International Journal of Infectious Diseases 47 (2016) 5–9

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Editorial

Taking forward a 'One Health' approach for turning the tide against the Middle East respiratory syndrome coronavirus and other zoonotic pathogens with epidemic potential

Keywords:
One Health
MERS-CoV
Zoonoses
Camels
Epidemic

SUMMARY

The appearance of novel pathogens of humans with epidemic potential and high mortality rates have threatened global health security for centuries. Over the past few decades new zoonotic infectious diseases of humans caused by pathogens arising from animal reservoirs have included West Nile virus, Yellow fever virus, Ebola virus, Nipah virus, Lassa Fever virus, Hanta virus, Dengue fever virus, Rift Valley fever virus, Crimean-Congo haemorrhagic fever virus, severe acute respiratory syndrome coronavirus, highly pathogenic avian influenza viruses, Middle East Respiratory Syndrome Coronavirus, and Zika virus. The recent Ebola Virus Disease epidemic in West Africa and the ongoing Zika Virus outbreak in South America highlight the urgent need for local, regional and international public health systems to be be more coordinated and better prepared. The One Health concept focuses on the relationship and interconnectedness between Humans, Animals and the Environment, and recognizes that the health and wellbeing of humans is intimately connected to the health of animals and their environment (and vice versa). Critical to the establishment of a One Health platform is the creation of a multidisciplinary team with a range of expertise including public health officers, physicians, veterinarians, animal husbandry specialists, agriculturalists, ecologists, vector biologists, viral phylogeneticists, and researchers to co-operate, collaborate to learn more about zoonotic spread between animals, humans and the environment and to monitor, respond to and prevent major outbreaks. We discuss the unique opportunities for Middle Eastern and African stakeholders to take leadership in building equitable and effective partnerships with all stakeholders involved in human and health systems to take forward a 'One Health' approach to control such zoonotic pathogens with epidemic potential.

1. Introduction

The appearance, disappearance, and re-emergence of novel pathogens of humans with both epidemic potential and high mortality rates have threatened global health security for centuries.[1] Over the past few decades, notable new zoonotic infectious diseases of humans have been caused by pathogens arising from animal reservoirs, including West Nile virus, yellow fever virus, Ebola virus, Nipah virus, Lassa fever virus, hantavirus, dengue virus, Rift Valley fever virus, Crimean-Congo haemorrhagic fever virus, severe acute respiratory syndrome coronavirus (SARS-CoV), highly pathogenic avian influenza viruses, Middle East respiratory syndrome coronavirus (MERS-CoV), and Zika virus (ZKV).[2] The recent Ebola virus disease (EVD) epidemic in West Africa[3] and the ongoing ZKV outbreak in South America[4] highlight the urgent need for local, regional, and international public health systems to be better prepared.[5–8]

The unique opportunities for Middle Eastern and African stakeholders to take leadership in building equitable and effective partnerships with all stakeholders involved in human and health systems, to take forward a 'One Health' approach to control such zoonotic pathogens with epidemic potential, is highlighted here. In this article the example of MERS-CoV is used as an important case in point.

2. Need for newer approaches to control zoonotic diseases

The 2014–2015 EVD epidemic in West Africa showed that countries with weak health services and inadequate capacity to identify infectious disease outbreaks early are unable to respond appropriately to control the outbreak. International health agencies were too sluggish to effect an early resolution. There were no rapid point-of-care diagnostics, no specific treatments, no vaccines, and insufficient medical care facilities, teams, and trained staff, and furthermore the international responses were initially uncoordinated and unable to adapt policies and advice for a very different expression of the disease. As a consequence, aggressive community responses to inappropriate health interventions, foreign aid workers, and researchers unfamiliar with local cultural and health systems norms were common and life-threatening.[9,10] Research to find and evaluate new treatments and vaccines conducted during the EVD epidemic was also slow to start and was dominated by foreign groups with little involvement of local scientists.[7,9] The development and evaluation of experimental tools came too late to

http://dx.doi.org/10.1016/j.ijid.2016.06.012

benefit the large majority of affected people. Some foreign aid workers and researchers were not familiar with local cultural and medical services norms and aroused local anxieties.[10]

The EVD epidemic highlighted the need for developing more comprehensive local, national, international, and global surveillance, as well as epidemic and outbreak preparedness response infrastructures. Multiple animal, human, and environmental factors are obviously playing a critical role in the evolution, transmission, and pathogenesis of zoonotic pathogens, and these require urgent definition to enable appropriate interventions to be developed for optimal surveillance, detection, management, laboratory analysis, prevention, and control in both human and animal populations.

An important need exists for establishing long-term, sustainable, trusting and meaningful and equitable collaborations between the animal, human, ecosystem, and environmental health sectors at the local, national, and international levels. These should include sustainable political and funder support for developing human and laboratory capacity and training that enables effective human–animal health cooperation leading to proactive surveillance, early detection of potential pandemic pathogens, and rapid initiation of public health prevention and control guidelines and interventions. Whilst a long list of pathogens with epidemic potential are on the radar of the World Health Organization (WHO),[2] ideally 'prevention is better than cure' and new pathogens should be dealt with at the animal source, tackling the drivers and triggers of pathogen evolution and emergence. This requires close cooperation between human and animal health systems and an appreciation of human impacts on the environment at all levels and easy access to adequate laboratory facilities.

