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## RUJMS



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## Dengue Fever in Yemen: A large-Scale Disease Outbreak in the Context of Ongoing Conflict

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### Abstract

**Background:** Communicable disease surveillance and control in conflict settings is challenging. **Aim:** To describes a large outbreak of Dengue Fever (DF) in Yemen in 2015 amid ongoing conflict. **Methods:** secondary analysis of routine surveillance data complemented by a literature review. **Results:** the 2015 DF outbreak was distinct in scale and geographic scope compared with previous years, with up to 14,500 reported cases. Control is hampered by worsening access to healthcare, scaling back of preventive activities and widespread infrastructure damage. **Conclusion:** In 2015, Yemen witnessed a dengue outbreak exceeding previous years. The ongoing conflict and blockade has rendered a weak health system incapable of implementing its routine control activities and provision of curative care. If this is not reversed, it is expected that the situation may worsen and bear higher case-fatality rates. International aid is much needed. Efforts must be exerted to preserve the healthcare system and its functionality, strengthened surveillance to improve reporting rates and greater control efforts are needed.

**Keywords:** Dengue Fever, Aedes Mosquitoes, Conflict, Yemen.

## Introduction

Dengue fever (DF) is a mosquito-borne systemic viral infection transmitted between humans by the bite of infective *Aedes* mosquitoes [1,2]. It is a tropical/subtropical disease with seasonal variation occurring during hot weather following rainy seasons, with cyclic variation caused by environmental and climatic factors and human and vector behaviour [3,4].

The viruses causing viral haemorrhagic

combatting the disease carrying *Aedes* mosquitoes and management of breeding sites [1].

Dengue is a global threat and is endemic or epidemic most countries located in the tropics [7]. Studies have documented that many countries of the Middle East have experienced outbreaks of VHFs including dengue virus, rift valley fever, Crimean-Congo haemorrhagic fever and chikungunya [6]. However, little has been published

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fever (VHFs) belong to four different families: Bunyaviridae, Flaviviridae, Filoviridae and Arenaviridae [5,6]. There are four virus subtypes of dengue (DENV 1-4). Infection with one does not cross protect. Dengue viruses produce syndromes conditioned by age and immunological status [7]. Dengue infection is often inapparent in humans but can lead to a wide range of clinical manifestations from mild fever to dengue

haemorrhagic fever and fatal dengue shock syndrome, hence for some patients dengue can become life-threatening illness [1] with case fatality rates exceeding 5% in some areas [5].

There are no licensed vaccines or specific therapeutics and treatment remains supportive. Efforts to curb dengue transmission focus on

on VHF in Yemen.

The burden of ill health due to dengue in tropical and subtropical world remains poorly enumerated. There has been an increase in the number of dengue cases reported to the WHO over the past five decades<sup>5</sup> and dengue has become endemic in more than 125 countries [7]. A high sero-prevalence of dengue immunoglobulin G (IgG) along with frequently reported outbreaks suggest dengue endemicity within a country [3].

According to the WHO 50 to 100 million infections occur annually worldwide but it has been estimated that the actual burden of dengue is three times that reported by the WHO [1,8].

The biggest source of disparity between actual and reported is that reported epidemics of dengue are based on symptomatic cases and therefore, the true incidence of dengue

may be underreported due to the large proportion of asymptomatic cases [3]. Another factor is the health seeking behaviour with a low proportion of patients seeking care from health facilities[1] and another proportion seeking health care in the private sector. Historically, dengue has been reported in Yemen as early as the 19<sup>th</sup> century. Periodic outbreaks of dengue in Yemen have been documented in Shabwah Governorate in 1994, Hadramawt in 2005, and Hodeidah in 1994, 2000, 2004 and 2005 [3,6]. These have been geographically localised and seasonal in occurrence (between April and August typically). Mortality rates have occasionally been high, with a reported case fatality rate (CFR) for an outbreak in Hadramout in 2010 of 1.9% [3]. Cases of DHF or Dengue Shock Syndrome (DSS) – more serious disease variants typically requiring inpatient admission and intensive care support – have been rare [6]. There were 2,051 confirmed cases of DF in Yemen in 2014.

