WHO-EM/CSR/063/E

Report on the

Intercountry meeting on the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) outbreak in the Eastern Mediterranean Region

Cairo, Egypt
20–22 June 2013

World Health Organization
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1. INTRODUCTION

The emergence of a novel coronavirus, now named the Middle East Respiratory Syndrome Coronavirus (MERS-CoV), in 2012 aroused global concern. By 30 May 2013, 50 cases had been identified, with 30 of them being fatal, and the disease which was first identified in Jordan in April 2012, in Saudi Arabia and Qatar in September, and in the United Arab Emirates later the same year had spread to Europe.

About 75% of the cases of MERS-CoV are elderly men and the most severe illness occurred in people with existing chronic health conditions. Most patients required intensive care including mechanical ventilation. There are no specific treatments or vaccines for the disease. WHO is coordinating the global response to this emerging virus through the International Health Regulations.

In response to the outbreak of this new virus, the WHO Regional Office for the Eastern Mediterranean organized an intercountry meeting to brief Member States of the Region and to discuss future actions. The specific objectives of the meeting were as follows:

- To update the Member States of the Eastern Mediterranean Region on the current outbreak of novel coronavirus infection;
- To find out the current level of public health preparedness measures of Member States in response to the outbreak of MERS-CoV;
- To share and orient Member States on the currently available scientific information on MERS-CoV in the areas of:
  - surveillance
  - case management
  - laboratory diagnostics
  - infection prevention and control
  - International Health Regulations; and
- To discuss practical steps for strengthening surveillance in Member States.

The programme is contained in Annex 1.

The intercountry meeting took place at the WHO Regional Office in Cairo, Egypt, on 20–22 June 2013, and concluded on the final day with a briefing for ministers of health and their representatives. More than 100 health officials and disease research specialists attended the intercountry meeting. The list of participants by country is attached as Annex 2. The meeting was chaired by Dr Ala Alwan (WHO Regional Director), Dr Ziad Memish (Saudi Arabia) and Dr Mahmoud Mohamed Fikri (United Arab Emirates).

The meeting was opened on 20 June 2013 by Dr Ala Alwan, WHO Regional Director for the Eastern Mediterranean, who referred to the meeting as a “reality check” in addressing the threat posed by MERS-CoV to public health. Reminding participants that a technical consultative meeting on this novel coronavirus had already been organized by the Regional Office in January 2013, Dr Alwan stressed the need to translate the knowledge accumulated so far on the virus into concrete action points that could be implemented in countries.

Since any outbreak today can be a problem for the world tomorrow, cooperation between countries and international health bodies was vital, Dr Alwan said. He urged countries to enhance their surveillance of severe acute respiratory infections (SARIs) and reminded them of the value of the International Health Regulations (IHR) for rapid and meaningful information-sharing between WHO and States Parties. Timely intervention was important to curb the threat of infection, he added, so countries must be prepared to share information rapidly.

Dr Keiji Fukuda, Assistant Director-General of WHO, added his welcome to that of Dr Alwan. Although the infection originated in the Eastern Mediterranean Region, the threat was global and many countries worldwide have expressed concern, Dr Fukuda said. MERS-CoV had already been discussed by the World Health Assembly in May 2013 and the need for more information on the virus and the disease it causes was urgent. It was important to let people know what we were doing so that they were informed, Dr Fukuda added.

Dr Jaouad Mahjour, Director of the Department of Communicable Disease Prevention and Control at the WHO Regional Office for the Eastern Mediterranean, then reminded participants of the objectives of the meeting and outlined the topics that would be addressed in each session.

2. OVERVIEW AND UPDATE ON THE OUTBREAK

Dr Anthony Mounts of WHO headquarters gave a brief overview of the epidemiology of MERS-CoV, presenting the latest information as of 20 June. Thus he reported 64 laboratory-confirmed cases, of which 60% had died. Most cases are among males and most are also among the elderly, but a few younger cases have also been identified. Most infected persons have had respiratory infections, some have also had pneumonia, and some had other viruses and pathogens at the same time as MERS-CoV.

The number of cases has increased in recent months, possibly due to growing interest and therefore more testing to identify cases. The virus is centred on the Arabian peninsula, and there have been some cases reported in Europe among travellers. However, there have so far been no cases reported from the east – from places like Indonesia and Philippines – and that is a concern since many persons from such countries live in the Gulf Cooperation Council states. This absence of reports is likely to be due to a lack of surveillance, Dr Mounts suggested.

Then he described a case of a Kuwaiti man who had lived in Italy for 20 years. After a 40-day vacation with relatives in Jordan he returned to Italy and, although symptomatic, he went to work. He had severe respiratory problems and was hospitalized. However, in addition to four symptomatic contacts in Amman, he had apparently infected two other persons in Italy – a 14-month-old niece and a colleague at work who both had minor symptoms. The Italian experience suggests incubation within 3–4 days, while research in Jordan suggests 1–13 days. A case in the United Kingdom suggested the incubation period might be between 1–9 days, while In France when a traveller infected someone in a hospital the incubation period was 9–12 days.

Dr Mounts stressed that different specimens taken from same person on different days may show differing results. Nasopharyngeal swabs are not very effective, and in a number of cases such swabs showed negative for MERS-CoV while other samples were positive. He emphasized that, while specimens from both the upper and lower respiratory tract have value, specimens from the lower tract are more sensitive to MERS-CoV infection.

The discussions of the scientific meeting that took place in the Regional Office on 19 June were then summarized. The meeting found that polymerase chain reaction (PCR) assays work well for virus detection, that samples from the lower respiratory tract are most sensitive to the virus, that low titres of infection may be found in the urine, blood and stools, and that the best approach in suspect cases is to systematically sample from multiple sites. Dr Mounts noted that serology assays have been developed and, though the need for further validation remains, they have already been used to great effectiveness in the field. Some researchers have advised using two or more of the methods. To further standardize the various assays, sera are needed from persons who have been infected with the virus but are recovering.

The scientific meeting noted that transmission of MERS-CoV among contacts was limited. The typical pattern so far has been a severe case with a number of associated milder cases, but the existence of milder forms of the disease raises the question of whether some cases are being missed. The estimated number of cases, based on the number of infected travellers would suggest the possibility of over 1000 infected persons so far.

At this point it is unclear whether the pattern of disease is due to unrecognized transmission persisting in humans or an unrecognized animal reservoir with sporadic introductions. There may well be transmission via one or more intermediaries. More investigations are needed of the genetic profiles of animals. In addition, it is important to find out from index cases where they have been, what they have been doing, who they have been in contact with, what they ate, what kind of an environment they were in, and whether they had contact with animals.

In terms of developing drugs for treating MERS-CoV, the focus is on repurposing currently licensed drugs (e.g. interferons, cyclosporine, ribavirin). Two possible vaccine targets under development are the spike and nucleocapsid. It was noted, however, that the lack of an animal model is a major challenge for drug and vaccine development since the laboratory monkeys and other animals infected do not get sick. Dr Mounts urged countries to use standard investigation protocols which are available from WHO, ISARIC and CONCISE.

Discussion

Participants asked a large number of questions, indicating considerable interest in learning more about this emerging disease. Questions included the length of infectivity (the example of other viruses like SARS indicates that patients are infectious at least while they are still symptomatic, and it may be wise to consider patients infectious at least until their respiratory tract is clear). It was felt that more information is essential to draw up some guidelines on infectivity. Regarding the existing guidelines on MERS-CoV, investigations have not yet developed sufficiently to justify any change.

Another group of questions related to expanding the PCR and it was felt that routine testing as part of the routine diagnostic panel for pneumonia cases would be helpful. It would not be appropriate to test everyone with influenza but to test those with an unusual course of illness or with unexplained developments. On communication, it was stressed that it is extremely important to make knowledge public. Panic is controlled not by not looking but by looking effectively and telling people what is found, he said.

It was stated that families often want to keep their family members at home unless they are severely ill. It was noted that some mild cases have been cared for at home, and it was recognized that in many places there is a tradition of large families meeting together. However, to do this safely one would need to take precautions such as having the patient sleep in a separate room, use separate utensils, etc. The principles and practices in place in hospitals could potentially be applied at home to help avoid further infections, but at the present stage of limited knowledge it was felt that the recommendation should be to put patients in a controlled environment where they can be monitored.

Requests were expressed for a rapid test for MERS-CoV, for guidance on appropriate reagents, for information on risk factors, and for further details on the effectiveness of serology. Participants supported calls for the strengthening of epidemiology, identifying the source of contamination, and for further information and guidelines on aspects of the disease. However, it was also recognized that, while WHO is trying to collate data and develop guidelines, countries should also try to supply more information about their cases to help the researchers and WHO to give more accurate advice.

3. COUNTRY UPDATES

3.1 Saudi Arabia

Dr Ziad Memish, Deputy Minister for Public Health of Saudi Arabia began by pointing out that MERS-CoV seems to affect the sicker patients predominantly. However, the first case from Bisha who died on 24 June 2012 was apparently healthy before his illness. He had a large family with three wives and 23 children, none of whom became infected. Since then, of the 64 confirmed cases of MERS-CoV and 38 deaths, 49 cases and 32 deaths were associated with Saudi Arabia. After the first case, the government convened the National Committee for Infectious Diseases, invited WHO and the United States Centers for Disease Control (CDC) to assist in investigations, and requested veterinary support from the EcoHealth Alliance and Columbia University.