3. WHO priority list of the top 10 emerging pathogens

On December 10, 2015 an expert panel convened by WHO prioritized a list of emerging pathogens "considered likely to cause severe outbreaks in the near future, and for which no, or insufficient, preventive and curative solutions exist".[11,12] The list of the top 10 includes the new viral zoonotic pathogen of humans MERS-CoV,[13,14] which was first isolated from a patient who died of a severe respiratory illness in a hospital in Jeddah, Saudi Arabia in June 2012.[15]

The emergence of MERS-CoV in 2012[15] was the second time (after SARS-CoV[16]) that a highly pathogenic coronavirus of humans emerged in the 21st century.[17] A strong link between human cases of MERS-CoV and dromedary camels has been established through several studies.[18–26] MERS-CoV is endemic in the camel populations of East Africa and the Middle East[21,25,26] and presents a constant threat to human health in both regions. Retrospective studies using stored serum from different geographical locations have indicated that MERS-CoV has been circulating for several decades.[25] As of May 1, 2016, there have been 1733 laboratory-confirmed cases of MERS reported to the WHO,[27] with a mortality of 34% (628 cases died). Whilst most MERS cases have been reported from the Middle East (a large proportion from Saudi Arabia), MERS cases have been reported from 27 countries in all continents.[27] The WHO has held nine meetings of the Emergency Committee (EC) for MERS-CoV.[28]

4. The persistent and lurking epidemic threat of MERS-CoV

Since evidence of sustained human-to-human transmission of MERS-CoV in the community is lacking, the WHO currently does not recommend travel restrictions to the Middle East. However, MERS-CoV remains a major global public health threat with continuing reports of new human MERS cases in Saudi Arabia, where millions of pilgrims from over 184 countries travel throughout the year.[29] Furthermore, a more intensive farm-based camel livestock system has emerged and there is a large, well-established trade in camels between countries at the Horn of Africa and countries in the Middle East. This has increased significantly, particularly following the lifting of the ban on live animal imports from Somalia by Saudi Arabia in 2009/2010. Somalia now exports some five million live animals every year to the Gulf Arab States (including 77 000 camels), making it the single biggest exporter of live animals in the world. The positive experience of reviving Somalia's livestock export industry through increased investment in animal disease prevention and control strategies highlights how effective the 'One Health' approach can be. Most of the African countries do not have the resources, expertise, or capacity, including laboratory facilities, to have active surveillance for MERS-CoV in place. In light of this, the need for increased vigilance and watchful surveillance for MERS-CoV in Sub-Saharan Africa has been highlighted previously.[30] Such an initiative could be supported through investments by countries that import large numbers of camels and other livestock from the region.

The epidemic potential of MERS-CoV was recently illustrated by a large outbreak in hospitals in Seoul, the Republic Korea, in mid-2015: MERS-CoV was imported by a traveller to the Middle East (an agriculture businessman), resulting in 184 MERS cases with 33 deaths.[31] The first case was reported on May 20, 2015 and over the ensuing 3 weeks, the number of secondary, tertiary, and perhaps quaternary cases of MERS from this single patient rose rapidly, resulting in the largest MERS case cluster occurring outside the Middle East. The unprecedented outbreak was attributed to poor infection control measures at the hospitals.[30] Sequencing studies of the MERS-CoV isolate showed genetic recombination of MERS-CoV in the case exported from Korea to China.[32] However, recombination is a frequent event in MERS-CoV and the Korean outbreak is unlikely to represent a special form of the virus. Nonetheless, the potential evolution of MERS-CoV into a more virulent form needs to be monitored closely.

Research on sequencing seems to have stagnated and there have been no further sequences published from new human MERS cases reported from the Middle East. Furthermore, the genetic evolution of MERS-CoV strains infecting humans over the past year remains unknown. There is an urgent need for more sequencing studies on MERS-CoV evolution in camels and humans, with the development of appropriate local capacity for these studies. The Kingdom of Saudi Arabia has kept proactive watchful MERS-CoV surveillance with regular reports to the WHO of MERS-CoV cases.[33] The WHO and ministries of health of Middle Eastern countries continue watchful surveillance of the MERS-CoV situation, and the watchful anticipation is that MERS-CoV may disappear with time like SARS-CoV. However, with the continuing, regular reports of community cases of MERS-CoV from Saudi Arabia,[27] there are no signs of this happening in the near future and lessons must be learnt from the Korean outbreak.[34] Whilst there is a growing camel livestock industry in the region, elimination of the virus is unlikely in the short term.

5. Urgent action required for more coordinated, collaborative multidisciplinary MERS-CoV research

Several animal, human, and environmental factors are obviously playing a critical role in the repeated movement of MERS-CoV from camels to humans. The disease ecology remains largely unknown. Urgent definition is required to enable appropriate interventions to be developed for optimal surveillance, laboratory detection, management, prevention, and control in both human and animal populations. Whilst several ad hoc research studies have been conducted and findings published over the past 4 years, more comprehensive investments in tackling MERS-CoV have not been forthcoming. There remain huge knowledge gaps on MERS-CoV.