http://dx.doi.org/10.20506/TT.2760

Addressing challenges in the Middle East at the human–animal interface under the 'One Health' concept

Idris Al Abaidani & Salim A. Salim Mohamednour[1]

1. Introduction

The One Health concept, which was initiated in the 2000s, recognises that the health of people is connected to the health of animals and the environment [1, 2, 3].

The One Health approach can be achieved by ensuring that physicians, veterinarians, ecologists and many other relevant stakeholders work together to monitor and control public health threats and to learn about how diseases spread among people, animals and the environment [1]. In light of the growing global risk of pathogens of zoonotic origin, the One Health approach is designed to make the animal and human health interface a reality. Risks grow stronger with globalisation, climate change and changes in human behaviour, all of which provide opportunities for pathogens to colonise new areas and evolve into new forms [3]. Nevertheless, most of the newly emerging diseases (75%) are zoonotic in origin [2]. Yet there is still a lack of understanding of how the One Health concept can be implemented at the global, regional or even national level.

During the 84th General Session of the OIE World Assembly of Delegates, held in Paris, France, in May 2016, the OIE Regional Commission for the Middle East adopted 'Addressing Challenges in the Middle East at the Human–Animal Interface under the One Health concept' as Technical Item II (without questionnaire) to be presented at the 14th Conference of the OIE Regional Commission for the Middle East, to be held in Istanbul, Turkey, from 2 to 6 October 2017.

The first part of this report will present an analysis of the results obtained by Member Countries of the Middle East region for three Technical Areas, related to the One Health concept, that are evaluated during the World Health Organization (WHO) International Health Regulations (IHR) Joint External Evaluation (JEE) missions. The second part of the report will provide details of the experience of Oman in dealing with zoonotic diseases. The report will conclude with a set of proposed recommendations and a conclusion.

2. Results of joint external evaluation missions in the Middle East Region

The IHR Joint External Evaluation (IHR JEE) came about as a result of the World Health Organization General Assembly (WHA) adopting resolution WHA68.5 approving the recommendations of the 'Review Committee on Second Extensions for Establishing National Public Health Capacities and on IHR Implementation'. Additionally, the recommendation [7] of the committee called on the WHO Director-General to *'…consider a variety of approaches for the shorter- and longer-term assessment and development of IHR core capacities'* [24]. The Committee stated that in order for the IHR to continue to serve their primary purpose of developing an agreed set of rules to minimise the international public health implications of the spread of an initially

1 Dr Idris Al Abaidani, Director of the Communicable Disease Surveillance Department at the Ministry of Health of Oman
Dr Salim A. Salim Mohamednour, WHO Consultant

localised risk that is sub-optimally controlled (as was planned by end of 2016), they should not be perceived as the end of implementation of the IHR capacities. It is therefore important to develop an improved capacity of monitoring and assessment scheme/process with a clear mechanism, recognising that a significant challenge for the implementation of the IHR in the foreseeable future is related to the lack of satisfactory metrics to demonstrate the actual benefits of their implementation as well as progress made towards their sustainability. Consequently, the global IHR Monitoring and Evaluation Framework for use after 2016 was required to satisfactorily ensure the mutual accountability of States Parties and the Secretariat for global public health security, be transparent in reporting and build trust through dialogue. Hence, IHR JEE Tool was developed to cover implementation of the IHR by covering all 19 Technical Areas and, depending on the aspect considered, adapted quantitative and qualitative methods [6, 8, 9, 23, 24].

The Joint External Evaluation is a voluntary and collaborative mechanism to evaluate a country's capacity under the International Health Regulations (IHR 2005) to prevent, detect and rapidly respond to public health threats irrespective of whether they are naturally occurring, deliberate or accidental [8, 9]. Nevertheless, the JEE is also intended to help the country to engage with stakeholders' and partners' initiatives to support country outbreak and health emergency preparedness [9].

The Joint External Evaluation Tool (JEE-Tool) is a qualitative and quantitative logarithmic data collection instrument which is used both by the country and the external expert's team. It scores the national capacity of the country under evaluation for IHR (2005). Conducted in two stages, the evaluation covers 19 Technical Areas of importance to prevent, detect and respond to event and hazards [9]. The first stage starts with the country that has requested the assessment voluntarily conducting a Self-Assessment using the JEE Tool independently. The second stage is an in-country evaluation conducted in joint collaboration between national and external experts [9]. The JEE Tool precisely helps countries to:

a) determine their baseline capacity, including any gaps and needs;

b) inform the development of action plans and roadmaps to address those needs;

c) measure the progress on work implemented;

d) systematically highlight gaps to enable both national authorities and donors to set their action priorities; and

e) identify the most urgent needs within their health system.

Each Technical Area is delineated by a level of advancement or scoring, ranging from 1 (no capacity) to 5 (fully sustainable). Due to the limitation of time for the IHR JEE mission (5-day duration), the tool and its scoring methodology cannot reflect the full and detailed capacity that each country has for each of the examined Technical Areas of the IHR, but still can give an overall reflection of the country's performance and ability in that area.

By simple statistical calculations of the IHR JEE scores, this part of the report aims to briefly analyse the performance, and highlight and elaborate on the collective gaps in the Middle East region regarding the three Technical Areas most likely to capture intersectoral collaboration at the human–animal interface under the One Health concept. These three areas are: antimicrobial resistance, zoonotic diseases and food safety.

