proportion of patients were HCWs. Further understanding of the disease transmission and prevention mainly in health care settings are needed.

An important emerging respiratory virus in the last few years is the Middle East respiratory syndrome coronavirus (MERS-CoV). The virus was initially described in a patient from Saudi Arabia in 2012,[1] and subsequently caused a spectrum of infections, from asymptomatic to mild infections,[2] and may result in a life threatening disease with a high case fatality rate.[3] As reported by the World Health Organization, the virus caused a total of 2,279 laboratory-confirmed cases from 27 countries with a case fatality rate of 35%, as of the end of February 2019.[4] Multiple health care–associated outbreaks were described mainly in the Kingdom of Saudi Arabia[5,6] and 1 large outbreak in South Korea spanning >17 health care settings.[7,8] In a systematic screening of all admitted patients with community-acquired pneumonia to a hospital in Saudi Arabia, only 20 (0.74%) of 2,657 screened patients were positive for MERS-CoV by polymerase chain reaction testing.[9] The spectrum of MERS-CoV infection ranges from mild to severe and fulminant infections with severe acute respiratory disease.[5,6] In addition, a large proportion of asymptomatic cases were reported specifically in children.[2] There have been multiple studies of the epidemiology and clinical disease; however, there are no recent data on the epidemiology of MERS-CoV in the last few years. Here, we analyzed publicly available MERS-CoV data to evaluate epidemiology of MERS-CoV in the last 2 years.

METHODS

This is a retrospective analysis of reported cases between December 2016 and January 2019. All reported MERS-CoV cases were obtained from the World Health Organization Web site. These

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cases were systematically reported and were reviewed including line listing.[10] Statistical analysis was done using Minitab version 17 software (Minitab, State College, PA). A significant *P* value was considered for $P < .05$. Boxplots of time to specified events were generated as follows: lapsed time from onset of symptoms to hospitalization, onset of symptoms to confirmation of diagnosis, hospitalization to confirmation of diagnosis, and from onset of symptoms to death. These times (in days) were calculated based on the differences between the date of symptoms onset, date of hospitalization, date of diagnosis confirmation, and date of death (if this was the case).

We used publicly reported anonymized case-patient data reported to the World Health Organization, therefore, there was no requirement for informed consent or institutional review board approval.

RESULTS

In the study period, there was a total of 403 reported cases with a majority being men (n = 300; 74.4%). The mean age ± SD was 52.5 ± 17.3 years. These cases were reported from Lebanon (n = 1, 0.25%), Malaysia (n = 1, 0.25%), Oman (n = 8, 2%), Qatar (n = 3, 0.74%), Saudi Arabia (n = 382, 90.6%), and United Arab Emirates (n = 8, 2%). A line graph of the distribution of cases over time is shown in Figure 1.

Of all the cases, there were 105 (26%) among health care workers (HCWs). Comorbidities were reported among 214 (53%) cases with no available information on 9% of cases. Data on camel exposure were available for 245 cases and 157 (64%) had camel exposure. Although camel milk consumption was reported for 151 cases and 64% did have camel milk ingestion, the majority (97.8%) of those with camel exposures had camel milk ingestion. Classification of MERS-CoV infection was reported for 212 cases; 58% were primary cases and the others (42%) were secondary cases.

Figure 2 shows boxplot of time to specified events for lapsed time from onset of symptoms to hospitalization, onset of symptoms to diagnosis, and onset to death. The case fatality rate was 29.3% in general, and there was a significant difference in the case fatality rates between HCWs (16%) and others (34%) ($P = .001$). The presence of comorbidities was 71% among non-HCWs and 1.9% among HCWs ($P < .0001$). In addition, the mean age ± SD was 47.65 ± 16.28 for HCWs versus 54.23 ± 17.34 for non-HCWs ($P = .001$).

