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Global seasonal occurrence of middle east respiratory syndrome coronavirus (MERS-CoV) infection

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Abstract. – OBJECTIVE: Middle East Respiratory Syndrome Coronavirus (MERS-CoV) is an evolving global health crisis. Despite recent efforts, there are numerous notable gaps in the understanding of MERS-CoV seasonal diversity. We aimed at investigating the global seasonal occurrence of Middle East Respiratory Syndrome coronavirus (MERS-CoV) outbreaks.

MATERIALS AND METHODS: We obtained the data on the prevalence and occurrence of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) infection from the World Health Organization (WHO) for all the MERS cases reported from the various countries and their allied ministries. We also recorded the research documents published in various global scientific journals on the seasonal occurrence of MERS-CoV infection during the period 2012-2017.

RESULTS: Worldwide 2048 laboratory confirmed cases of MERS-CoV infection were reported from June 2012 to the Dec 2017. 1680 (82.03%) cases were from the Saudi Arabia and 368 (17.96%) cases were reported from the other countries of the world. The maximum number of cases reported in June was 474 (23.14%). 287 (14.01%) cases were reported from Saudi Arabia and remaining 187 (9.13%) cases were reported from all over the world. The number of cases reported from April to June was 396 (19.33%) while the cases encountered from October to December were 231 (11.27%).

CONCLUSIONS: The highest global seasonal occurrence of Middle East Respiratory Syndrome coronavirus-MERS-CoV outbreak cases were found in the month of June, while the lowest was found in the month of January during the period of 2012 to 2017. The pattern of MERS-CoV infections has been observed to have seasonal variations. It is suggested that the health officials should highlight the seasonal occurrence of MERS-CoV outbreak and take better preventive measures to minimize the disease burden nationally and globally.

Key Words:
MERS, MERS-Co Virus, Coronavirus, Prevalence, Seasonal occurrence.

Abbreviations

Middle East Respiratory Syndrome (MERS), Middle East Respiratory Syndrome Coronavirus (MERS-CoV), World Health Organization (WHO), Gulf Cooperation Council (GCC).

Introduction

The viral infections are the most frequent infectious diseases and common trigger of constituting clinical problems worldwide[1]. Middle East Respiratory Syndrome coronavirus (MERS-CoV) infection became an emerging worldwide health concern. MERS-CoV was first identified in 2012 as a primitive source of respiratory illness caused by a novel pathogenic coronavirus[2,3]. It affected 2048 people in 27 countries and 4 continents[4]. In Middle East, Saudi Arabia is considered as the epicenter for MERS-CoV infection[5]. Middle East have the highest number of cases 88.4%; followed by Asia 10.7%; Europe 0.8% and USA 0.1%[6]. The various regional appearances have provided the evidence of speedily transmuting of viruses. MERS-CoV triggered an outbreak of severe respiratory illness in the Middle East with secondary spread to Europe, Africa, Asia, and North America.

MERS-CoV infection is transmitted from animals to animal, animal to human, and human to human. MERS-CoV transmission most likely

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originated form bats to other animals and then to humans[7]. Evidence is available that bats aided as the original host species of MERS-CoV. Interestingly, recent investigations[8] revealed that MERS-CoV in horseshoe bats are able to infect the human. The direct interaction of humans with bats or their secretion is occasional, transitional hosts vulnerable to MERS-CoV may be involved in transferring this virus to humans. The main source of occurrence of MERS-CoV infections is exposure to animals, mainly the bats and camels[9,10] although other animals such as sheep, goats and cows were also found to play role in the transmission of infection. Literature is available on the incidence of MERS-CoV infections however, despite recent efforts, there are numerous notable gaps in the understanding of MERS-CoV seasonal diversity. Therefore, this study aimed to investigate the global seasonal occurrence of Middle East Respiratory Syndrome coronavirus-MERS-CoV infection.