The WHO Eastern Mediterranean Region (WHO EMR) consists of 21 countries, extends over a wide geographical area and falls within several climate zones. More than 583 million humans live in this region, making it one of the most important markets in terms of production and consumption of animal and agricultural products. It also has a wide variety of wildlife [4, 5]. These factors place the region in a unique position, facing renewable risks of zoonotic diseases and public health threats.

The IHR JEE for the WHO EMR was conducted in 14 countries in the region. To evaluate the One Health concept performance in the region, this report analyses the results of the IHR JEE in the countries that fall within the OIE Middle East region [7, 9]. The countries examined were Afghanistan [6], Bahrain [10], Jordan [11], Kuwait, Lebanon [12], Oman [19], Qatar [13], Saudi Arabia [14], Somalia [15], Sudan [16] and United Arab Emirates [18].

As a general point, it is worth mentioning that the Progress Report on implementation of the IHR presented at the Sixty-Fourth Session of the Eastern Mediterranean region of the WHO Commission stated that the countries of the region demonstrated strong capacity for minimising the transmission of zoonotic disease, especially in terms of surveillance for priority zoonoses/pathogens and the veterinary and animal health workforce [7, 9]. The report also stated that the WHO EMR region demonstrated an overall high capacity for Technical Areas related to the response capacity of countries and, in particular, in relation to the ability to link public health with security, as well as in deployment and receipt of medical countermeasures and personnel during an acute health crisis. While many countries have the capacity to activate emergency operations when needed, it was noted that mapping of public health risks, developing public health emergency preparedness and response plans and having procedures and plans in place for emergency operating centres were areas that needed strengthening [7].

Furthermore, risk communication was an area consistently identified as weak in all the JEEs performed in the Region, as many countries lacked an all-hazard, national, risk communication plan. In particular, capacities for communication engagement with affected communities, dynamic listening and rumour management were cited as consistently weak [7].

The IHR JEE-Tool average score for the 11 countries in this report was 2.83 for the three Technical Areas related to the One Health concept (i.e. antimicrobial resistance, zoonotic diseases and food safety). This average constitutes 57% of the maximum score of 5, which can be seen as the region's capacity in these three Technical Areas. Therefore, the region can be considered to be in the stage of establishing the One Health concept but as not yet having fully developed the sustainable mechanisms to implement it. Nonetheless, two countries out of the 11 in the region (18.81%) were found to be in a state of critical challenge to develop their capacities to achieve and fully apply the One Health concept (score: <2). Yet, with the current important animal and natural resources in the region, this should be seen as a window of opportunity rather than as areas of risk when technical and financial assistance is provided.

2.1. Antimicrobial resistance [9]

The average of the IHR JEE-Tool scores for the countries of the Region in terms of antimicrobial resistance (AMR) was found to be 2.40 (48% of the maximum score of 5). Accordingly, and as the tool explains the meaning of this score for an individual country, we can say that, collectively the support work being coordinated by WHO, FAO, and OIE to develop an integrated global package of activities to combat antimicrobial resistance, spanning human, animal, agricultural, food and environmental aspects (i.e. a One Health approach) is almost half that which is expected in the region as a whole. This also means that only half the required capacity for decisive and comprehensive action to enhance infection prevention and control activities to prevent the emergence and spread of AMR, especially among drug-resistant bacteria, was reached in the Region. The detailed scoring analysis of the indicators for this Technical Area was as follows:

2.1.1. Antimicrobial resistance detection [9]

The average score for AMR resistance detection capacity for the region was 2.54. This means that the regional capacity of designated laboratories in conducting detection and reporting on priority AMR pathogens is on average at 50% of full requirement (i.e. maximum score of 5). It was observed that 27.3% of the countries had no national plan for detection and reporting of priority AMR pathogens. This might be due to pre-existing poor infrastructure and lack of resources dedicated to this Technical Area in general, or due to the fact that the AMR core capacity was newly presented and has not yet been fully introduced equally to all countries in the region.

2.1.2. Surveillance of infections caused by AMR pathogens [9]

It can be seen from the score results that a national plan for surveillance of infections caused by priority AMR pathogens has been approved in 54% of the countries, while the remaining countries that have managed to designate sentinel sites for AMR are conducting surveillance for infections caused by some of the priority AMR pathogens. Accordingly, half of the region needs to establish designated sentinel sites and conduct

surveillance of infections caused by all priority AMR pathogens for at least one year, then for five years with a system for continuous improvement, in order to achieve full compliance.

2.1.3. Healthcare-associated infection (HCAI) prevention and control programmes [9]

It was found that 72.7% of countries have developed HCAI prevention and control programmes and the remaining 27.2% of countries have approved a national plan for HCAI prevention and control programmes. It was noted that countries with functioning health services and a higher per capita GDP [17] obtained a better score in terms of developing HCAI prevention and control programmes.

2.1.4. Antimicrobial stewardship activities

It was observed that 81.81% of the region's countries analysed have failed to develop a national stewardship plan for AMR. The WHO EMR Regional Committee report clearly indicates that this capacity needs to be addressed as a regional priority [9].