The case occurred a few weeks before the Hajj at which there was screening of suspected cases. Egypt and France both did testing of persons returning from the Hajj but found no cases. After the Hajj, Saudi Arabia had a number of small clusters in families and large clusters in hospitals. A case in Riyadh involved a person who was considered to be the index case but who happened to mention that his father had recently died of pneumonia in another hospital; investigation then showed that the father was the index case. Four of the family of 29 persons living in same household were infected. When a cluster of MERS-CoV

infections emerged in Zarqa, contacts were tested by the United States Naval Research Unit No. 3 (NAMRU-3) in Egypt and showed eight more infections than previously known.

The outbreak in Al Ahsa in 2013 involved transmission of MERS-CoV in a private hospital facility. Twenty-three of the 30 cases had contact with confirmed or suspected cases of MERS-CoV, and 10 of the 30 had animal contacts. The median of incubation was five days. When the outbreak was recognized, the hospital was closed to new admissions and some patients transferred to other hospitals. Much of the transmission was found to have occurred among chronically ill patients in the hospital's 32-chair haemodialysis unit. Four of the viruses from the Al Ahsa cases were submitted for sequencing and the detailed sequences were put on GenBank.

As a result of the outbreak, strict hygiene practices were put in place with strict droplet and contact precautions, an increased nurse-to-patient ratio, and increased spacing between dialysis chairs. More than 500 contacts were tested in relation to this cluster, and three family members and two health-care workers tested positive for MERS-CoV. All cases were reported to WHO in line with the IHR requirements, and active surveillance is being carried out throughout the country.

A team from the United States of America investigated possible sources of community infection – particularly bats but also livestock and domestic animals. International regulations on the overseas shipment of animal samples held up some of the dispatching but a licence has recently been received. In addition, one shipment to the United States thawed because of a delay in customs, so the samples were poor.

In conclusion Dr Memish stressed the urgent need for guidance on which serological tests to use and in what sequence, and on what to say to family members if their serological tests are positive. He said that Saudi Arabia is communicating information about the virus and the cases to the general public, and this has resulted in people coming forward to be tested for MERS-CoV.

Discussion

In discussion it was noted that Saudi Arabia does active contact-tracing and that, whether contacts are symptomatic or not, all are being screened for MERS-CoV. It was also noted that Saudi Arabia has no unconfirmed cases; they are all infected or not. The infection of health care workers is not common, though in Saudi Arabia two were infected and one recovered. The virus does not seem to infect healthy persons, but hospitals are prone to the virus since there are sick people there. However, Saudi Arabian investigations revealed no evidence that the virus was spread through air conditioning systems. Hospitals initially discharged MERS-CoV-positive patients when they became asymptomatic but now the policy is to wait until the PCR is negative, especially if they are health-care workers.

In response to a question about attendance at the Hajj, Dr Memish stated that elderly, patients with chronic diseases, terminally ill persons, pregnant women and children are

advised to delay their Umrah/Hajj for their own safety, although people will not be turned away if they come.

2.2 Jordan

Dr Mohammad Abdallat, Director of Communicable Diseases at the Ministry of Health, told the meeting that Jordan has had a severe acute respiratory programme since 2008, with three sentinel sites. In April 2012 it was reported that four health-care workers at Zarqa hospital had pneumonia. The cases looked like a hospital acquired infection so they were isolated, personal protection equipment (PPE) was used, samples were taken and protective measures were put in place. Investigations among persons with respiratory problems admitted to the hospital from 15 March to 30 April found 13 cases of which 11 were health-care workers; two persons were confirmed as having MERS-CoV. The Ministry of Health investigated the outbreak with assistance from WHO and in April 2013 CDC was asked to help with retrospective investigation of the outbreak. For this, nine of the original 13 cases were located, as well as household members and health-care workers, totalling in all 124 persons. Samples were taken and analysis was done using newly developed CDC serological tests. The results showed six positive household members, one positive household contact, and one positive health-care worker who recalled having minor symptoms which were not serious enough to seek medical advice. One household member who tested positive was pregnant. She had respiratory symptoms but did not seek medical care out of concern for the fetus and subsequently miscarried. Analysis of clinical and epidemiological data collected from the 124 persons is continuing.

2.3 France

Dr Didier Che of the French Public Health Surveillance Agency of France said that in France, as part of routine surveillance, any cluster of hospitalized patients with severe respiratory infection, regardless of history of travel, should be notified to the public health authority. The French MERS-CoV surveillance system now uses, as a case definition for a possible case, any patient with a history of travel in an at-risk country with clinical and/or radiological signs consistent with acute respiratory distress syndrome (ARDS) or pulmonary parenchymal infection with fever ≥38 °C and cough within 14 days of return, any contact of a symptomatic possible or confirmed case presenting with acute respiratory infection with an onset of symptoms within 14 days of the last contact with a possible/confirmed case while symptomatic, and in immunocompromised patients, or in patients with chronic underlying conditions, occurrence of febrile syndrome with diarrhoea or any severe pathology should be considered. As of 17 June 2013 France had two confirmed cases and one result pending (out of 194 suspected cases reported and 51 classified as possible).

Dr Benoit Guéry, Professor of Infectious Diseases at the Regional University Hospital Centre in Lille, France, added details about clinical features and viral diagnoses of the two confirmed French cases. The first was a 64-year-old man with hypertension and diabetes who had undergone renal transplantation in 1998 and had sigmoiditis in 2012. He visited Dubai in April 2013, returned on 17 April, and was admitted to hospital in Valenciennes with a fever of 39 °C and diarrhoea on 23 April. Respiratory problems developed and after various analyses

and a lung scan he was transferred to an intensive care unit at another hospital in another city on 29 April. After his respiratory status worsened he was transferred to the Lille University Hospital where he developed haemorrhagic complications contributing to renal failure. He died on 28 May.

The second case was a 51-year-old man who lived in northern France and had not recently travelled abroad. His medical history included myocardial infarction in 2005 and arterial hypertension. He was admitted to the Valenciennes hospital on 26 April with thrombosis in his arm and was discharged on 30 April. By 8 May he had developed respiratory problems and was directed to the infectious diseases department at Lille hospital. He was identified as a contact of the first patient (they had shared the same room in the hospital at Valenciennes) who by that time had been diagnosed with MERS-CoV. The second patient developed pneumonia and his condition kept worsening. Dr Guéry noted that little could be done for him. By 20 June he was still in a very serious condition and undergoing extra corporeal membrane oxygenation (ECMO).

Dr Guéry stressed the urgent need for guidelines on treatment of MERS-CoV patients. He pointed out that the first patient had contact with health-care staff without PPE and the second patient had contact with family members but there had been no transmission in these cases.

3.4 Tunisia

From Tunisia there was a report of a 66-year-old man who was diabetic (though not treated and not followed up) who visited Qatar in March and April 2013. Five days after his return to Tunisia he was hospitalized in Monastir with fever. Despite antibiotics his condition deteriorated and he died on 10 May. This index case was categorized as a “probable case”. Two symptomatic contacts were identified about four days after his death. The man’s son had coughing and produced sputum with a stream of blood, while the daughter had bronchitis. Both of them tested positive for MERS-CoV by PCR on the throat swabs. Other contacts have also been identified and samples have been sent to CDC for analysis. Results were still awaited as of 20 June.

It was reported that the Tunisian Ministry of Health has sensitized health-care workers to MERS-CoV, and persons planning to go on the Hajj have been advised to be aware of possible symptoms and have been informed what to do if they notice them. There was a call from meeting participants for study of the index cases to be accelerated to find out more about the disease.

3.5 Qatar

Dr Mohammed Al-Hajri of the Public Health Department of the Supreme Council of Health in Doha reported that Qatar had its first two cases of MERS-CoV in October 2012 but had no possibility of diagnosing the disease. One was diagnosed in Germany and the other in the United Kingdom. The health authorities explained the situation to family members, health-care workers and industry, and awareness-raising sessions were conducted with the

staff of intensive care units. Health care staff have been advised to strengthen basic safety measures such as hand hygiene. The general public has been advised to take precautions such as avoiding touching the eyes, nose and mouth with the hand, and avoiding wild animals during travel. Health alerts on MERS-CoV have been issued to surveillance sites and hospitals to keep them informed and there is a hotline that can be used for notifications. It was noted that Qatar hopes for a WHO visit to investigate the disease, including possible animal investigations.

Qatar now has routine sample testing of all cases of acute respiratory distress syndrome (ARDS) admitted to hospital, and so far 282 cases have been followed up. Dr Said Al Dhahry, Consultant Virologist at the Hamad Medical Corporation in Doha, described sample-testing of cases, all of which all have proved negative for the MERS virus. Infection control guidelines have been developed and have been adopted by all health care facilities at national level. Efforts are under way to expand the guidelines to primary care clinics, private hospitals and ambulances. A PCR test for animals is available and sampling of animals will begin soon.