Materials and Methods

This observational study was conducted in the Department of Physiology, College of Medicine, King Saud University, and King Abdul Aziz City for Science and Technology (Riyadh, Saudi Arabia). In this study, we obtained the data on the prevalence and occurrence of Middle East Respiratory Syndrome Coronavirus-MERS-CoV infection from the World Health Organization (WHO) for all the MERS cases reported from the various countries and their allied ministries to the WHO[11,12]. We recorded MERS cases data from individual countries, we also reviewed the literature on MERS-CoV published in the Institute of Scientific Information (ISI) Web of Knowledge, Thomson Reuter journals during the period 2012-2017[13].

Ethical Statement

In this study we obtained the information about the occurrence of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) infection and we used the available data from the WHO; hence, we did not require the Ethical approval.

Statistical Analysis

The data were analyzed by using Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA, software version 21). Data were expressed in number and percentage. The Pearson correlation coefficient was calculated to find the strength of relation between the variables. The Pearson correlation coefficient test was calculated to find the strength of relation between different variables. p-value < 0.05 was considered significant.

Results

Worldwide, the occurrence during the period 2012-2017 for the total number of Middle East Respiratory Syndrome coronavirus-MERS-CoV infections was 2048 (Table I). The patterns of MERS-CoV infections have been observed to have seasonal variations. 1680 (82.03%) cases were reported from the Kingdom of Saudi Arabia and 368 (17.96%) cases were reported from the different countries worlwide (p-0.0001). The maximum number of cases were reported in the month of June 474 (23.14%); from them, 287 (14.01%) cases were reported from Saudi Arabia and remaining 187 (9.13%) cases were reported from all over the world. The maximum number of cases were reported in the month of June (23.14%) (Figures 1-6). The number of cases reported from January to March (16.65%) April to June (52.73%); July to September (19.33%) and the cases encountered from October to December were (11.27%).

Discussion

MERS-CoV infection is an emerging global health issue affecting a large number of people in 27 countries. It is identified in the Middle East mainly in Saudi Arabia, and spread to Korea, Europe, North America, Africa and Asia. In this study we found an occurrence of seasonal pattern of MERS-CoV infections. The worldwide laboratory confirmed cases of MERS-CoV infections from June 2012 to the end of 2017 were 2048. 82.03% cases were reported from the Saudi Arabia while 17.96% cases were from the other countries of the world. The maximum number of cases were reported in the month of June (23.14%) (Figures 1-6). The number of cases reported from January to March (16.65%) April to June (52.73%); July to September (19.33%) and the cases encountered from October to December were (11.27%)

The knowledge about MERS CoV infection in resource-limited countries is poor. There has

Table I. Global occurrence of MERS-CoV cases.

Months	Worldwide occurrence	Saudi Arabia	Total
Jan to March			
January	11 (0.53%)	36 (1.75%)	47 (2.29%)
February	6 (0.29%)	133 (6.49%)	139 (6.78%)
March	12 (0.58%)	143 (6.98%)	155 (7.56%)
Sub-total	**29 (1.41%)**	**341 (16.65%)**	**341 (16.65%)**
April to June			
April	43 (2.09%)	234 (11.42%)	277 (13.52%)
May	54 (2.63%)	275 (13.42%)	329 (16.06%)
June	187 (9.13%)	287 (14.01%)	474 (23.14%)
Sub-total	**284 (13.86%)**	**796 (38.86%)**	**1080 (52.73%)**
July to September			
July	13 (0.63%)	44 (2.14%)	57 (2.78%)
August	9 (0.43%)	185 (9.03%)	194 (9.47%)
September	15 (0.73%)	130 (6.34%)	145 (7.08%)
Sub-total	**37 (1.80%)**	**359 (17.52%)**	**396 (19.33%)**
October to December			
October	5 (0.24%)	91 (4.44%)	96 (3.22%)
November	7 (0.34%)	53 (2.58%)	60 (2.92%)
December	6 (0.29%)	69 (3.36%)	75 (3.66%)
Sub-total	**18 (0.87%)**	**213 (10.40%)**	**231 (11.27%)**
Total	**368 (17.96%)**	**1680 (82.03%)**	**2048**

Seasonal variance in KSA: p-0.0001. Seasonal variance in the world: p-0.043.