2.2. Zoonotic disease [9]

The IHR JEE Tool indicator explanation for each Technical Area is used to reflect the capacity of the region in that area as a whole. According to the analysis for this Technical Area and the evaluation results, the average score for the countries of the Region was 3.24 (65% of the maximum score of 5). As the tool explains, this score can be interpreted as showing that the region is more than halfway to achieving full compliance, namely has adopted measured behaviours, policies and/or practices that minimise the transmission of zoonotic diseases from animals into human populations. Equally, it can be concluded that the region already has half the capacity needed to identify the five zoonotic diseases/pathogens of greatest national public health concern and the region is a little more than halfway to achieving the necessary strengthening of its existing surveillance systems for priority zoonoses. Thus, the region is more than halfway to having the necessary capacity to develop and implement operational frameworks – based on international standards, guidelines, and successful existing models – that specify the actions necessary to promote One Health approaches to policies, practices and behaviours that could minimize the risk of zoonotic disease emergence and spread. The detailed scoring analysis of these Technical Area's indicators is as follows:

2.2.1. Surveillance systems in place for priority zoonotic diseases/pathogens [9]

More than 90% of the countries of the region have zoonotic disease surveillance systems in place. However, in 54.5% of countries, these systems only cover between 1 and 4 of the zoonotic diseases/pathogens of greatest public health concern. According to the score interpretation for this indicator, surveillance for priority zoonoses/pathogens and the existence of a supportive veterinary and animal health workforce in the region demonstrate a strong capacity for minimising the transmission of zoonotic diseases. Nevertheless, considerable attention needs to be given to regional improvements on response mechanisms for zoonotic diseases [7].

2.2.2. Veterinary or animal health workforce [9]

Ninety percent of the countries of the region have animal health workforce capacity within the national public health system. However, the risk of introduction and emergence of zoonoses is considered fairly significant, as indicated by the IHR JEE individual reports for countries with large movements of people, livestock and wildlife through their national seaports and airports/hubs [13, 14, 18].

2.2.3. Mechanisms for responding to infectious zoonoses and potential zoonoses are established and functional [9]

A national policy, strategy or plan for the response to zoonotic events is in place in 33% of the countries. However, 55.5% of the countries showed evidence of timely and systematic information exchange between animal/wildlife surveillance units, human

health surveillance units and other relevant sectors in response to potential zoonotic risks and urgent zoonotic events.

2.3. Food safety [9]

Sixty percent of the countries of the Region have surveillance and response capacity for food- and water-borne disease risk or events. This means that the region is more than halfway to achieving the target, namely timely detection and effective response of potential food-related events in collaboration with other sectors responsible for food safety.

3. Oman's experience in dealing with zoonotic disease outbreaks

3.1. Overview

The Sultanate of Oman is located in the south-eastern corner of the Arabian Peninsula. Its coastline extends over 1,700 kilometres from the Strait of Hormuz in the north to the borders of the Republic of Yemen, overlooking the Arabian Gulf, the Gulf of Oman and the Arabian Sea. It borders the Kingdom of Saudi Arabia and the United Arab Emirates in the west and the Republic of Yemen in the south, and has the Strait of Hormuz to the north and the Arabian Sea to the east. The total area of the Sultanate of Oman is approximately 309.5 thousand square kilometres. The climate differs from one area to another; the climate is hot and humid in the coastal areas in summer and hot and dry in the interior, with exception of the higher mountains and Dhofar Governorate, which enjoy a more temperate climate throughout the year. In 2014 (Mid-Year Estimation of 2014), the total population was 3 992 893, of which 43% were non-Omani. The Omani population has a sex ratio of 100 males to 100 females. It is a relatively a young population, with 14.3% aged under 5 years and 34.3% aged under-15 years. Only 6% are 60 years and over. In 2013, the estimated total fertility rate of Omani women was 3.9. The crude birth rate (CBR) in 2013 was estimated to be 33.8 per 1,000 in the Omani population. The CBR has remained the same over the past ten years. This has also been accompanied by a slight decline in the crude death rate (CDR), from 3.65 in 2000 to 2.9 per 1,000 in the Omani population in 2013. The infant mortality rate is 9.8 while the under-five mortality rate is 11.8 per 1,000 live births. The Ministry of Health (MoH) is largely responsible for providing health care to the people of Oman.

The National Zoonotic Committee, inclusive of all stakeholders in the area of zoonotic diseases, has been established, with members from the Ministry of Agriculture and Fisheries, the Ministry of Health, the Ministry of Regional Municipalities, the Royal Oman Police, the Ministry of the Environment, Sultan Qaboos University and the Muscat Municipality.

The terms of reference of the National Zoonotic Committee are as follows:

- to formulate joint action plans and coordinate activities for the control of endemic zoonotic diseases;
- to share and exchange information among the various sectors;
- to establish a joint rapid response team (RRT) of investigators to respond to public health events;
- to formulate and implement a risk communication plan.

The following zoonotic diseases have been identified as a priority in Oman:

1) MERS-CoV;
2) West Nile fever (WNF);
3) highly pathogenic avian influenza (HPAI);
4) brucellosis;
5) Crimean-Congo haemorrhagic fever (CCHF);
6) rabies;
7) Rift Valley fever (RVF); and
8) Q-fever.

The surveillance system in the animal health sector is predominantly passive through event reporting or occasionally through follow-up surveys. However, the active surveillance system is initiated when information or notification is received from the Ministry of Health of the occurrence of a zoonotic event such as human case(s) of Middle East respiratory syndrome coronavirus (MERS-CoV) infection, or CCHF. The veterinary research centre also provides support through animal surveys for zoonotic infections for MERS-CoV, CCHF, brucellosis, echinococcosis, Q-fever, etc. The surveillance system for communicable diseases in humans was formally launched in March 1991, to address diseases and conditions classified and grouped according to their importance, their seriousness and their relevance as a global concern. The objective is to systematically collect data on priority communicable diseases from all health institutions in the public and private sector, to collate, analyse and provide feedback of collected information to those responsible for disease control programmes at both governorate (provincial) and national level, to implement a prompt coordinated and effective response in terms of disease outbreak investigation and control, to evaluate the effectiveness and the impact of interventions and control measures and to provide data for the purpose of health service planning. The surveillance system is mainly passive, but active surveillance is carried out when cases are found or any further notification of zoonotic diseases is received from the Ministry of Agriculture.