3.6 Germany

Dr Udo Buchholz of the Robert Koch Institute in Germany reported on German experience with two cases of MERS-CoV. The first was a 45-year-old man from Qatar who was transferred to a hospital in Essen on 24 October 2012, on the 20th day of his illness. His diagnosis was unrecognized for three weeks, with staff taking only standard precautions. He was referred to rehabilitation on 21 November with the precise illness still not recognized. The following day, information on MERS-CoV was received and he was readmitted. Contact tracing revealed 120 hospital contacts and three out-of-hospital contacts.

The second patient was a 73 year-old man from the United Arab Emirates, who had had multiple myeloma since 2008 and who was transferred to a hospital in Munich on 19 March 2013 after originally being hospitalized in Abu Dhabi with pneumonia on 10 March. This case was on the 11th day of illness when admitted to hospital in Munich. He was intubated that day and died on day 18. Follow-up was carried out with close and distant contacts (with the difference defined by a distance from the patient of two metres). Close contacts were asked to report daily on their health, while more distant contacts were asked to report only if they had any MERS-CoV symptoms. Of 84 contacts, 13 were found to be symptomatic but all were negative for MERS-CoV.

3.7 Discussion

A variety of questions were asked and issues raised during the discussion of country reports. It was noted, for instance, that not all samples of the Qatar cases and contacts had been obtained, and that one of the Qatar cases had visited Saudi Arabia. While the first case in Qatar was the owner of a farm, at the time it was not considered necessary to take samples from animals there.

It was reported that following the German case from Abu Dhabi, the United Arab Emirates authorities traced 80 health-care worker contacts there. They also traced contacts of the French case from their country.

There were questions about the levels of preparedness for future cases, to which Jordan responded that they had done awareness-raising about the infection with the general public and with health-care workers about the need to use protective equipment. Jordan also had guidelines in place regarding acute respiratory illness. While it was felt that it was important to note the miscarriage of the pregnant contact in Jordan, it was felt to be difficult to formulate advice at present based only on this one case. However, it was pointed out that pregnancy was a risk factor for H5N1 infection.

There was a question as to whether bacterial infections could have made the Munich patient worse but the German response was that it had been impossible to culture the virus. In Germany, the MERS virus was found in the urine but not in the blood. Kidney samples, even taken postmortem, would provide an independent test. It was stated that animal studies in monkeys found the virus only in the lungs and nowhere else. Tests on human blood and stool are important to find out more about the virus, but they cannot be considered tests for the confirmation of MERS-CoV.

There was stress on the need for training and protective equipment for personnel dealing with samples. It was advised to take samples from multiple sites in the body to find out where the virus is. For milder infection it is best to get both upper and lower respiratory tract samples. The point was raised that superinfections must be considered in the case of viral infections.

4. TECHNICAL GUIDANCE ON SURVEILLANCE: CURRENT APPROACH AND PRACTICE

4.1 WHO interim recommendations

Dr Anthony Mounts introduced this topic by pointing out that WHO's interim MERS-CoV surveillance recommendations, which were prepared in October 2012, are available on the WHO web site. The aim of surveillance is to identify sustained human-to-human transmission and risk areas, as well as to determine key clinical and epidemiological characteristics. The 2012 guidelines have now been updated to include a stronger recommendation for surveillance of the lower respiratory tract (since there is increasing evidence that upper respiratory tract specimens are not as sensitive as specimens from the lower tract) and a longer observation period for contacts or travellers to the infected area (increased from 10 to 14 days).

WHO recommends that the persons who should be tested are those with fever, cough and pneumonia who require admission to hospital. In addition, clusters of pneumonia should be investigated (even if persons have not travelled), as should health-care workers who have pneumonia and need to be hospitalized, pneumonia patients who were in the Middle East within the previous 14 days, any case of pneumonia with an unusual course, and any person

with a respiratory illness who has been in contact with a MERS-CoV patient in the last 14 days. For countries in the Middle East in particular, the minimum requirement should be to test all persons with SARI who need mechanical ventilation. If the resources exist, this can be expanded to include testing of all SARI cases.

As stated in the guidelines, it is strongly advised to collect lower respiratory samples such as sputum, endotracheal aspirate or bronchoalveolar lavage. If lower respiratory tract specimens cannot be collected, both nasopharyngeal and oropharyngeal swabs should be collected from the upper tract, and if the initial testing of an upper respiratory specimen is negative in a patient suspected of having MERS-CoV infection, the testing should be repeating. Serology should also be considered. All confirmed and probable cases should be reported to WHO within 24 hours, and information about exposures and clinical course should be added.

Discussion

A question was asked as to whether to adopt a standard reporting form in the Eastern Mediterranean Region. It was agreed that a standard form should be developed. It was reported that Iran had already developed such a form and would be willing to share it.

There was also discussion about whether to discharge a patient after a negative test, as some people have advised retesting. WHO said it would not recommend routine retesting except in a case of suspected MERS-CoV. In relation to this discussion it was noted that that there are no clear data on when a person starts and ceases to be infectious. However, it was felt that it would not be appropriate to require an asymptomatic person to remain in hospital.

In response to a question about how a cluster is defined, it was noted that the important point is – if several cases of pneumonia are identified – more questions should be asked.

There was some discussion of whether airline passenger locator cards should be used to trace contacts of infected persons who had travelled by air. Saudi Arabia reported having checked all passengers who sat near the patient who flew to London (including persons in the row in front and in the row behind the patient). However, all tested negative. Nevertheless, the person who collected the patient from the airport in London became infected. It was suggested that the risk of infection may depend on a person's immune status. In response to a question, Saudi Arabia reported not yet having found a symptomatic person who tested negative.

4.2 Influenza-like illness/severe acute respiratory infection surveillance guidance

Dr Samir Refaey, Director of the Epidemiology and Surveillance Unit of the Ministry of Health and Population of Egypt, addressed surveillance guidance and approaches to early detection of human infection with the MERS virus. In Egypt, where 96% of the population lives in 6% of the land area, surveillance for influenza-like illness (ILI) was set up in 2009. Dr Rafaey described the case definition and methodology used for SARI surveillance in Egypt between 2007 and 2013. Of the 14 000 SARI patients studied, 13 313 were tested by PCR and 31% tested positive for influenza viruses.

For surveillance of coronavirus, Egypt followed WHO's interim definition and collected demographic and clinical data as well as information on travel and symptoms. In 2012, 324 samples were tested for the novel coronavirus and 1241 were tested as part of the SARI surveillance; 6% and 19% respectively tested positive for influenza but none were positive for MERS-CoV. The samples tested in 2012 included samples from 183 pilgrims returning from Saudi Arabia, all of which were negative. Of suspected cases found in hospitals, 93% were pneumonia.

Dr Refaey reported that a risk assessment regarding MERS-CoV included the fact that some 85 000 Egyptian pilgrims travel to Saudi Arabia during the Hajj and Umrah season each year. In addition, some two million Egyptians work in the Arabian peninsula, cultural customs include festivals and large family and social gatherings, the intensive care and isolation capacity of health-care establishments may be limited (according to the size of an outbreak), infection may be difficult to prevent, and transmission to Egypt is likely to occur soon. Challenges include improving the quality of case management and of early detection and diagnosis, while on the positive side Egypt has a good SARI surveillance system, an established focus on public health, good resources and health-care infrastructure, and centres of excellence at national level

Dr Payman Hemmati of the Center for Disease Control of the Islamic Republic of Iran referred to the terms of the IHR, stating that prevention of the international spread of epidemic diseases requires two strategies – rapid identification at international borders, and containment and mitigation within each country. Dr Hemmati argued for a system of syndromic surveillance, which could be instituted according to indicators, rather than a system based on laboratory confirmation. There could also potentially be surveillance based on health-related behaviours or on non-health behaviours, he said. If one could capture society's health behaviours one would have an indication of potential health problems developing.

The Iranian Influenza Surveillance System (IISS) identified 326 SARI cases in the first month of the current Iranian year (from 21 March to 21 April 2013). In the second month (21 April to 21 May 2013) 211 cases of SARI were found, and between 21 May and 20 June some 88 cases were found, showing a noticeable decline. Similarly, influenza-like illness has also shown a decline, indicating that surveillance of this illness is not a likely place to find coronavirus.

Participants were shown a reporting sheet for influenza and SARI symptoms for use by quarantine officers at ports of entry into Iran which has been enhancing laboratory capacity to identify MERS-CoV since January 2013. Since the IHR came into force in 2007, Iran has established some 170 negative-pressure isolation rooms around the country. In addition, guidelines based on those of WHO are being developed for health-care workers (including a set of do's and dont's), as well as a pamphlet for the general public. It was pointed out that Iran would be willing to share its web-based IISS with other countries.

4.3 Case investigation

Dr Anthony Mounts introduced WHOs latest guidance on case investigation which aims to identify more cases of MERS-CoV with the aim of reducing human transmission. Dr Mounts said that the initial interview is critical in order to put together a picture of the patient's life and behaviour – particularly travel, social contacts, exposure to food, and contact with animals – and to describe the clinical syndrome. Close contacts of the patient should be monitored and should be tested with PCR if symptomatic. It is also advised to collect sera on all acute and convalescent contacts. The contacts should also be asked about their exposures since, if infected, one might be the index case.