been little effort to understand the evolutionary and seasonal diversity of MERS CoV on a global scale and variation in the factors that contribute to the risk of emergence infection switching[14]. Since 2012, MERS has been reported from the 27 countries including "Austria, Algeria, Bahrain, China, Egypt, France, Greece, Germany, Italy, Iran, Jordan, Kuwait, Lebanon, Malaysia, Netherlands, Oman, Philippines, Qatar, Republic of Korea, Saudi Arabia, Turkey, Tunisia, Thailand, United Arab Emirates, United Kingdom, United States and Yemen" [11,12].

MERS-CoV is mainly spreading across the geographical region of the "Gulf Cooperation Council (GCC) countries including Saudi Arabia, United Arab Emirates, Qatar, Kuwait,

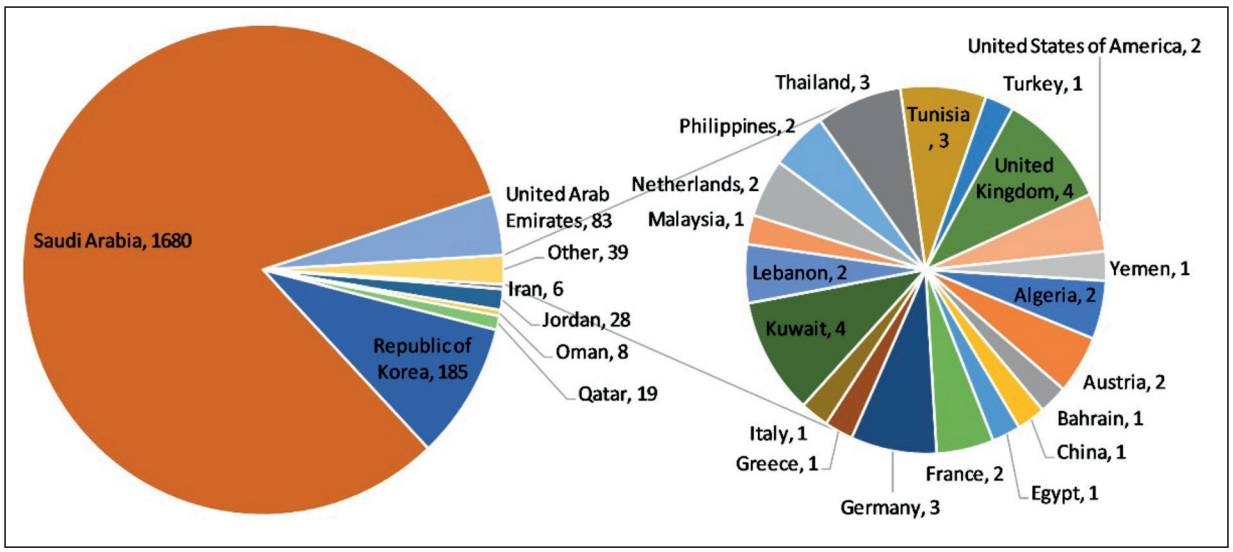

Figure 1. Global prevalence of laboratory confirmed cases of Middle East Respiratory Syndrome Coronavirus infections.