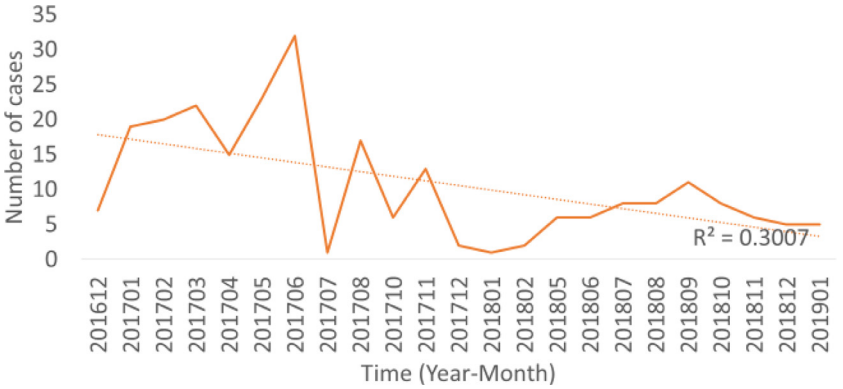
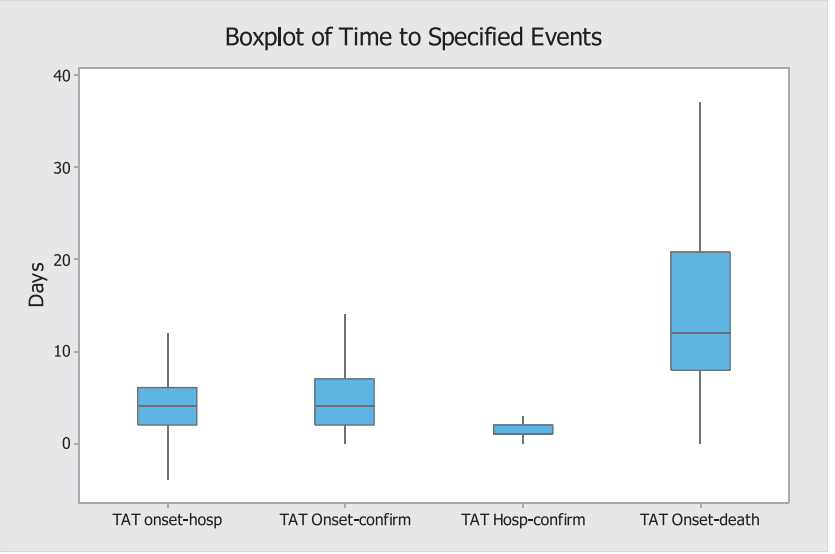


Fig 1. Line graph showing monthly Middle East respiratory syndrome coronavirus cases from December 2016 to January 2019.



TAT= turn-around-time; hosp=hospitalization; confirm=confirmation

Fig 2. Boxplot of time to specified events and was calculated as follows: lapsed time from onset of symptoms to hospitalization, onset of symptoms to confirmation of diagnosis, hospitalization to confirmation of diagnosis, and from onset of symptoms to death. These times (in days) were calculated based on the differences between the date of symptoms onset, date of hospitalization, date of diagnosis confirmation, and date of death (if this was the case). *confirm*, confirmation; *hosp*, hospitalization; *TAT*, turnaround time.

Table 1
A comparison of primary and secondary cases

	Primary cases	Secondary cases	*P* value
Number	136	100	
Age mean ± SD	57.5 ± 16.3	24.8 ± 15.8	<.0001
Male, N (%)	114 (83)	54 (54)	<.0001
Health care workers, N (%)	1 (0.74)	42 (42)	<.0001
Comorbidities, N (%)	108 (82)	31 (45)	<.0001
Camel exposure, N (%)	79/85 (92)	77/107 (72)	<.0001
Death, N (%)	51 (37.5)	14 (14)	<.0001

A comparison between primary and secondary cases is shown in Table 1 and Figure 3. Primary cases were older with higher comorbidities, male sex, and case fatality rate. However, secondary cases were more likely to be HCWs.

DISCUSSION

The total reported cases in the last 2 years was 403 and constitutes 17.6% of all reported cases. These were reported from 6 countries: Lebanon, Malaysia, Oman, Qatar, Saudi Arabia, and United Arab Emirates. However, there was a continued decline in the monthly number of cases. It had also been shown that there was a negative trend and reduction in monthly numbers of primary MERS-CoV cases over a 3-year period from 2015-2017.[11] This continued reduction in the number of cases is primarily owing to containments of the cases and prevention of health care–associated outbreaks.[12] It was also projected that primary MERS-CoV cases would decrease to 5 cases in the spring of 2019.[11]