A local definition should be developed for case-finding, which should include timing, signs and symptoms, exposures – who, when, where. Dr Mounts recommended looking in hospitals, talking with health-care workers, and checking death records for recent cases of unexplained pneumonia. This could be followed by enhanced surveillance in a particular area for at least a month. Laboratory capacity could be introduced in the area if possible. Clinicians and health-care facilities should be informed of the case definition and the reporting mechanism.

Dr Mounts reiterated that nasopharyngeal swabs may not be enough and that lower respiratory tract specimens are needed. If a test is negative but infection strongly suspected, testing should be repeated. PCR testing is standard and serology is also available.

The importance of knowing what people do and where they go was again stressed. While it will be useful to find out what the animal host is, the key at this stage is to identify how the transmission takes place. Rates of seroprevalence may be useful for comparing rates in different population groups. Current priorities are to identify what nonhuman exposures result in infection and to determine the clinical presentation and course.

Discussion

There was a question about the viability of postmortem sampling which had been recommended as useful but which was not always culturally acceptable. In any case, it would be difficult to delay burials.

There was also discussion about the different capacities of countries. It was felt that if countries do not have the PCR, then there is really no alternative. Serological testing is possible but is retrospective, and if a country does not have the resources for a PCR it is unlikely to be able to do other testing. However, even in resource-poor situations, if samples can be taken they can be sent to a laboratory via the WHO Regional Office.

In response to a question as to whether to test for MERS-CoV if another cause of SARI is identified, it was felt that it is difficult to give a clear guideline for all situations and it would remain a matter of judgement.

4.4 Surveillance at the human–animal interface

Dr Peter Ben Embarek of the WHO Department of Food Safety and Zoonoses at WHO headquarters noted that it is not easy to find out how people are becoming infected with MERS-CoV. However, it is important to identify the source in order to allow the introduction of public health measures to reduce or stop transmission. He cited the examples of SARS in China and Nipah virus in Malaysia in which cases it was possible to interrupt animal transmission of the virus.

Dr Ben Embarek summarized the little that is known about the virus: its source appears to be in several countries in the Region, it seems to be present in both urban and rural settings, and so far all cases have been residents or travellers (and not expatriates). The source could be an animal, an animal product, a contaminated food, a contaminated environment, or a number of other things. Foods to examine could be camel milk which is consumed raw by residents and is also a tourist attraction, and also dates and other fruits. One should also consider local products used in traditional medicine. There are currently no data on environmental exposure to MERS-CoV, but information on SARS indicates that the SARS virus can persist for a long time.

Few of the MERS-CoV cases have reported contact with animals. However, those few were camels, cats, birds, falcons, pigeons and bats. It is already known that the virus is very close to other coronaviruses found in some bat species, and sampling has been done in Saudi Arabia in the bats that are likely sources. Saudi Arabia has about 29 species of bats.

It was felt that he potential link to camels needs further investigation. There are banks of camel serum samples in the Eastern Mediterranean Region that could be used for testing. It would also be useful to find out if some professional groups related to camels are likely to be infected. It is known that the international trade in camels links the Arabian peninsula to Djibouti, Sudan and other countries. There are also a lot of camels in other parts of the world, such as Australia. In the future, veterinary, agriculture and food safety services need to be involved in the search for the source of MERS-CoV.

Discussion

In discussion it was noted that it is important to consider all possible sources in order to find links between cases. It was also pointed out that it is still not clear whether the cases being referred to as index cases really are index cases. A common factor needs to be identified between all cases.

In response to a question about stored animal blood, it was agreed that this should be screened. It would be important for WHO to discuss the possibility of doing this with a reference centre of the Food and Agriculture Organization of the United Nations (FAO) or of the World Organisation for Animal Health (OIE).

Although some tests have yielded negative results, it was felt that these should be continued. Dr Ben Embarek said it is not surprising that there are negative results because the tests are not easy to do. However, it is unlikely that anything will be found by chance.

It was pointed out that at this stage the aim is not long-term surveillance. Rather it is to seek evidence of the way that people are becoming infected. At the same time, testing of animal sera is helpful in order to find possible sources of the virus.

5. OUTBREAK AND PREPAREDNESS FOR MASS GATHERINGS

Dr Maurizio Barbeschi of WHO headquarters described mass gatherings of people as an opportunity to raise awareness of the need for surveillance and prevention. The mass gathering may be a festival, a sporting event, a riot, a religious gathering or any other occasion on which large numbers of people gather together. At major events there are likely to be security concerns, there may be high-profile sponsorships, many journalists are present and so many people are watching, often around the world. The key to health security in such a situation is to assess the event to identify threats and design interventions to counter those threats.

During any mass gathering, normal health services must continue and any extra pressure from the event itself may stretch them beyond their capacity. Mitigating risk will often require intersectoral approaches involving different government ministries. Within the context of the IHR, mass gatherings are a special case for focusing attention on disease prevention in the host country, the prevention of international disease spread, and the public health legacy after the gathering is over.

Dr Barbeschi described WHO's interim framework for risk management during mass gatherings. In particular, he stressed the need to assess the hazard, the exposure and the context. For instance, if the hazard is MERS-CoV, there needs to be an up-to-date understanding of the epidemiology of the virus, its clinical features and speed of onset, geographical area and settings affected, the populations at risk, the response to treatment, and control measures. In addition, there needs to be an assessment of the likely exposure to the virus, including the size of the population likely to be exposed, the numbers likely to be susceptible, the modes of transmission, the incubation period, and access to health-care facilities. And lastly, there should be an assessment of the context of the mass gathering, the country in which it takes place, and the origins of those attending.

It was noted that in 2012 the WHO Executive Board decided that health security linked to mass gatherings should be a part of WHO's programme of work. Consequently WHO has developed a number of resources in this area.

Discussion

It was reported that in 2009 Saudi Arabia had similar concerns about the possible spread of H1N1 at the Hajj. Vaccination with Tamiflu was encouraged and screening facilities were in place. However, there is currently no vaccine available for MERS-CoV. A project for the

expansion of the Mecca and Medina mosques is underway which will increase the capacity in Mecca from the present 35 000 people doing the circumambulation in one hour to 150 000 per hour in future. Thus preparations to prevent the spread of infectious disease will become increasingly important. The Saudi Arabian government has limited the number of pilgrims this year because capacity is reduced due to building work. The terminally ill, pregnant women, and children, who are not supposed to perform the Hajj anyway and are more likely to be harmed by infectious disease, are especially being discouraged from attending this year.

In the context of several questions about the Umrah pilgrimage, it was emphasized that anyone with pneumonia should be screened for the coronavirus. Each year the Ministry of Health of Saudi Arabia issues requirements for people coming to the Umrah and the Hajj. So far, no travel restrictions have been issued in relation to MERS-CoV but restrictions will be introduced if evidence becomes available to make them necessary.

It was pointed out that the decision to impose travel restrictions is a difficult decision to make since it is necessary to stop the spread of disease but travel restrictions cause other kinds of harm to countries. It was reported that WHO is currently discussing whether to convene an IHR committee on MERS-CoV.

Several participants noted that risk communication and messaging must be a high priority, and it was felt that WHO help is needed to develop messages that can work among all language groups. Regarding religious festivals, it was agreed that pilgrims should be given health messages before their departure from home. Experience shows that health messages from respected persons within your own group are more likely to be taken notice of than general leaflets for everyone.

It was noted that medical staff accompany the groups of pilgrims and these medical staff are arranged by the tour operators. However, these accompanying staff are clinicians rather than public health specialists. It was reported that Oman ensures that the health advice from Saudi Arabia is included in each Omani pilgrim's "health bag".

Concern was raised about schools as places where disease may spread easily, and WHO was asked if it had any advice on closing schools in a MERS-CoV outbreak. WHO responded that with so little information at the present stage it is not possible to predict what should be done with regard to schools.

6. TECHNICAL SUPPORT AND INTERIM GUIDANCE FOR MANAGEMENT OF CASES

Dr Nahoko Shindo of WHO headquarters introduced this session which aimed to summarize the key clinical features of MERS-CoV infection (and the knowledge gap), highlight the key clinical interventions outlined in WHO's interim clinical management guidance document, and present potential treatment options and international collaborative research.

6.1 Case management and WHO guidance

Dr Shindo explained that the MERS-CoV clinical spectrum varies from severe (primary viral pneumonia progressing rapidly to ARDS and needing life support) to mild (acute upper respiratory infection with or without fever). It is not known if there are asymptomatic MERS-CoV infections. The incubation period is 2–15 days but the Saudi experience with severe cases showed incubation in three days leading to death in 10 days. This is very unlike SARS, which means that SARS model of case management may not be appropriate. Countries were encouraged to compile data on MERS-CoV cases in a systematic way so that a picture of the most appropriate case management can be built up. MERS-CoV has a higher overall fatality proportion than SARS but MERS-CoV cases have so far tended to be older and many have diabetes and other serious conditions – cases which were also associated with higher death rates from SARS.

Not only are there gaps in knowledge about the route of transmission and infection of MERS-CoV, Dr Shindo said. There are also gaps in knowledge of the natural history of the disease, viral kinetics, the immune response and pathophysiology. There is a need for the collection of diagnostic specimens and for prognostic markers, and there is a need for more knowledge about management and treatment. With SARS the overall immune response from the host played an important role in deterioration of the disease, but with MERS-CoV the development of the disease is much more rapid, suggesting aggressive primary viral invasion to the lungs.