3.2. Brucellosis

Brucellosis is one of the priority communicable diseases in Oman and is included in what are called Group B diseases. It is considered a major zoonotic infectious disease and is mainly restricted to the southern governorate of the country (i.e. Dhofar, accounting for 95% of cases). The climate in Dhofar is significantly different from that of the rest of the country. The majority of the population live in the coastal area. The region receives monsoon rainfall during June to August (Khareef season). Animal herding and breeding is the main occupation of people living in the green areas in the mountains (Jabals).

The animal population is mainly comprised of cattle, camels, sheep and goats. An earlier (1985–1986) serosurvey conducted in the animal population in Dhofar revealed a prevalence of 8.0% in camels, 6.4% in goats and sheep and 3.3% in cattle. In 1997, a multisectoral Regional Brucellosis Control Committee (RBC) was established with members from MoH, the Ministry of Agriculture and Fisheries and the Ministry of Municipality & Water Resources. The diagnostic criteria and the treatment regimen were reviewed and resolved. Health education material emphasising the importance of brucellosis prevention was produced and distributed. The topic was also introduced into the school health education programme. An animal vaccination project with Rev1 was launched in 2003 divided into four phases of three years each.

Human brucellosis cases have occurred sporadically in the Northern governorates of Oman since surveillance began in 1991. However in 2016, an upsurge of human brucellosis cases was reported from the north of Oman with a total of 120 cases (Fig. 1). The mean proportion of all human brucellosis cases in Oman that was reported from Northern governorates during the period 1991–2015 was 3.9% and in 2016 with the outbreak it reached 28.8%.

The majority of cases were reported in Saham Wilayat. From May to November 2016, 75 confirmed human brucellosis cases were identified. Thirty-eight Omani families living in 16 nearby coastal villages were involved. Forty-one percent of the patients were male. The majority of cases were diagnosed during the period June to August 2016, with maximum numbers being reported in July. Most of the patients were between the ages of 21 and 40 years, 12 were below the age of 12 years and 6 were above 60 years. The majority of the patients (41) were serologically positive for both *Brucella melitensis* and *B. abortus*, while 32 cases were positive for *B. melitensis* alone. For 2 cases in which the serology was negative, the culture result was positive.

The One Heath concept was implemented by forming a multidisciplinary task force from Ministry of Health, the Ministry of Agriculture and Fisheries, the Ministry of Municipality & Water Resources and the Municipality of Sohar Governorate with the common objective of conducting a thorough epidemiological investigation, active case finding in both the animal and human populations and a plan for risk mitigation. A circular with advice on case definition and

diagnosis was sent to all health institutions to raise the level of alertness among healthcare workers. Testing was carried out in animals in nearby farms and at local cheese producers. Thirty-four animal samples were tested, of which 13 (38%) were positive for brucellosis. Additionally, a ban was imposed on unauthorised home-made cheese producers. All sectors under the One Health umbrella, including the Governor of the province, were involved in the intervention activities, such as developing health education material and health talks for professionals, including healthcare workers, veterinarians and other Ministry officials. Educational material, such as leaflets, banners and roll-up stands, was produced with messages on prevention. Trained volunteers and community groups were involved in awareness-raising activities. As a result, no new cases emerged in the Wilayat of Saham and no new clusters were detected in other Northern Governorates.

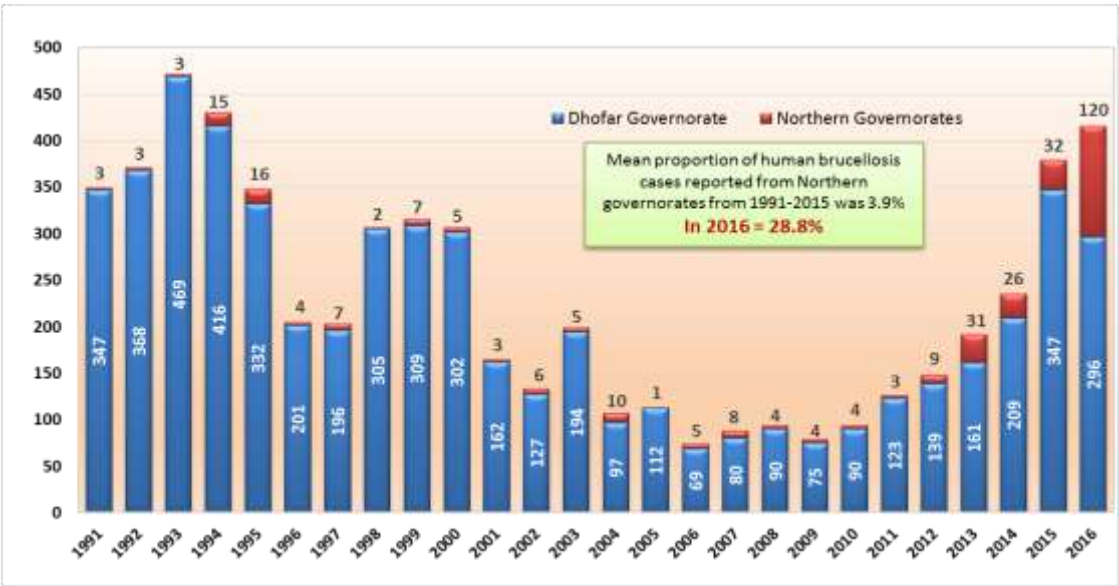

Fig. 1. Human brucellosis cases reported in Oman during the period 1991–2016 (Dhofar Governorate and Northern Governorates)