In Yemen, dengue is a neglected communicable disease and concern is focused on dengue epidemics and crisis management rather than strategic surveillance to define the true burden of disease. Having poor reporting, weak healthcare and surveillance systems makes measurement of the true burden of disease difficult. This has worsened since the start of the conflict.

The impact of communicable disease in conflict settings is well recognised, resulting from disruption to surveillance systems, outbreak

prevention and control, damage to critical infrastructure including water and sanitation, and reduced health system functionality [9].

Over 18 months into a bloody and protracted conflict in Yemen, a combination of a high pre-war burden of infectious disease and structural weaknesses makes the probability of a significant communicable disease outbreak high, particularly for endemic pathogens such as DF.

**Aim of the study:** The aim of the study is to describe a DF epidemic in Yemen in 2015 using routine surveillance data, and highlights challenges to effective prevention and control in the context of a conflict largely ignored by the international community.

## **Subjects and Methods**

Findings are based on a descriptive analysis of routine surveillance data from Yemen generated by the Ministry of Public Health and Population (MoPHP) and WHO Regional Office (WHO EMRO) through their electronic early warning system (eDEWS), augmented by a rapid review of peer and non-peer reviewed literature on DF and Dengue Haemorrhagic Fever (DHF – a rarer and more serious variant of DF that may require intensive care treatment) in Yemen published since 2005. ProMED reports from the conflict period were consulted for data verification purposes.

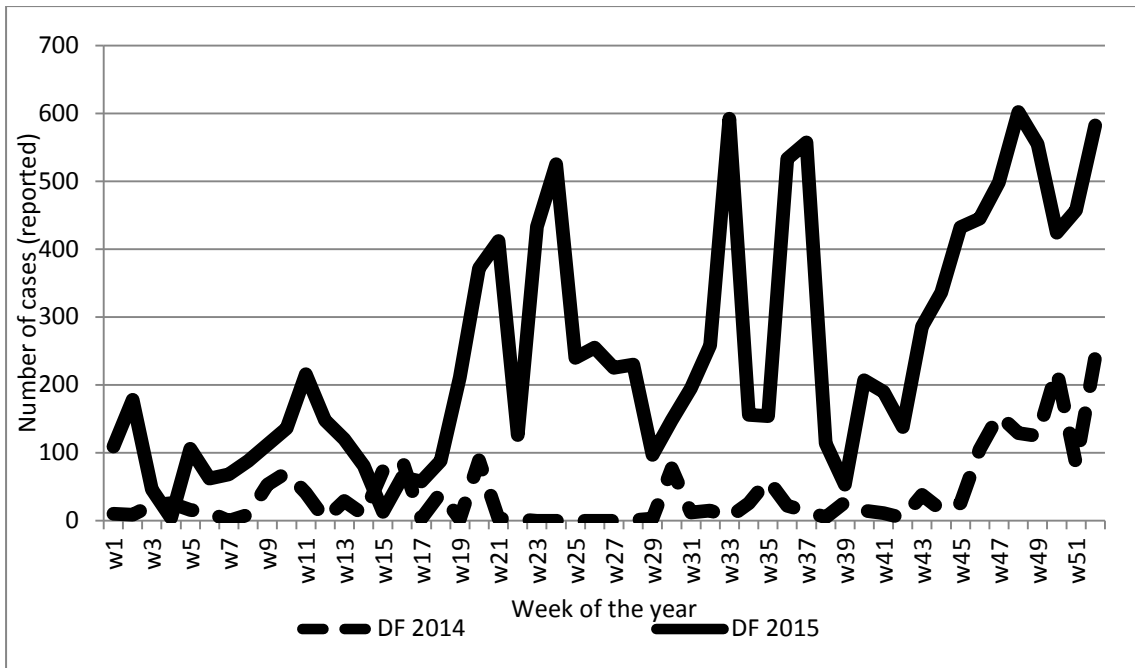
The analysis was conducted during the first half of 2016. Study subjects included all subjects diagnosed as having dengue from the 16 Governorates in Yemen under eDEWS surveillance and hence counted as a case. The case definition of dengue was as per the WHO definition of dengue fever. Diagnosis in 14 Governorates is based on clinical picture and laboratory confirmation, and in 2 Governorates it is based on clinical picture alone.