Priority clinical research for MERS-CoV should include efforts to determine the optimal timing of any treatment measure and to guide infection control (e.g. studies on viral kinetics, inflammatory and cytokine responses, seroprevalence, and identification of predictors of poor clinical outcome), comparison of the severity of cases, determination of the full spectrum of clinical disease, investigation of the role and timing of convalescent plasma, and assessment of antiviral therapies and ventilatory strategies.

WHO's interim guidance document on *Clinical management of severe acute respiratory infections when novel coronavirus is suspected: what to do and what not to do* is aimed at frontline clinicians caring for patients with SARI in an intensive care setting. The document has sections on (i) early recognition and management, (ii) management of severe respiratory distress, hypoxemia and ARDS, (iii) management of septic shock, and (iv) prevention of complications. The aim is to take a practical approach and make the document applicable to resource-limited cases, with a focus on high-quality supportive care since no virus-specific intervention is yet available. The document was drafted in consultation with 11 expert panel members from the WHO Clinical Network and is peer reviewed. Each section has a set of clear do's and dont's, describing the steps to be taken point-by-point and drawing attention to those things that should not be done.

Dr Shindo also described WHO's *SARI critical care training curriculum* which enables participants to perform critical care management of severe forms of influenza infection. She drew attention to the need for standardized protocols; two are available – on natural history of the disease, and on specimen collection. She also emphasized the importance of collecting

convalescent plasma and urged countries to communicate with the clinical community about MERS-CoV, to plan and be ready for research, and to promote good patient management.

6.2 The experience of the United Kingdom

Speaking by teleconference, Dr Richard Pebody of Public Health England described how the United Kingdom set up surveillance for MERS-CoV in September 2012, focusing on travellers returning from Middle East. So far 63 suspected cases have been tested and all have been negative except for four.

The first case, a Qatari national, was still in intensive care and was still alive on 20 June (he has since died). He was 49 years old and was apparently healthy before the infection. A prospective observational cohort study was conducted of all close contacts of this case, with contacts being followed up for 10 days (the putative incubation period) from the time of their last effective contact. The study showed considerable exposure not only to family members and friends but also to unprotected or partially protected health-care workers. However, serological testing showed no evidence of serological response consistent with infection among close contacts of the case despite unprotected exposure.

The second MERS-CoV case was originally diagnosed with influenza A which distracted from the diagnosis of MERS-CoV. This person was a resident of the United Kingdom who visited Pakistan and then Saudi Arabia and who was taken ill in Saudi Arabia and took a commercial flight to the United Kingdom. He stayed with his family until admitted to hospital first in Birmingham and then in Manchester. He subsequently died. Contact tracing in this case included not only family, friends and health-care workers but also the aircraft passengers in the same row and two rows in front and behind the patient on the flight from Saudi Arabia to London when he was unwell.

The two other persons who developed MERS-CoV had not left the United Kingdom. Both were infected by the second MERS-CoV patient. One was an adult male family member who was immunosuppressed and had close contact with the traveller on his return. This immunosuppressed person became ill on 6 February 2013 and died on 17 February. The remaining case was an adult healthy female living in another household but part of the same extended family who had limited exposure to the traveller three times while visiting in hospital. This person had mild symptoms but did not need hospital admission and is fully recovered. The infection seems to have been transmitted when this person visited without protective equipment while the traveller was being ventilated in intensive care. No further transmission was found from the two secondary cases.

Dr Maria Zambon of Public Health England then described experience of case management of the four MERS-CoV cases in the United Kingdom. She stated that so far the United Kingdom cases had exhibited three courses of disease, namely severe disease with

death, severe disease with recovery, and mild disease with recovery.[1] She noted that there was a time in February 2013 when three of the four ECMO beds in England were occupied by MERS-CoV patients.

Examination of the first MERS-CoV case (from Qatar) showed samples tested positive or negative according to the body part they came from and the stage of the illness. Thus a sample from one body part might test positive on one day, negative a few days later, and positive again some days after that. Hence it was advised to sample patients from multiple sites. Virus detection lasted for 30 days and there was a good antibody response. It was noted that at day 18 only about 10% of the patient's lung was available for oxygenation, while at day 200 some 30% was available, though it was clear that there would be limited respiratory capacity in the long term. The improvement was said to be due to ECMO. No particular interventions were made against the disease, though the patient had steroids at an early stage. Dr Zambon said issues to consider included what interventions might have made a difference to this outcome and whether there should have been attempts to reduce virus shedding or prevent end organ damage.

The second MERS-CoV case (the traveller who had visited Pakistan and Saudi Arabia) also showed inconsistency of sampling, with the blood testing negative after day 14 of the illness but the respiratory tracts still testing positive at day 49 when he died despite a good antibody response. He was given ECMO but it did not save him.

The experience of these two cases showed that MERS virus detection may be prolonged and that the virus may be detected in multiple parts of the body. Samples from the upper and lower respiratory tract were useful but samples of faeces, urine and blood were not very informative. It was also seen that common infections may also occur at the same time as MERS-CoV. Antibodies were detectable from around day 14 onwards and in the first case there was prolonged antibody detection after nine months

The third case (an immunocompromised family member of the second case) had his regular chemotherapy for his known disease six days before exposure to MERS-CoV. It was considered whether to take convalescent plasma from the first MERS-CoV case who had developed antibodies, but it was felt that it was too dangerous for the donor to take 400 ml of blood from him to produce 200 ml of convalescent plasma. Since it was certain that the outcome of the third case would be disastrous, some experimental efforts (with protease inhibitors) were made. He died on day 10 of his illness.

The fourth case (the only female of the four) had mild symptoms and stayed home from work but soon recovered. Limited tests were performed. Her sputum was found to be positive for the disease but not the respiratory tract.

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[1] NB: The case described as severe disease with recovery was still in intensive care on 20 June and has since died.

While acknowledging that there can be no guidelines since there is as yet no evidence and no clinical trials, Dr Zambon stressed that there is a need for “decision support” to help clinicians to take decisions based on the evidence available to them in the situation they face. She suggested that convalescent plasma treatment should be considered in patients who are deteriorating, despite other specific and supportive therapy, and in whom the virus remains detectable.

The United Kingdom has prepared decision support documents ready for any future cases as well as case management and sampling protocols. Virus shedding will be monitored regularly, and there will be systematic sampling from different parts of the body. Ethics approvals have been obtained for intervention studies in all ECMO facilities and for the use of convalescent plasma. There will be serological follow-up of all cases and contacts, and serological algorithms have been developed for population studies

6.3 Discussion

The discussion was opened with an update from Saudi Arabia which said that in the previous two days four health-care workers had reported with symptoms. Two were tested positive for two days, and one for three days. A fourth case had a negative result. These were health-care workers who had been considerably exposed to infected patients. It was felt that this was important information for building a further picture of the virus. This led to a question regarding who should be tested. It was reported that in the United Kingdom symptomatic persons are tested. It was felt that taking nasopharyngeal swabs from all contacts might identify further mild cases, although expanded testing would put an extra burden on the health system.

A question was raised about asymptomatic infection but there was little evidence of this. A very few cases were reported from Jordan and from Saudi Arabia and such cases should be monitored, but there is no plan to treat asymptomatic cases. It was noted that testing asymptomatic contacts is costly to the health service but, if resources are available, it could perhaps be studied in a research context. There is no community guidance available that is specific to MERS-CoV but it was pointed out that there is advice taken from the experience with pandemic influenza. Very few pediatric cases have been seen and most were mild infections, though a two-year-old Saudi child who already had serious medical problems had a more serious MERS-CoV infection.

Participants emphasized the need for good quality data on all aspects of the MERS virus, and even on the genetic makeup of the male. It would be important to find out whether MERS-CoV is being caused by exposure or by behavioural or genetic factors. The meeting heard that Dr Guery of France had agreed to develop an international protocol on interferon and MERS-CoV and that he wished to hear from countries that could assist.

Since the sampling strategy seems to vary according to the stage of the disease, it was seen as important to have, as soon as possible, a clear strategy according to type of sample and time of sampling. It was pointed out that the first sample is likely to be taken to find out which illness is being dealt with and that, if MERS-CoV is suspected, this sample should be

from the lower respiratory tract. Once a diagnosis of MERS-CoV is confirmed, then a sampling strategy should be developed by stage of the disease and number of days. It was admitted that sampling in the United Kingdom was not entirely systematic because, by the time the patients were hospitalized, the tests and diagnoses had already taken place. It was noted that comorbidities appear to be likely but they may vary and further data are needed. Work on coreceptors is still under way.

In response to a question about sampling that can distinguish between different coronaviruses, it was stressed that so far little work has been done on serology or correlates of protection for coronaviruses. There is ongoing work on antigenics, trying to measure the relationships between different groups of coronaviruses, but so far there is no clear link between what is measured and what one infers from that. It was noted that serology tests still need to be validated but they can nevertheless be used. There are no molecular data on MERS-CoV as yet, but countries were urged to share genetic information if they have it. In the United Kingdom some molecular evolution was seen in the virus strains but there is too little evidence on this as yet. It was stressed that there is a need to establish a panel of virus strains for further research.