In conclusion it may be stated that brucellosis is not only a disease of the South of the country but has also become established as an endemic infection in the Northern governorates of Oman. Although the distribution of the infection may not be uniform all over (no evidence is available on this as yet), it is anticipated that cases will continue to occur in the future unless legislation on food safety and animal trade regulations are strictly enforced. Other important recommendations are the follow-up measures of test-and-slaughter, animal vaccination, community education, case detection and effective treatment. Thus, strengthening the national brucellosis control programme needs the One Health platform to properly organise, implement and coordinate all relevant public health intervention activities.

3.3. Crimean-Congo haemorrhagic fever (CCHF)

CCHF was first reported in Oman in 1995. Since then, sporadic cases have been diagnosed in different areas of the country. A survey conducted in the Sultanate in 1995–1996 by a team from Centers for Disease Control (CDC), United States of America, revealed seroprevalence among certain occupational groups and the presence as well as evidence of infection in the vector ticks. Various species of ticks of the genus *Hyalomma*, including the major vector *Hyalomma anatolicum anatolicum*, were identified. A recent survey and observations by the Ministry of Agriculture and Fisheries suggest that CCHF virus infection in domestic animals, including goats, cattle and camels, is high and hence is presumed to be endemic in Oman (Fig. 2).

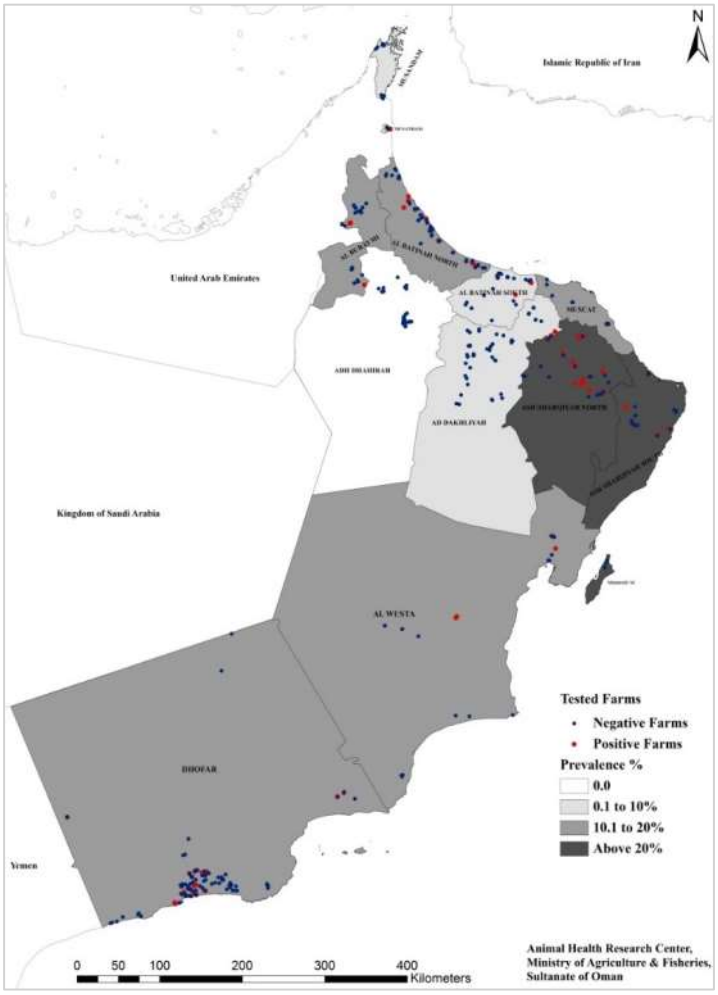

Fig. 2. Map showing the locations of farms/holdings (n=496) sampled for the detection of CCHFV antibodies and herd level prevalence (%) in different governorates of Oman during 2012–2014

In the past, no CCHF cases were reported in the Sultanate over a period of almost 14 years (1997–2010) despite a good surveillance system.

Globally, a rising trend has been observed in CCHF endemic countries since 2012. The surveillance system in Oman also detected cases in 2011 after a substantial gap. During the following years, the number of CCHF cases in Oman rose to 10 in 2013, 18 in 2014, 20 in 2015 and 19 in 2016.

In 2014 and 2015, CCHF showed a distinct pattern of clustering of cases coinciding with the Eid celebrations, which include festive slaughtering (Figs 4 and 5).

The mean age of all reported cases up to September 2017 (n=88) was 34.8 years, with a range of 15 to 68 years, suggesting young adults were affected the most. No cases were reported in

children. Men were more affected than women (79 out of the 88 cases [89.8%]) since traditionally men are involved in the slaughtering of animals, either for occupational reasons (animal handlers, milking, slaughterhouse workers) or while participating in slaughtering during the Eid festivities.