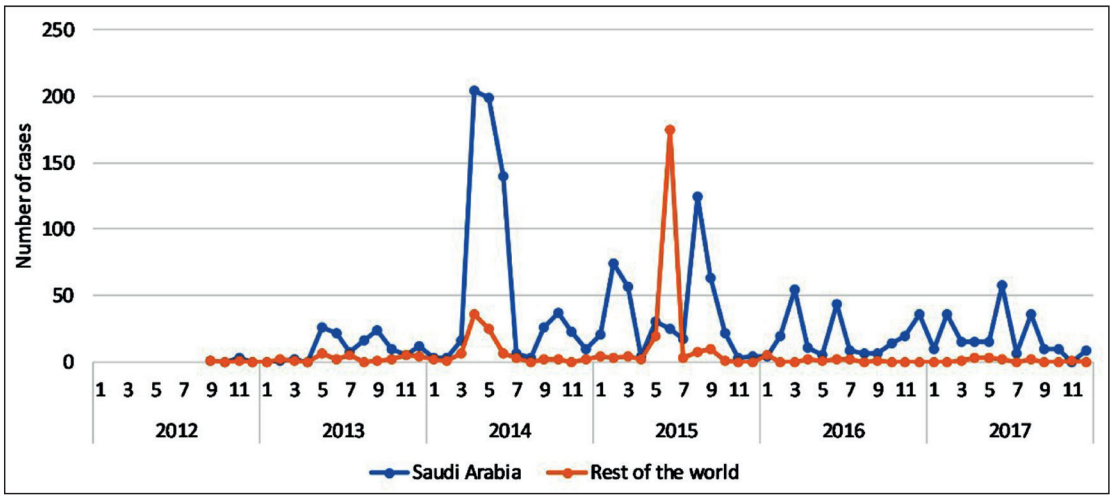

Figure 2. Worldwide seasonal occurrence of Middle East Respiratory Syndrome Coronavirus infections.

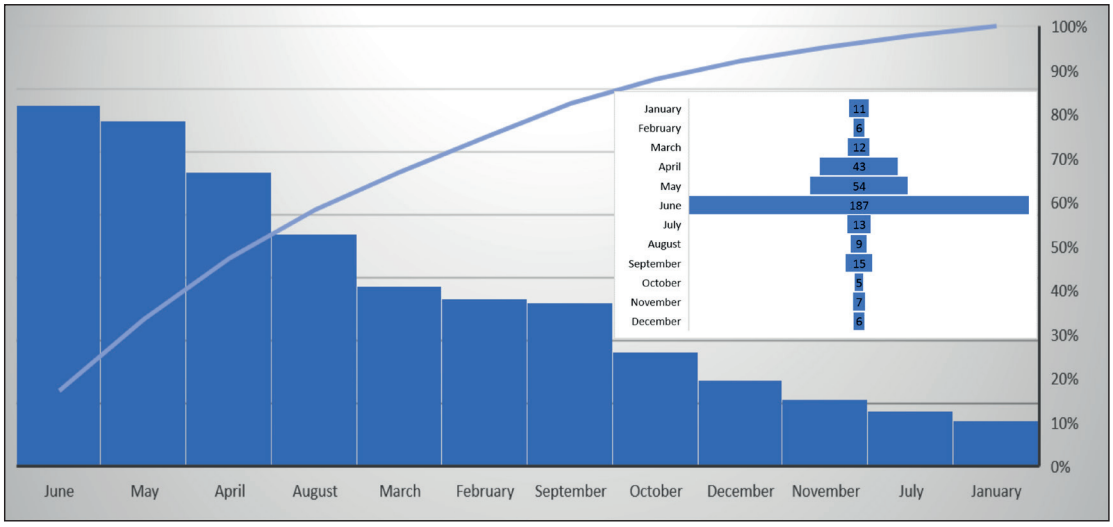

Figure 3. Global monthly seasonal occurrence with percentage of Middle East Respiratory Syndrome Coronavirus infections.

