EDITORIAL
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Dengue Fever: An Emerging Disease in Oman Requiring Urgent Public Health Interventions

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Dengue, the most widespread mosquito-borne viral infection in humans, is an emerging public health problem in countries of the Eastern Mediterranean region threatening national, regional, and global health security.[1,2] The disease is endemic in more than 128 countries in the African, Americas, Eastern Mediterranean, Southeast Asian, and the Western Pacific regions[3,4] with estimates of 390 million cases representing 17% of the global burden of infectious diseases in 2013.[5]

Outbreaks and sporadic cases of dengue, dengue-like disease, and dengue hemorrhagic fever (DHF) have been reported across the Eastern Mediterranean region, from Pakistan, Saudi Arabia, Yemen, Somalia, Sudan, Djibouti, and Oman (travel-related).[6–9]

Dengue fever (DF) is a self-limiting illness with clinical manifestations evoking a common viral illness. However, a few patients will develop DHF, which is a serious and potentially life-threatening disease.[2] *Aedes aegypti* is the primary vector transmitting the dengue virus and three other viruses causing yellow fever, chikungunya, and Zika fever.[2,10]

In Oman, DF and DHF are notifiable diseases.[8] Between 2001 and 2017, 173 cases were reported, and all were travel-related.[8,9] Between 2013 and 2017, the annual notification rate of dengue exhibited an upward trend from 0.3 to 1 per 100 000 population, and the case fatality rate was 0.01%.[8] Cases were mainly reported from the Muscat (9.6/100 000), Dhofar (2.4/100 000), and North Batinah (2/100 000) governorates. Ninety-five percent of cases were foreign-born adults from India, Sri Lanka, Pakistan, and other Asian nationalities. Only two indigenous cases of DF were reported both from the Dhofar governorate; a suspected case in 2004 (personal communication) and a confirmed case in 2009.[8,11]

In 2006, a one-year entomological survey was conducted in the Muscat governorate. Three *Aedes* species were discovered (*A. arabiensis, A. granti,* and *A. vittatus)*, but the vector of dengue, *A. aegypti,* was not found. However, in December of 2018, entomological surveys yielded the vector *A. aegypti* in A'Seeb, Busher, and Muttrah in the Muscat governorate.

A similar survey was conducted in the Dhofar governorate in 2008, 2010, and 2012 and *A. aegypti* was captured in Sarfet, Deem, and Dhalqut with 10% of households positive for breeding. Other species found were *A. vittatus* and *A. arabiensis*.[8,12] The vector breeding was continuously observed from July to August.

In 2018, a total of 67 DF cases were notified, of which 30 cases (44.8%) were travel-related. None developed DHF, and no mortality was recorded. Between 12 November 2018 and 6 January 2019, 40 indigenous DF cases were reported[13] and confirmed by using the immunoglobulin M antibody-capture enzyme-linked immunosorbent assay (MAC-ELISA) or the polymerase chain reaction. During the same period, 14 cases were admitted to our hospital, 64% were male. The patients mean age was 43.4 years. Nine out of 14 cases were Omani, and five (35.7%) were foreign-born persons residing in Oman. All except one had no recent travel history to countries in which dengue was endemic (within 30 days of disease onset). All cases were residing in A'Seeb namely Al Hail and Al Mawaleh. All patients presented with fever, myalgia, and

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thrombocytopenia (mean platelet count was 46). Patients had dengue virus serotype 2.

Since 2008, *A. aegypti* and *A. albopictus* have been documented in some areas of Oman; however, autochthonous transmission of dengue has not been widely reported. Between November 2018 and January 2019, DF was reported in individuals without a recent history of travel to dengue-endemic countries, suggesting the occurrence of autochthonous transmission and the first ever outbreak of indigenous dengue transmission. The first case was reported on 25 November 2018 in an Omani patient with no travel history from A'Seeb and the rest of the cases started to cluster on 9 December 2018. The first case could be an index case exposed to mosquitoes infected from an asymptomatic viremic traveler residing in the same area.

In a tropical area such as Muscat, from November to February, the temperature ranges between 24–28 °C, which is the ideal temperature for *A. aegypti* breeding.[14] The mosquito often circulates when vector control measures are poor facilitating imported dengue viruses to infect vector populations during permissive climatic conditions.

The main factors contributing to the current outbreak were poor vector control interventions (including routine monitoring of key entomological indicators and qualitative monitoring of vector control operations), weak entomological surveillance systems, inadequately trained personnel, funding gaps for the prevention and control of vectors, and a lack of multidisciplinary and intersectoral collaboration.

Other contributing factors include certain local practices (e.g., man-made habitats that promote the growth of mosquitoes), an unprecedented increase in travel of foreign-born and Omani population by air, and import of goods (e.g., tyres, containers, plants) from dengue-endemic countries.[14]

Vector control remains the key strategy in prevention and control. Therefore, preventing dengue virus transmission depends entirely on controlling the vectors or interruption of human-vector contact. Given the imminent current outbreak in Oman, there is an urgent need to step-up an efficient entomological surveillance system guiding the program on vector control interventions. Control of dengue also requires a sustained national commitment, concerted actions by multidisciplinary and intersectoral collaborations from civil society and communities, the capability for rapid and effective outbreak investigation at all levels, and sound technical support at the local level to channel resources effectively.

Strategies for vector control should focus on source reduction of the urban habitats of competent vectors and careful environment management to deprive the *A. aegypti* of stagnant water for breeding.

Vector-borne diseases contribute to lost productivity, school absenteeism, social stigma, high healthcare costs, and overburdened public health services.[15] Oman's Ministry of Health should aim to reduce mortality and morbidity from dengue to zero through an active vector control program that focuses on functional surveillance, preparedness, and adopting the World Health Organization Integrated Vector Management approach.[15] Additionally, a strong seaport monitoring system for goods that could potentiate entrance of the vector should be established. Festivals occur annually in Muscat in January, and Dhofar during July and August; the period where the temperature is ideal for *A. aegypti* breeding and dengue virus transmission. Henceforth, comprehensive strategies should be in place to prevent the disease in these areas. Without all these critical elements in place, most prevention and control efforts will have limited success.

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