## Results

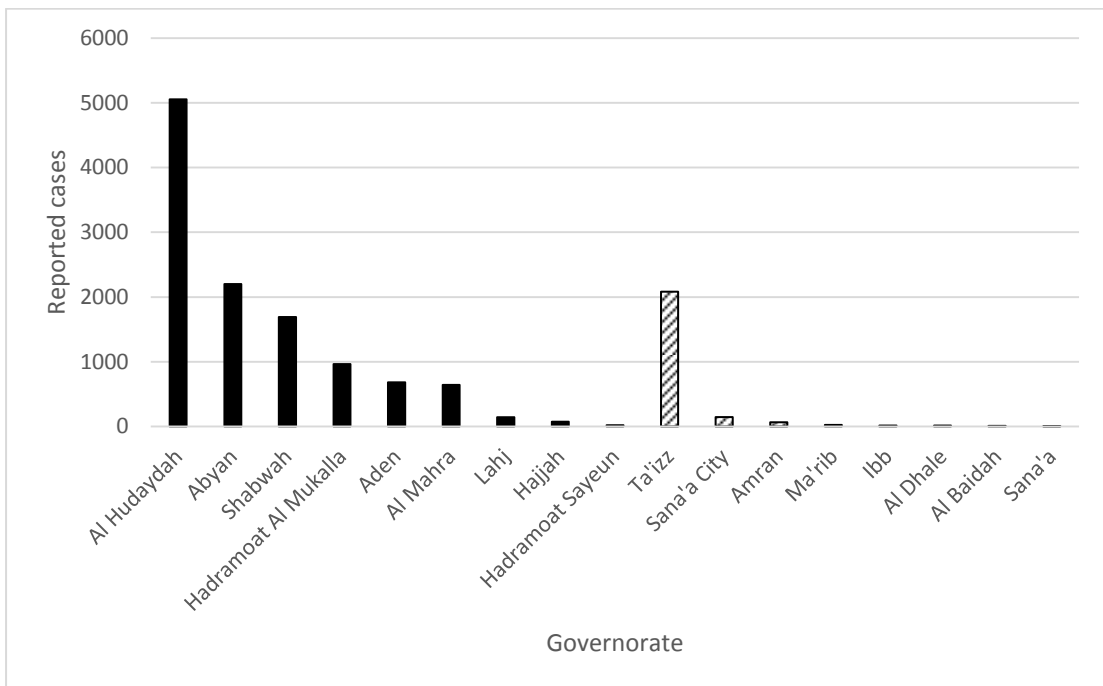
The 2015 outbreak was of much larger magnitude and duration than those previously seen in Yemen. The total number of cases reported through health facilities in 2015 ranged from 13,846 to 14,509 depending on the source consulted. Caseload spikes occurred during late spring and mid-summer, with a gradual upward trend towards the end of 2015 (figure 1). In addition, cases were reported across a wider range of governorates than other recent Dengue outbreaks in Yemen – although predominantly in urban areas and low-lying coastal governorates, as before (figure 2). Case confirmation has proven possible in only a proportion of cases because of difficulties accessing laboratory facilities; treatment on clinical suspicion has been common. Deriving a reliable CFR is therefore difficult. A crude estimate of 0.3% based on data from the last 12 weeks of 2015 (the period for which figures are most complete) likely underestimates the true figure because the denominator is reported caseload, and some 54% of

the Yemeni population now cannot access basic healthcare at all. Comprehensive data on DHF caseload is not available, but 66 cases were reported in the last 12 weeks of 2015, equivalent to about 1.5% of the total Dengue caseload in that period.