A participant pointed out that the MERS-CoV case definition seems to differ from country to country. The United Kingdom reported that it uses the WHO definition, which was developed for global surveillance, and 70% of the cases match these; thus it includes some cases of milder illness and some persons from countries beyond the Middle East though none of these have been found to be positive.

In response to questions about treatment and prognosis, Dr Zambon noted two cases in the United Kingdom who had CMV reactivation which was found as part of routine blood screening. All the United Kingdom cases had influenza-type symptoms but in one French case the problem began with diarrhoea. In the case of SARS there was a high degree of virus shedding following gastric infestation but so far nothing definite has been found with MERS-CoV. It was pointed out that animal tests may show whether the MERS virus affects the gastrointestinal tract, but at this stage with very few cases and one case in which it happened, it should certainly be expected. It was difficult to comment on prognosis for patients with MERS-CoV infection but, based on experience so far, the younger the patient the better the prognosis.

It was reported by Djibouti that the Horn of Africa lacks a surveillance system but that many cases of atypical influenza are found. It was agreed that Djibouti needs a great deal of assistance and it was pointed out that the WHO Regional Office is organizing a series of training courses there.

There were calls for a document that would contain everything known about MERS-CoV, for an IHR questionnaire, and for a standby team to be ready to react in case of an outbreak. The WHO Regional Office responded that, while one comprehensive document is not yet available, participants would receive electronic copies of all the MERS-CoV background documents prepared so far. An IHR questionnaire had already been sent to countries but not all have yet responded. The Global Outbreak Alert and Response Network

(GOARN) serves as a standby team for outbreaks in coordination with WHO at regional and global levels.

7. TECHNICAL GUIDANCE AND SUPPORT FOR LABORATORY DIAGNOSTICS

7.1 Development of laboratory diagnostics

Dr Susan Gerber of CDC presented the Centers' work on reverse transcription PCR (RT-PCR) diagnostics, sequencing, and serological assays related to MERS-CoV. She repeated earlier calls for specimens to be taken from different areas of the body and at different times.

Dr Gerber informed the meeting that RT-PCR diagnostic kits, allowing 1000 reactions per kit, had been authorized by the United States Food and Drug Administration (FDA) for emergency use in the USA in testing for MERS-CoV if considered necessary. The USA currently has no MERS-CoV cases but the kits will be supplied to laboratories throughout the country in the coming weeks as a precaution. The kits can also be supplied to other countries on a case-by-case basis and CDC is willing to provide training in their use.

CDC has also developed advanced molecular diagnostics that can trace a range of viruses, including MERS-CoV. Deep sequencing can be done from patient specimens containing MERS-CoV.

The current work of CDC on serology assays for MERS-CoV was described. Dr Gerber said that recombinant protein-based serology assays show high reproducibility, are safer in that they do not require cultivation of MERS-CoV, are easier to standardize, are less labour-intensive and have good sensitivity. She described the development of an enzyme-linked immunosorbent assay (ELISA) which was modified from the SARS N ELISA that was originally developed by the CDC laboratory and which was shown to have high specificity of 96%–97%. The assay has, however, not been validated as human sera were available from only one case.

An immunofluorescence assay has also been developed but, while being reliable and highly specific, it is cumbersome for large-scale screening. The development of a microneutralization assay is also under way and, in addition, a MERS-CoV assay is in preparation. All these assays have been tested in the USA, though the latter two are still under evaluation.

7.2 Overview of laboratory testing

Dr Pierre Formenty of WHO headquarters gave an update on laboratory testing for suspected MERS-CoV. After the discovery of MERS-CoV in 2012, a PCR assay was quickly developed and published by the University of Bonn, Germany. WHO recommends two PCR tests targeting two different sites of the genome (UpE and 1A), or one PCR test followed by amplification and sequencing, for confirmation of MERS-CoV infection. CDC can supply RT-PCR kits on a case-by-case basis. The University of Bonn, Germany, has PCR assays and

bench protocols, while the European Virus Archive distributes positive controls for PCR tests. Public Health England in the United Kingdom and Institut Pasteur in France can supply reagents on a case-by-case basis

Results from the testing of specimens in the Munich MERS-CoV case showed changes in titre over time. Lower respiratory tract specimens are more sensitive than upper tract specimens but both have value. The virus can also be found in blood, faecal samples and urine but at lower titres. Thus Dr Formenty reiterated the need to sample systematically from multiple sites in suspected cases and to sample sequentially from multiple sites in confirmed cases.

Dr Formenty listed the serology tests on MERS-CoV that are currently available, and noted that several assays have been developed and multiple antigens are being used. Paired sera should be used when possible. However, serology tests need further validation so a panel of different sera is needed for this – sera from convalescent patients to use as positive controls, sera from negative patients as negative controls, and sera from other coronavirus infections to standardize the test. Questions also remain about when the antibody response starts and how long antibodies persist.

Participants were directed to the MERS-CoV section of the WHO web site and to the Organization's laboratory site for up-to-date information. All WHO regions have identified laboratories that are willing to do testing for those countries that do not have the laboratory capability to do it themselves.

7.3 Shipping and transport of specimens

Dr Hala Esmat of the WHO Regional Office for the Eastern Mediterranean summarized the situation with regard to the shipping and transportation of specimens. She noted that shipping to laboratories overseas is done for a number of reasons – such as diagnosis, quality control and confirmation of diagnosis. However, shipping raises a number of challenges.

Dr Esmat pointed out that shipping of MERS-CoV samples is becoming more urgent because of countries' lack of primers and positive controls for the virus, a lack of confirmatory tests and the absence of a high containment laboratory needed for virus isolation. She noted a lack of systems for the shipping of specimens outside of vertical disease-specific programmes; WHO encourages Member States to allocate funds to establish such systems. To address the lack of understanding of the shipping process, WHO has arranged training courses in order to have national certified shippers in each country, and has also developed guidance and issued instructions on shipping. National shippers are certified for a period of two years and certification is renewable.

In some countries where there are no couriers, shipping companies ask the laboratory to pack the specimens and they transfer them to couriers. Yet in some places there may be a lack of packing materials. She urged countries to identify national responsible authorities and couriers for the shipment of biological specimens and viruses, to identify gaps and allocate resources to them (including shipment costs, training and staffing needs), to ensure that there

is always a certified shipper, and to ensure the availability of appropriate amounts of different types of shipment supplies at all times.

7.4 Discussion

A number of participants expressed appreciation for the support received from WHO, CDC and other laboratories. In a discussion of what specimens to collect, it was noted that these are listed in WHO's interim recommendations that has been published on the WHO web site.[2] There was some concern that patients might refuse to undergo the more invasive tests, but it was stressed that sputum comes from the lower respiratory tract, which is an important sample source for MERS-CoV, and is routinely collected by tuberculosis teams. Thus it should be reasonably straightforward to collect nasopharyngeal swabs and sputum – plus other specimens in suspected MERS-CoV cases. There was an opinion that deep sequencing may be needed but, at present at least, it is best to use a variety of complementary approaches.

A question was asked as to when a patient can be judged to be negative for MERS-CoV infection. Some months earlier a patient in intensive in the United Kingdom care was considered negative after six sequential negative samples had been taken. For mild infections it was still uncertain when to declare a patient non-infectious, but the impression of those who had dealt with cases was that infectivity may be early in the illness. The importance of research to find antigens was noted, especially for immunosuppressed patients who cannot create antibodies, but no such research was known about.

It was reported from Jordan that the country had been collecting human sera from MERS-CoV cases. This was felt to be useful as it would be necessary to develop a sera bank for research purposes. A private hospital in Jordan had also asked for primers for a commercial kit it had obtained. Dr Gerber of CDC said that commercial kits exist but that CDC had no involvement in developing them so she could not comment on them. The danger with any kit is false positives, she warned, advising that only experienced laboratories should do the testing.

A number of countries, including Morocco, said they wished to receive PCR kits from CDC, noting their experience with H5N1 and SARS investigations. Dr Formenty said that each laboratory with the necessary capabilities will be considered for involvement in the research. He also advised, in order to save time, to do both PCR tests targeting two different sites of the genome (UpE and 1A) at the same time, and not the two tests in two successive assays. It was pointed out that the World Health Assembly has asked WHO to improve laboratory capacities for a number of infections.

On the issue of shipping of specimens, there was concern that some countries lack both the money and the packaging materials for the safe transport of viruses. NAMRU-3 in Egypt expressed readiness to assist by funding and making transport arrangements but stressed that

[2] See: www.who.int/csr/disease/coronavirus_infections.

they require time to do this. In the meantime a specimen can be kept in a refrigerator for several days so long as it does not require isolation.

There was strong support for sharing the existing serology tests with countries for validation. It was also noted that there was an urgent need for a panel of sera on MERS-CoV and other coronavirus infections, including negative sera for the validation of assays.

8. GUIDANCE ON INFECTION PREVENTION AND CONTROL

8.1 WHO interim guidance

Dr Sergey Eremin of WHO headquarters introduced the topic of infection prevention and control (IPC) by showing a video of someone taking off personal protection equipment but touching his face immediately after removing it, thus negating the protective effect. Dr Eremin stressed that IPC is an IHR core capacity, one of the key indicators of IHR implementation. He emphasized that preparedness strategies of continuing IPC programmes are fundamental to a successful outbreak response.