In the current analysis, a large proportion of cases were among HCWs. The amplification of MERS-CoV is well known to occur in health care settings as the hallmark of its transmission.[12] In previous studies, HCWs represent an important fraction of people with MERS-CoV infection with a reported rate of 14%-64%.[13] From September 2012 to July 2017, of the total cases, 2,040 (31%) were health care facility-associated infections.[14] The present study showed that 26% were among HCWs. During the study period 2017-2018, there was a large outbreak in Saudi Arabia in June 2017 involving 3 health care settings.[15-17] The most common route of transmission of MERS-CoV to HCWs is health care–acquired infections from patients to HCWs.[5,18-25] There are multiple factors contributing to the transmission within health care facilities and these factors were recently reviewed[12] and are clearly reported,[5,18,19,21] as summarized in a previous study.[12] Therefore, all health care facilities should adopt strategies for early detection and isolation of patients suspected to have MERS-CoV infection.[13,20,26] HCWs with MERS-CoV infection were either asymptomatic or had mild disease, and fatal cases were described.[27] Transmission of MERS-CoV among HCWs was reported to result from asymptomatic HCWs.[27]

The presence of comorbidities was seen in 53% of patients in the current study, and it was reported that severe disease tends to occur in people with comorbid diseases and the elderly.[28] The case fatality rate in the current study is 29.3%, and seems to be within the previously reported rates of 28%-64%.[29,30] However, higher case fatality rate was attributed to the inclusion of symptomatic and critical ill patients,[30] and the identification of more asymptomatic cases resulted in reduction in the case fatality rate from 64%-30%.[6,20,31,32] HCWs with MERS-CoV had a lower fatality rate of 7%.[33]

Of those with known camel exposure in the study, 64% had camel exposure mainly as camel milk ingestion. There are multiple studies describing the relationship between camel exposure and MERS-CoV infection. The rate of camel exposure was variable in different studies from 1.7% in a study of 70 cases to 4.3% in a study of 161.[32] In a study of 348 primary MERS-CoV cases, 191 (54.9%) had contact with dromedaries.[34] It is known that the calving season for dromedaries is November and March.[31,35-37] In 1 study, the prevalence of MERS-CoV was higher among camels in the winter time (71.5%) than the summer time (6.2%).[38] However, the current cases occurred at a high number in May and June 2017 and not the winter time.

The study showed interesting points in relation to primary cases in that these patients were older and had higher case fatality rate and comorbidities. The finding is similar to previous analysis of MERS-CoV cases.[34] These differences reflect different risks as primary cases occur frequently among camel exposures and in the community, whereas secondary cases occur mainly in the health care settings with a high rate of young HCWs.

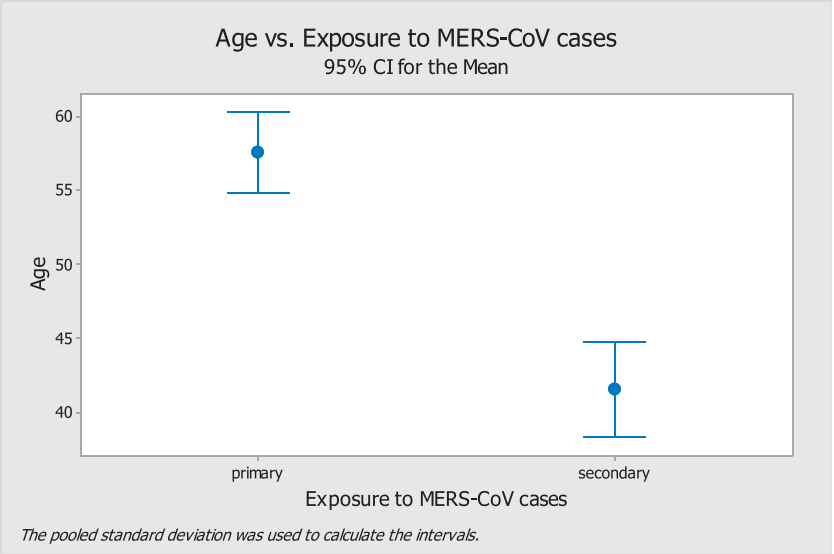


Fig 3. Interval plot of age versus exposure to MERS-CoV cases. *CI*, confidence interval; *MERS-CoV*, Middle East respiratory syndrome coronavirus.

CONCLUSIONS

There remains a large number of MERS-CoV in 2017 and 2018, with a decreasing number over time. HCWs constitute a high-risk group owing to continued exposure at health care settings. Primary cases are older and have a higher case fatality rate. It is important to screen exposed HCWs prior to allowing them to resume medical duties and multiple samples may be needed. In addition, there is a need for continued vigilance and identification of suspected cases.

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