Of the cumulative total of 88 cases, Omanis comprised 58% (51 cases) while Bangladeshis were the second most affected group (18, 20.5%) followed by Pakistanis (7, 8%) and Indians (4, 4.5%). Other nationalities affected included 3 Yemenis, 2 Somalis, 2 Egyptians and 1 Sri Lankan.

The CCHF cases detected outside the risk period mentioned above were mainly related to occupational exposure. They occurred either in slaughterhouse employees or in animal handlers involved in looking after, transporting or milking animals. Slaughtering of animals and subsequent human exposure to fresh blood or tissues was seen as the most important risk factor responsible for virus transmission. Surprisingly, since 1995, no secondary transmission has been observed among contact persons, including healthcare workers looking after patients, members of the patient's family or other community contacts.

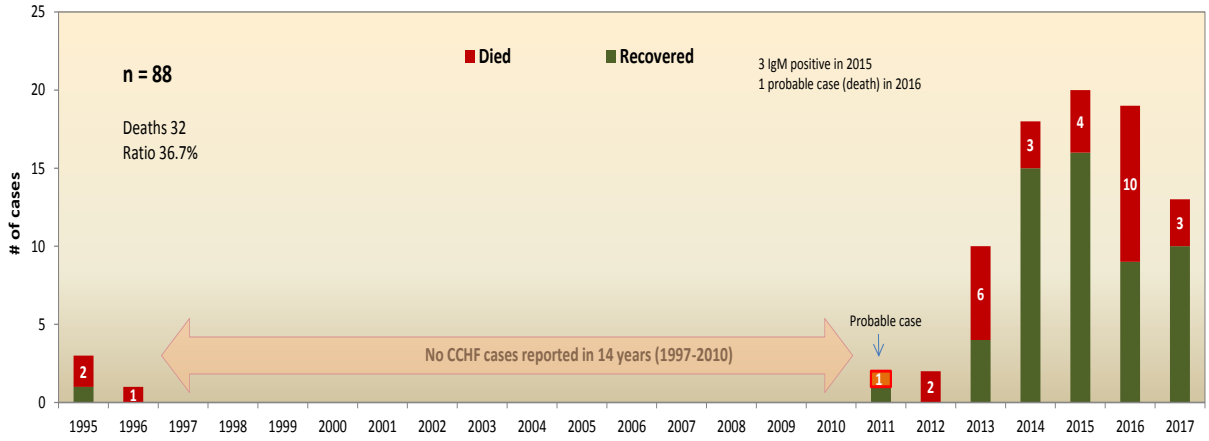

Fig. 3. Human CCHF cases in Oman with deaths 1995–2017 (Sept.)

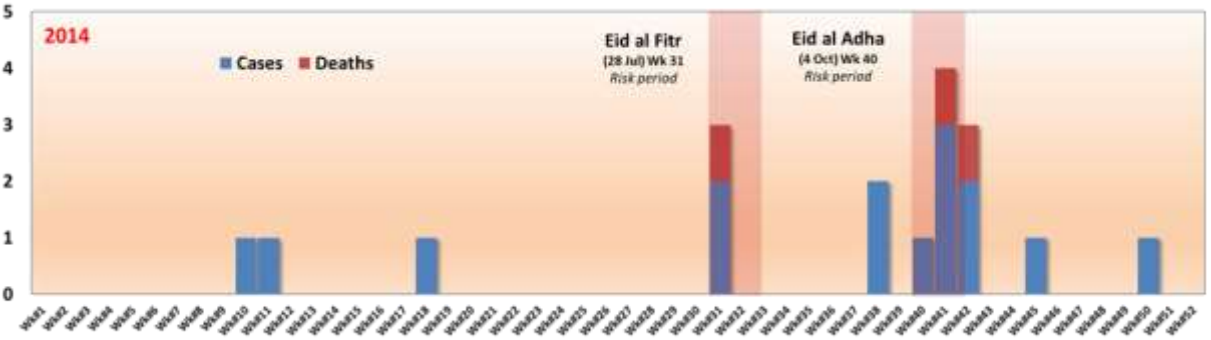

Fig. 4. Weekly incidence of CCHF cases and deaths in Oman by date of onset and ISO week: 2014 (n=18)

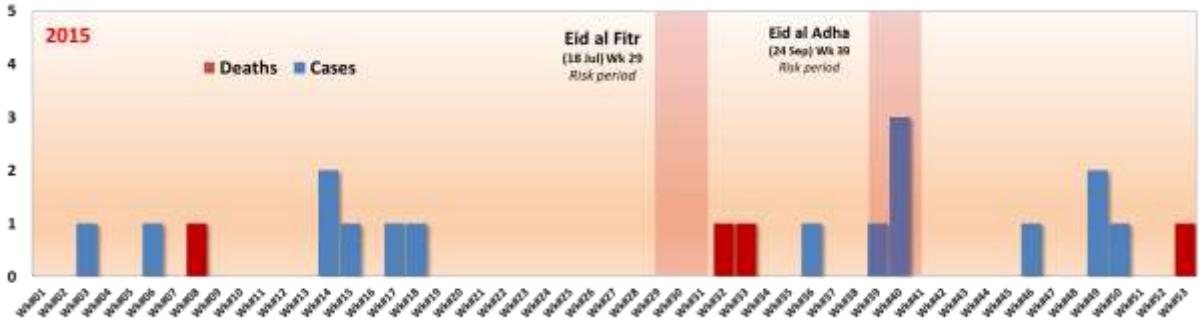

Fig. 5. Weekly distribution of CCHF cases and deaths in Oman by date of onset and ISO week: 2015 (n=20)

To date, the overall case fatality rate (CFR) is 36.7% (32 deaths out of 88 cases) (Fig. 3). In 2014 and 2015 the CFR was lower compared to the previous years. Of the 20 cases reported in 2015, 4 died (CFR = 20%). The low mortality rate was likely due to the sensitisation of healthcare workers, leading to early detection of mild cases. In 2016, the CCHF mortality rate was high (CFR 52.6%); however, the usual surge following Eid festivities declined due to aggressive health education campaigning under the joint One Health banner (Fig. 6).