WHO's revised guidelines on IPC are now close to publication on the WHO web site. The guidelines are designed for all countries, they are evidence-based, and they provide a balance of benefits and disadvantages. Guidelines are also being developed specific to MERS-CoV, although these are being constantly updated as more data become available. It was noted that MERS-CoV infections have taken place in hospitals in several countries.

Dr Eremin warned that the use of PPE, suggesting that it should not be overemphasized at the expense of other aspects of IPC. He stressed that in many cases IPC requires not PPE but a change in human behaviour. What is important for preventing transmission of infection are safe health-care practices in a safe environment. Important administrative controls include sustainable IPC infrastructures and activities, education of health-care workers, adequate provision and use of supplies, policies and procedures for the occupational health of health-care workers, monitoring of compliance, rapid identification of staff and patients with acute respiratory infections, and spatial separation of patients. Standard precautions should not become a ritual but should be carried out with an understanding of why they are necessary. Standard precautions should be applied for all patients, droplet precautions should be added for all ARI patients, airborne precautions should be added when performing aerosol-generating procedures for all ARI patients, and contact precautions plus eye protection should be added to these when caring for MERS-CoV patients.

8.2 Experience of the United Kingdom

Dr Zambon of the United Kingdom summarized infection control for an emerging virus infection. For MERS-CoV the United Kingdom started from the experience of dealing with SARS. It was assumed that transmission was from an infected person and that there would be prolonged virus shedding in a hospital environment. The practical problems were not knowing when to relax restrictions on severe cases in hospital, how to manage contacts who are well, which contacts to follow and test, and how long to follow them.

Since the virus was not found in tests on certain body parts at late stages, there is the possibility that the infectious period may be early in the course of the disease and may be short. However, Dr Zambon noted that this will remain uncertain until there is a lot more information. Health-workers were defined as close contacts if, from the onset of illness and throughout the symptomatic period, they provided direct clinical or personal care or examination of the patient or were close to the aerosol-generating procedure and did not wear full PPE. Other persons were defined as close contacts if they had face-to-face contact of more than 15 minutes with a confirmed case in a household or other closed setting. Sampling was done on 62 of 64 close contacts.

Investigations showed that infection control was much more lax in one hospital than in another since one patient had far more close health-worker contacts than the other did. Dr Zambon felt that the United Kingdom team had learned a lot from the experience with MERS-CoV. In particular, there was a clear need for better training of staff.

8.3 Experience of Saudi Arabia

Dr Ziad Memish described IPC in Saudi Arabia, noting at the same time that there are so few data that it is difficult to give advice. He described the overall IPC structure of the country and then focused on the Al Ahsa cluster of MERS-CoV infections. He noted that all information on this cluster has been published, but he stressed that the investigation was retrospective since the cluster was discovered after it had begun.

The first hospital involved was a private facility with 150 beds, a 32-chair haemodialysis unit, a 12-bed critical care unit, and negative pressure rooms in both haemodialysis and critical care units. Reports on deaths at the hospital related to pneumonia of unknown etiology began in mid-April 2013. Monthly mortalities did not differ significantly from previous months but the causes of death shifted from chronic comorbidities to pneumonia and respiratory failure. As a result, all patients with pneumonia in the hospital (23 persons) were screened, and as a precaution a number of patients were transferred to other hospitals.

It was then found that the problem was MERS-CoV which had been transmitted from an index case who used the haemodialysis unit, infecting other patients there who then infected other persons. An investigation showed that safety measures and hygiene in the hospital were good. However, the chairs in the haemodialysis unit were one metre apart and patients were transported to the unit in ambulances with two patients in the back. When the infection was recognized, space was increased between patients in the unit, the transport system was revised, and the ratio of nursing staff to patients was increased. Environmental cleaning was also enhanced and exposed health-care workers were all swabbed, as were all other contacts, blood was sampled, and all symptomatic persons were told to stay at home until they had been asymptomatic for over 24 hours and with negative RT-PCR on nasopharyngeal swabs. More than 800 contacts related to this cluster were tested, three cases were found among family contacts and two health-care workers also tested positive for MERS-CoV. Active surveillance is continuing throughout the country with more than 1800 samples tested to date.

Suspected or confirmed cases of MERS-CoV are now housed in single rooms when feasible, or with at least two metres and a physical separation between beds if not, with dedicated nursing and housekeeping staff, dedicated equipment and portable air purification systems. The number of isolation rooms has been increased. Dr Memish stressed that, by testing all contacts, a number of asymptomatic cases or persons with very mild symptoms had been discovered. These were persons with mild symptoms whose illness would otherwise not have been known. He said this suggested that the disease may be more common than initially thought and that most cases seen so far are the very serious ones.

8.4 Discussion

In discussion participants noted that if there are many asymptomatic cases the mortality rate may not be as high as initially thought, the definition of the disease would need to be revised, and the surveillance would need to change. Dr Memish pointed out, however, that one family member who a week before had shown only a very mild infection on PCR had since become symptomatic. He added that it was only by screening everyone who came within one metre of a patient that Saudi Arabia found the asymptomatic cases. He also said that one health-care worker who was found to be infected had kept her distance from the patient but was in the same room while he was receiving ventilation. Health-worker contacts were allowed back to work when they have a negative PCR. The contacts of the asymptomatic persons are not currently being tested.

Following a query about negative pressure rooms, it was pointed out that these are available commercially but WHO is unable to recommend a particular manufacturer. Dr Eremin also stressed that WHO's recommendation on negative pressure rooms is optional and that well ventilated rooms are also suitable. It was also suggested that the protection measures used in the United Kingdom may often be excessive due to pressure from the authorities and from health-care workers. When asked about the disposal of bodies, Dr Eremin said that standard precautions are recommended as there is no additional risk.

9. THE ROLES OF MEDIA AND RISK COMMUNICATION

Dr Gregory Hartl of WHO headquarters said that most crises begin with an early warning that something has gone wrong and then extend over days, weeks or months until the incident has been addressed and the situation returns to normal. Experience has shown that there is much more opportunity to influence people's perceptions early in the crisis than later. Consequently, he said, it is important to be prepared for a possible crisis (with a plan and resources in place), to address all stakeholders (interacting with them collaboratively and continuously), and to respond rapidly – especially in the first 24 hours after the crisis strikes.

Overreactions occur when people have not been told about something, Dr Hartl said. With incomplete information people are uncertain and fearful of their own health, and rival theories start to arise as people make their own risk assessments and judgements which are not necessarily the same as those of scientists and policy-makers. Outbreak communication is most importantly about trust. It is also about being transparent, listening to people's concerns, announcing information early, and planning – of which the first three also feed into the trust

that people have in what you say and do. Journalists are trained to be questioning and to find out things that people may be trying to hide, and as media go digital it is becoming more difficult to meet people's demand for updated information promptly.

Dr Hartl gave a number of examples of building trust, or avoiding uninformed publicity. For instance, during the H1N1 pandemic, WHO held press conferences every day at the same time, posted transcripts of the conferences on the web, and gave journalists as much information as possible as soon as it became available. In that way, WHO became an authoritative source for the journalists. However, WHO was not good at countering rumours which it heard about and saw in the social media but had no way to counter or even respond to. Some rumours in blogs started to be reproduced in press articles and caused major political reverberations.

Since then WHO has revised its approach and now has two full-time staff working only on social media. Thus when rumours began spreading in China that people should consume large quantities of salt to absorb iodine to offset radiation from the Fukushima power plant accident in Japan, WHO was ready to react. WHO put out information on its social media outlets that the caesium radiation was limited to a small area of Japan and that the amount of iodine in salt was so small that even by consuming very dangerous levels of salt one would get no protective effect.

Dr Hartl told participants that currently there is much more attention than before on the coronavirus. Internet searches for the term "coronavirus" rose dramatically between the end of April and mid-May. This heightened public attention should be seen as an opportunity since when people listen and enquire it is easier to get attention for one's messages. As WHO works with health authorities and scientists it is also an opportunity to find answers to public concerns. And with large numbers of pilgrims due to visit Saudi Arabia, this is an opportunity to sustain government and public attention and communicate effective messages.

Challenges remain, however. The fact that the Umrah and Hajj are expected to bring huge crowds to infected states means it is urgent to address the issue immediately with what limited information is available. Without evidence of what is being done now, any outbreaks on a larger scale will complicate efforts tremendously. Dr Hartl noted that there are still inconsistent messages from WHO and member states regarding the virus that feed public concerns and confusion. He added that, in terms of communication, WHO and governments need to be ready to handle the tough situations and to communicate bad news while sending positive messages about eventually winning the battle against the disease.

In response to questions Dr Hartl stressed that the more channels you use for communicating your messages, the more people you reach who need to know. He also emphasized that the more often you repeat something, the less sensational it becomes, but if you keep quiet about it you will lose your credibility when people find out.

10. MINISTERIAL MEETING

The Ministerial Meeting was opened by Dr Ala Alwan with a welcome to the ministers and ministerial representatives present and to the WHO representatives who were connected by teleconference.