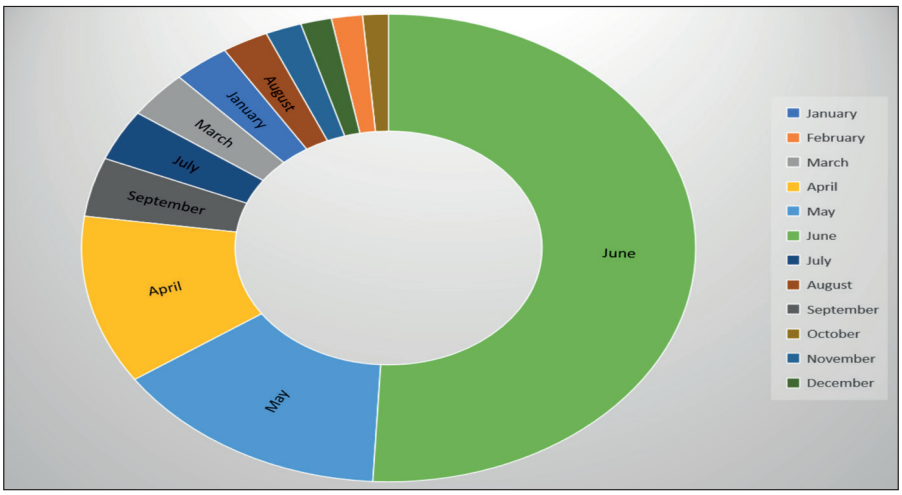

Figure 4. Global monthly based occurrence of Middle East Respiratory Syndrome Coronavirus infections.

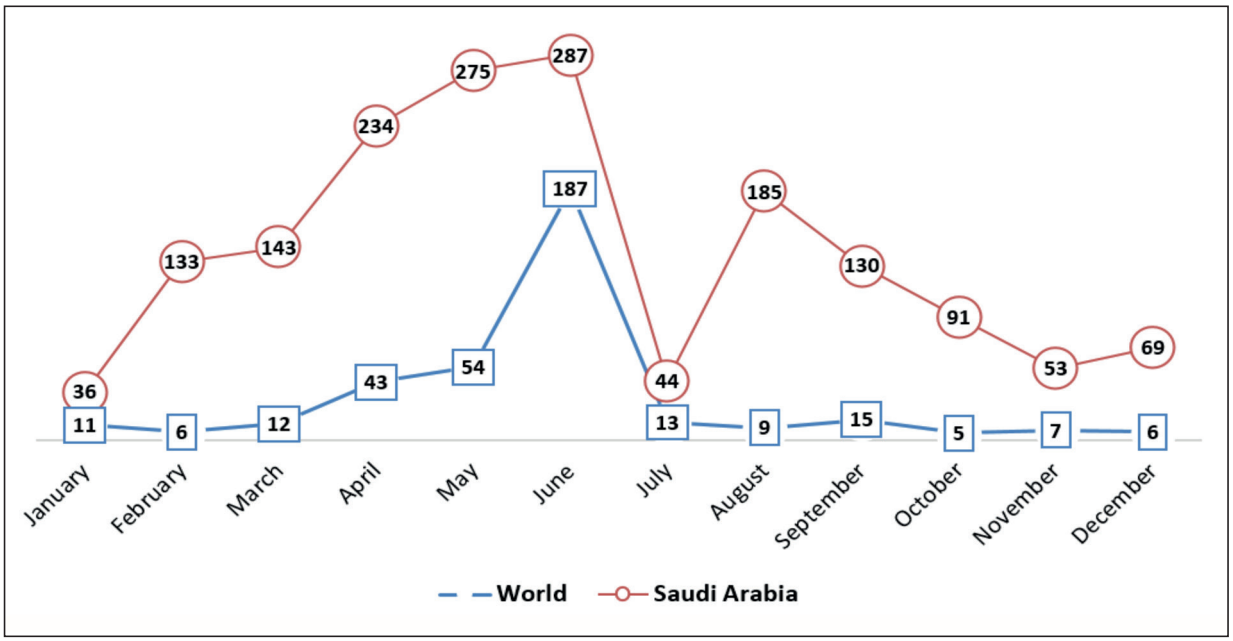

Figure 5. Occurrence of MERS CoV infections in the World and Saudi Arabia goes side by side.

Bahrain and Oman". These countries had dominant distributions of MERS-CoV infections, which may be due to the large number of d*romedary* camels in the Middle East. The scientific literature suggests that during the breeding season of camels, the camel farms are a potential source of MERS-CoV infections. The main modes of MERS-CoV transmission are by contact, droplet or airborne and its transmission happen among animals, from animals to human, and from human to human. The viral incubation period is from 2 days to 2 weeks. MERS-CoV directly targets the lower respiratory tract in dromedary camels and continues to replicate favorably in the airway cells of the upper respiratory tract.