During the period from 1995 to September 2017, all governorates in the country reported cases of CCHF (n=88) with the exception of Musandam and Al Wustah. The highest number of cases was in Dhofar (16 cases). The other governorates that reported cases during this period were: North Batinah (14), Dakhliyah (14), North Sharqiyah (10), Buraimi (9), South Batinah (7), Dhahira (7), Muscat (6) and South Sharqiyah (5). The distribution pattern of cases points to a higher incidence in geographical areas closer to the borders with Yemen and the United Arab Emirates. However, the serological evidence of CCHF virus infection in animals and the vector ticks over almost all the country and the steady incidence of human infection in major population centres in recent years are indicative of the disease being endemic in Oman.

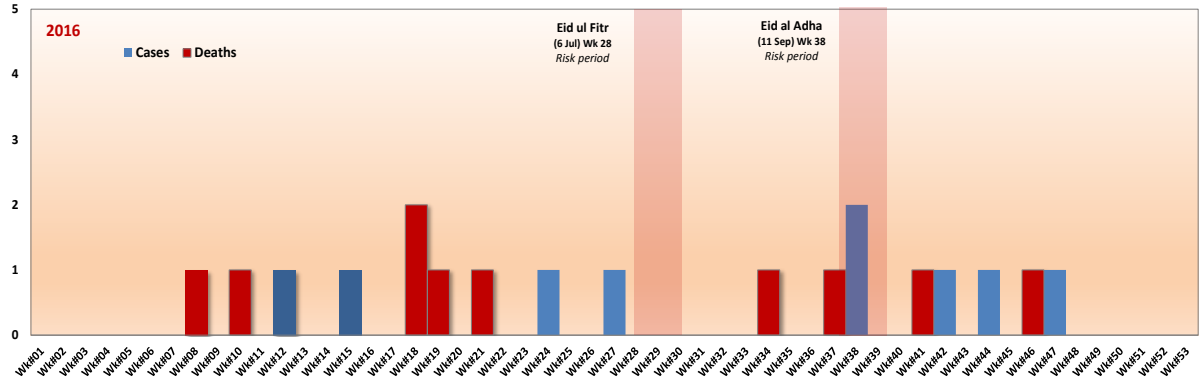

Fig. 6. Weekly incidence of CCHF cases in Oman with deaths 2016 (n=19)

Realising the risk of CCHF infection associated with festive slaughtering, the MoH has undertaken a number of initiatives, including educational activities to inform the community. A joint strategic plan was developed in collaboration with the Ministry of Agriculture and Fisheries and the Ministry of Regional Municipalities emphasising the importance of surveying and testing animals (serology, PCR), testing ticks for CCHF virus infection and performing tick control, and ensuring safety at slaughterhouses. Health education material was broadcast on the news and via social media to inform the public about risk-related practices involved in animal slaughtering during Eid festivities. Health education material was also targeted at healthcare workers and veterinarians.

Thus, the One Health approach, through successful collaboration among all stakeholders, has had a demonstrable impact on reducing the incidence of CCHF cases, especially following the Eid festival, as shown above.

4. Conclusion

The human–animal interface under the One Health concept in the Middle East faces many challenges. The One Health capacity of the region is currently at almost half the desired level. Intersectoral collaboration between different stakeholders is considered a paramount goal that needs to be achieved. Establishing antimicrobial resistance plans, and strengthening zoonotic disease detection and response, while addressing food safety testing, surveillance and research, should be considered as the top priorities of the region. Inter-country and even regional mapping of the Veterinary Services' capabilities is important in order to identify collaboration opportunities with the human health sector. Countries need to address their challenges by showing stronger will and a wider mobilisation of resources for faster and more effective implementation of the One Health concept.