Implementation of basic Dengue control measures including Insecticide-Treated Bednet (ITN) distribution and fumigation have been undermined by the effects of ongoing conflict, and long-standing issues with knowledge and acceptability of preventive measures among the Yemeni population [7]. Direct and indirect attacks on health facilities, including the destruction of the Malaria Control Centre in Tihama, have greatly disrupted prevention efforts. Vertical programmes with previously significant ground presence in Yemen (e.g. Roll Back Malaria) have scaled back their activities as the conflict has intensified. Responsibility for ITN distribution now falls largely to WHO and partner agencies. Breakdown in basic sanitation and water supply systems has been a major challenge: many Yemenis are forced to store water in open containers that provide fertile breeding grounds for DF vectors. Effective clinical management of DF, and particularly DHF, has been complicated by the dynamic nature of the conflict and associated impediments on free movement for civilians, and physical inaccessibility of some communities, especially in rural areas [10]. Shortages in basic medical supplies, including IV fluids and administration kits, have been acute across the country.



**Figures 1:** trends in reported cases of Dengue Fever through the Yemen eDEWS system, by week, across 2014 and 2015.



**Figures 2:** reported cases by governorate— distinguishing coastal (solid bars) from inland (hashed bars) governorates.

## Discussion

Descriptive data presented above should be treated with caution. First, reporting rates from eDEWS fell as low as 51% in mid-2015 (although they had recovered to 95% by January 2016); in conflict-affected urban areas such as Taiz, reporting rates were below the 60% minimum threshold set by eDEWS for much of the year. Second, facility-reported cases exclude individuals presenting to private sector clinics and those unable to attend at all. Third, sentinel surveillance can gather data only on reported cases; case-confirmation is lacking in many instances.

Nevertheless, it is apparent that there was a sizeable and geographically dispersed epidemic of DF across Yemen in 2015. This is much higher than what has been reported in previous national outbreaks in Yemen and outbreaks in the region. Data from MoPHP eDEWs up to the week 33 suggests that this outbreak is ongoing but at lower levels than 2015 [11]. Prevention efforts have been hampered by disruption to critical infrastructure arising from the conflict. A year into the conflict, the humanitarian imperative for parties to the conflict to guarantee access for health workers to affected areas to strengthen prevention and control, is stronger than ever. Strengthened surveillance to improve reporting rates, and greater international support for control efforts are urgently needed.

## Conclusion

In 2015, Yemen witnessed a Dengue outbreak exceeding outbreaks witnessed previously. The number of cases reported may be an underestimate of the true burden of disease due to reasons explained previously. The ongoing conflict and blockade has rendered a health system incapable of implementing its routine control activities due to lack of funding for operating and control activities, shortage of supplies and fuel, hindered movement and logistics, and lack of commitment and motivation in light of collapsing health system. In addition, coping mechanisms adopted by the public in terms of having to store water for long durations of time potentially exposed creates an environment favourable for vector breeding.

If the MoPHPs functionality and ability to implement control measures is not resumed it is expected that Yemen will continue to witness these high if not increasing levels of dengue infection.

Furthermore, in light of the health system struggling to provide basic services it is clear that diagnostic and curative services have been severely affected. Accordingly, there is a risk that uncomplicated dengue cases will not receive the treatment needed and will progress to become complicated cases of dengue haemorrhagic fever and dengue toxic shock syndrome. This will translate into higher case fatality rates.

Support to the health sector, vector control activities and therapeutic



services are urgently needed, in addition to humanitarian access.

### **Recommendations**

Preserving the healthcare system and its functionality, strengthened surveillance to improve reporting rates and greater control efforts are needed. There should be serious efforts to broker an agreement between the parties of the conflict to spare the health system. In light of the collapsing health system there is an urgent need to provide the financial support to ensure functionality of the health system. Priority should be given to conducting dengue control activities as well as providing curative services. Obviously, this is not likely as parties to the conflict care the least about the health status of the Yemeni population and the functionality of the health system and are actually drying funding of the health sector.

The United Nations and International community must take lead and exert serious efforts to ensure that parties of the conflict spare the health system from damage and ensure it's funding so it can continue to operate.

On the other hand international organisations working in the health sector in Yemen need to increase their support in terms of provision of health services and conducting health activities.

### **Conflict of interest**

The authors declare that there is no conflict of interests regarding the publication of this paper.

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