The majority of MERS-CoV cases reported from June 2012 to December 2017 were from

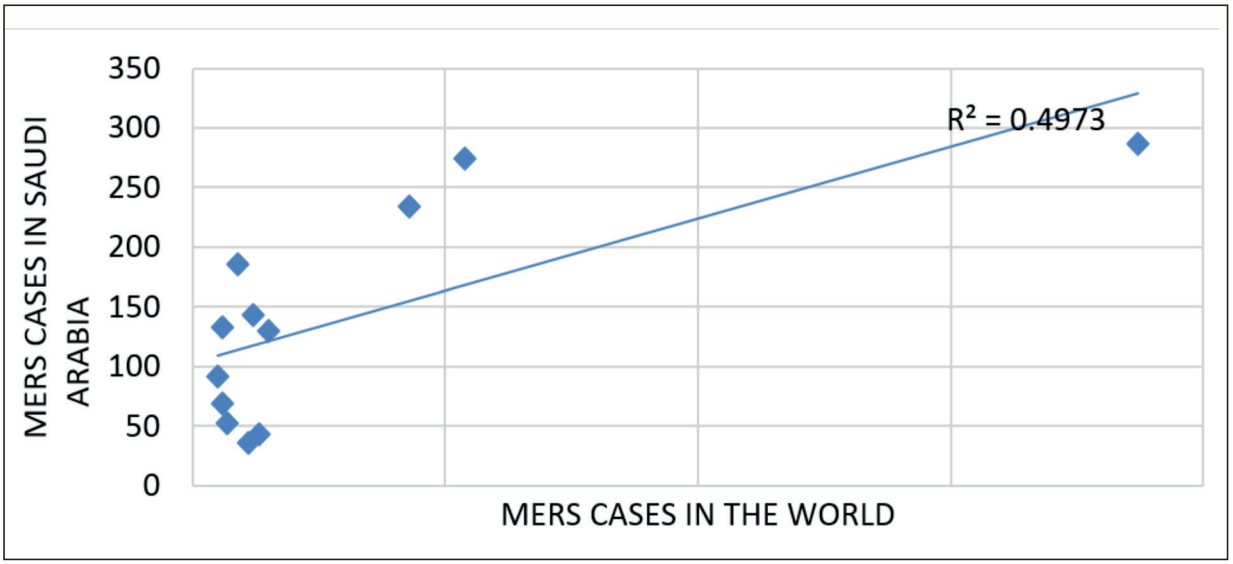

Figure 6. Correlation between the occurrences of MERS CoV infections in Saudi Arabia and the world.

Saudi Arabia. However, the remaining 5 Gulf Co-operation Council (GCC) countries also contributed with 7% of the cases. The gender based analysis demonstrates that 60% were male and 31% female. Age-specific distribution of MERS-CoV showed a positive correlation, 2% cases occurred in age group ≤ 20 years and 25% cases were in age 20-39 years[6]. Similarly, in the present work we found MERS-CoV infection was originated in the Saudi Arabia. The maximum seasonal occurrence of MERS-CoV infections were found in the month of June, and lowest occurrence of infections were seen in the month of January. The pattern of MERS-CoV infections has been observed to have seasonal variations.

Aly et al[6] reported that MERS-CoV infections mainly occurred in Saudi Arabia during the whole year whereas the incidence of human outbreaks peaked in winter and summer months. The disease incidence was also highest among the elderly population aged 60 years and above. We found that MERS-CoV infection was markedly occurred in June whilst lowest occurrence of infections were seen in January.

Conclusions

MERS-CoV infection affected 2048 people worldwide; 82% cases were reported from the Saudi Arabia and 17.96% cases were reported from other countries worldwide. The maximum number of cases 23.14% were reported in the month of June. However, low occurrence of infections were seen in the month of January.. The health sectors need of awareness programs to mandate implementation of effective control strategies and stringent compliance with better standards of health and hygiene nationwide. The health officials also need to highlight the seasonal occurrence of MERS-CoV suggesting to take the better preventive measures to minimize the disease burden globally.

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Conflict of Interest

The Authors declare that they have no conflict of interests.

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