References

1. Centres for Disease Control and Prevention (CDC).– One Health Basics. Available at: www.cdc.gov/onehealth/basics/index.html.
2. World Organisation for Animal Health (OIE).– The OIE introduces its new 'One health' web portal. Available at: www.oie.int/en/for-the-media/press-releases/detail/article/the-oie-introduces-its-new-one-health-web-portal/.
3. World Health Organization (WHO).– Global Early Warning System for Major Animal Diseases, including Zoonoses (GLEWS). Available at: www.who.int/foodsafety/areas_work/zoonose/glews/en/.
4. World Health Organization (WHO) Regional Office for the Eastern Mediterranean (EMRO).– Health topics. Available at: www.emro.who.int/health-topics.html.
5. Agriculture and Agri-Food Canada.– Sector Trend Analysis - Livestock and Meat Trends in the Gulf Cooperation Council. Available at: www.agr.gc.ca/eng/industry-markets-and-trade/foreign-market-information-by-region/middle-east-and-africa/market-intelligence/sector-trend-analysis-livestock-and-meat-trends-in-the-gulf-cooperation-council/?id=1490119143313.
6. World Health Organization (WHO) (2017).– IHR: Joint External Evaluation of IHR Core Capacities of the Islamic Republic of Afghanistan, 4–7 December 2016. WHO reference number: WHO/WHE/CPI/REP/2017.43. Available at: www.who.int/ihr/publications/WHO-WHE-CPI-REP-2017.43/en/.
7. World Health Organization (WHO) Regional Office for the Eastern Mediterranean (EMRO) (2017).– Implementation of the International Health Regulations (IHR 2005). Progress report. EM/RC64/INF.DOC.8 Rev.1; August 2017. Available at: www.emro.who.int/about-who/rc64/documentation.html#progress_reports.
8. World Health Organization (WHO).– Core Functions of the IHR. Available at: www.who.int/ihr/en/.
9. World Health Organization (WHO) (2016).– Joint External Evaluation Tool: International Health Regulations (2005). IHR (2005) Monitoring and Evaluation Framework. WHO Library Cataloguing-in-Publication Data. ISBN 978 92 4 151017 2. Available at: http://apps.who.int/iris/bitstream/10665/204368/1/9789241510172_eng.pdf.
10. World Health Organization (WHO) (2016).– Joint External Evaluation of IHR Core Capacities of the Kingdom of Bahrain. Mission report: 4–8 September 2016. WHO reference number: WHO/WHE/CPI/2017.4. Available at: www.who.int/ihr/publications/WHO-WHE-CPI-2017.4/en/.
11. World Health Organization (WHO) (2016).– Joint External Evaluation of IHR Core Capacities of the Hashemite Kingdom of Jordan. Mission report: 28 August – 1 September 2016. WHO reference number: WHO/WHE/CPI/2017.1. Available at: www.who.int/ihr/publications/WHO-WHE-CPI-2017.1/en/.
12. World Health Organization (WHO) (2016).– Joint External Evaluation of IHR Core Capacities of the Lebanese Republic. Mission report: July 2016. WHO reference number: WHO/WHE/CPI/2017.2. Available at: www.who.int/ihr/publications/WHO-WHE-CPI-2017.2/en/.
13. World Health Organization (WHO) (2016).– Joint External Evaluation of IHR Core Capacities of State of Qatar. Mission report: 29 May – 2 June 2016. WHO reference number: WHO/HSE/GCR/2016.24. Available at: www.who.int/ihr/publications/WHO-WHE-CPI-2017.6/en/.
14. World Health Organization (WHO) (2017).– Joint External Evaluation of IHR Core Capacities of the Kingdom of Saudi Arabia. Mission report: 12–16 March 2017. WHO reference number: WHO/WHE/CPI/2017.25. Available at: www.who.int/ihr/publications/WHO-WHE-CPI-2017.25.report/en/.
15. World Health Organization (WHO) (2017).– Joint External Evaluation of IHR Core Capacities of the Republic of Somalia. Mission report: 17–21 October 2016. WHO reference number: WHO/WHE/CPI/2017.14. Available at: www.who.int/ihr/publications/WHO-WHE-CPI-2017.17/en/.
16. World Health Organization (WHO) (2017).– Joint External Evaluation of IHR Core Capacities of the Republic of the Sudan. Mission report: 9–13 October 2016. WHO reference number: WHO/WHE/CPI/2017.15. Available at: www.who.int/ihr/publications/WHO-WHE-CPI-2017.15/en/.
17. The World Bank.– GDP Per Capita. Available at: https://data.worldbank.org/indicator/NY.GDP.PCAP.CD.
18. World Health Organization (WHO) (2017).– Joint External Evaluation of IRH Core Capacities of the United Arab Emirates. Mission report: 19–23 March 2017. WHO reference number: WHO/WHE/CPI/REP/2017.57. Available at: www.who.int/ihr/publications/WHO-WHE-CPI-REP-2017.57/en/.
19. World Health Organization (WHO) (2017).– Joint External Evaluation of IRH Core Capacities of the Sultanate of Oman. Mission report: 2–7 April 2017. WHO reference number: WHO/WHE/CPI/REP/2017.59. Available at: www.who.int/ihr/publications/WHO-WHE-CPI-REP-2017.59/en/.
20. World Health Organization (WHO).– Global Health Observatory data repository. Population Data. Available at: http://apps.who.int/gho/data/view.main.POP2040ALL?lang=en (accessed on 5 April 2017).
21. Economic Prospective.– Available at: http://econperspectives.blogspot.com/2008/08/limitations-of-using-gdp-as-measure-of.html.
22. World Health Organization (WHO) (2015).– Global Antimicrobial Resistance Surveillance System: Manual for Early Implementation. WHO Library Cataloguing-in-Publication Data. ISBN 978 92 4 154940 0. Available at: http://apps.who.int/iris/bitstream/10665/188783/1/9789241549400_eng.pdf.

23. World Health Organization (WHO) (2015).– Implementation of the International Health Regulations (2005): report of the Review Committee on Second Extensions for Establishing National Public Health Capacities and on IHR Implementation: report by the Director-General. EB136/22 Add.1. Available at: http://apps.who.int/iris/bitstream/10665/251717/1/B136_22Add1-en.pdf.
24. World Health Organization (WHO) (2015).– Development, monitoring and evaluation of functional core capacity for implementing the International Health Regulations (2005): Concept note. Available at: www.who.int/ihr/publications/concept_note_201507/en/.