10.1 Overview of MERS-CoV

Dr Anthony Mounts provided an introduction to MERS-CoV, pointing out that the WHO Eastern Mediterranean Region is seeing the evolving emergence of an exceptional new viral infection which is highly pathogenic and has spread from person to person and to other countries. He added, however, that the meeting had heard of some asymptomatic cases in Saudi Arabia so it is possible that the virus may affect many people with little effect. The first known cases of MERS-CoV infection emerged in 2012 and the virus appears to be of animal origin, though which animal is unknown. By the time of the meeting there had been 64 laboratory-confirmed cases, most of them older males with chronic medical conditions.

Dr Mounts pointed out that the number of cases is increasing, partly as a result of cases being found in Saudi Arabia as a result of testing. While the infection has been found in the Eastern Mediterranean and European regions, no cases have been reported from Asian countries such as Indonesia, Pakistan or Philippines although many persons from those countries live in the Arabian peninsula. All cases of MERS-CoV infection have respiratory illness ranging from mild symptoms to severe pneumonia, and no vaccine or virus-specific therapy is available, although there are steps that can be taken to support the patient such as ECMO which oxygenates the blood by bypassing the lungs. The role of comorbid conditions in the infection is unknown and the potential for sustained transmission among humans is uncertain. A major question is where the virus comes from and why it has emerged at this time.

The key points of the scientific and intercountry meetings were then summarized. Thus, PCR testing which is widely available has a good level of sensitivity and specificity, but it is important to take specimens from the lower respiratory tract. Just taking a test from the nose may not find the infection. Serology tests are available but they need more validation and this requires international cooperation. Transmission to contacts seems to be limited but the discovery of mild cases suggests that many cases may have been missed. The original source of the virus is most likely to be bats, although this remains a hypothesis, and there is tentative data that camels may play a role. This indicates that even if bats are discovered to be the original source of the virus, there could be one or more intermediary carriers in the transmission to humans. Vaccines and drugs are still in development.

The meetings had shown that critical areas for investigation are to discover which exposures result in infection of humans and whether the virus is transmitting in a sustained way. Specimen collection methods need to be changed to include lower respiratory tract specimens, data need to be pooled internationally, and serological assays should be used. It is also necessary to improve understanding both of the utility of different tests and of infection

and transmission. During the meetings it was shown that many international partners are available to assist in these investigations.

10.2 Implementation of the International Health Regulations

Mr Bruce Plotkin gave a general overview of the rights and obligation of States Parties to the IHR. The current IHR, which were adopted by the World Health Assembly in 2005 and came into force in 2007, involve routine surveillance to identify emerging events. The previous IHR were specific to certain diseases, but the current IHR provide a legal framework to deal with any emerging pathogens that could have major health, social and economic impacts. The IHR apply to all countries automatically unless they specifically choose to opt out, which none have done.

Apart from health, the concerns behind the IHR are the internationalization of travel and trade and the interdependence of countries. Thus an event in one country might not seem a major problem in that country but put together with other events elsewhere may indicate a wider issue. At the same time, another principle of the IHR is that all countries should be able to deal with major health risks on their own territory. Consequently there is emphasis on the need for countries to have certain core capacities to deal with health risks effectively. The regulations also say that any steps taken should minimize the impact on international travel and trade. The IHR recognize potential risks to human health from animals. And whereas the previous IHR were focused on what the health administrations of countries should do, the current IHR are to be implemented by the country as a whole.

With regard to MERS-CoV infection and similar events, the IHR require States Parties to have effective National IHR Focal Points (including intersectoral coordination for communication and information), plus notification, reporting and verification to WHO of potentially international health events and risks within 24 hours, and subsequent follow-up information. States Parties have in turn the right to information and assessments from WHO. There are also requirements and rights for States that wish to apply measures that affect international travel, transport and trade. All States Parties are required to develop and maintain national capacities for surveillance and response.

Mr Plotkin noted that most information about events comes initially to WHO not from governments but from the media, and WHO is required to request official confirmation.

The obligation to notify WHO is critical, but notifying WHO does not automatically mean that this is a public health event with an international risk. There can also be reporting of infected cases or disease vectors imported from other countries. WHO assesses all reports and requests verification only if the issue is considered important. An event is considered to be an IHR event only if there is confirmation.

10.3 Discussion

While thanking Mr Plotkin for his detailed explanation, participants stressed the need at the early stage of MERS-CoV for countries and international partners to work as a team rather

than to think in terms of rights and obligations. Some countries have revised, or are revising, their public health laws to align them with the requirements of the IHR. Countries and international partners were urged to develop an effective diagnostic tool, and some felt that PCR is not feasible as it is too expensive.

It was stressed that there is a need for improved international surveillance. The Islamic Republic of Iran reminded participants that it had developed a syndrome-based surveillance model. There was also a call for a more widely distributed laboratory capacity. The feeling was expressed that, of the four criteria in the IHR which a disease must fulfil, two need to be interpreted. It was also unclear what measures can be taken to not reduce international trade. It was emphasized that each country must make its own decisions about its surveillance systems and the actions it will take in the face of an outbreak. IHR focal points were encouraged to contact WHO if they need assistance.

11. RECOMMENDATIONS

The meeting recognized that – while collection and sharing of epidemiological, clinical, immunological and virological information related to MERS-CoV infections in accordance with the requirements of the International Health Regulations are essential for better understanding and characterization of the disease and will contribute to global preparedness against this novel infection – coordinated and intersectoral actions are also important for increasing global, regional and interregional collaboration among countries and with WHO and other international health partners in responding to the outbreak caused by this novel virus.

The meeting identified a set of concrete public health action points that can collectively improve and strengthen global public health preparedness, surveillance and response to MERS-CoV. These recommended action points are addressed both to Member States, as well as to WHO.

The following primary recommendations were identified.

- Increase detection through increased surveillance and testing, and thoroughly investigate every new case of MERS-CoV to determine the exposures that resulted in infection, the likely route of transmission, and the extent to which transmission is occurring.
- Develop and participate in free and open data-sharing using a standard questionnaire developed by WHO to produce a global database of epidemiological, clinical and laboratory data that can be used to inform management and control policies.
- Develop and participate in further development of diagnostic assays through international networking with technical agencies, sharing of materials and resources, and participation in studies.
- Ensure international cooperation and collaboration, as envisaged by the International Health Regulations, to address the primary recommendations rapidly and to support Member States' capacities for preparedness and response.

The meeting also highlighted the need for urgent action in a series of key thematic areas.

Surveillance

Recommendations to Member States

1. Enhance surveillance for MERS-CoV in every country according to WHO surveillance recommendations.
2. Strengthen cross-sectoral and multidisciplinary mechanisms between public health and other sectors (e.g. animal health, food safety) to investigate potential sources of exposure for each case and to conduct appropriate animal studies to identify the potential reservoir and route of transmission.
3. Share epidemiological, clinical and laboratory data with WHO on all confirmed and probable cases of MERS-CoV infection, in accordance with the International Health Regulations, using a standard questionnaire developed by WHO, for inclusion in a global database for the purpose of informing critical guidance related to response and management.

Recommendations to WHO

1. Create a global database in which data from cases and investigations can be pooled and analysed for informed public health decision-making.
2. Continue to develop and update multilingual protocols, guidelines, and standards for surveillance, investigation and management of MERS-CoV infections in light of additional data and scientific discovery.
3. Work with stakeholders and international partners, including the Food and Agriculture Organization and the World Organisation for Animal Health, and with networks (e.g. Infosan), to support cross-sectoral and multidisciplinary preparedness and response capacity, and to ensure rapid support to countries when requested.

Mass gatherings

Recommendations to Member States

1. Develop evidence-based public health recommendations and plans to address additional risks posed by MERS-CoV to mass gatherings.
2. Increase public awareness of MERS-CoV, other airborne diseases and possibly other diseases through films shown during the Hajj/Umrah flights in various languages.
3. Member States are encouraged to include public health doctors/officials among the health missions accompanying their citizens during the Hajj to raise awareness in the field of infection prevention and control.

Recommendations to WHO

1. Work with countries to strengthen existing preparedness activities for planned mass gatherings, and coordinate research agendas on MERS-CoV and mass gatherings.
2. Facilitate collaboration among countries on international travel and mass gatherings using innovative messages for risk communication.

Clinical management

Recommendations to Member States

1. Communicate with health-care communities to ensure awareness for case detection, protection of staff and other patients, and optimal case management.
2. Implement preparedness in intensive care units and other high-dependency medical units which care for patients with severe acute respiratory infections.
3. Participate in collaborative clinical research to address key questions, and ensure timely availability of information.

Recommendations to WHO

1. Identify the needs of Member States regarding case recognition and management of MERS-CoV patients.
2. Ensure that Member States are aware of available WHO guidance in order to prepare and strengthen MERS-CoV case management.
3. Provide support to countries for organizing training courses for medical doctors in intensive care units, community doctors, nurses, laboratory workers and Infection Prevention and Control committees.

Laboratory diagnostics

Recommendations to Member States

1. Ensure laboratory capacity to investigate MERS-CoV cases.
2. Ensure that samples are collected systematically and sequentially from multiple sites in confirmed MERS-CoV cases for studies to inform clinical management, laboratory and infection control recommendations.
3. Participate in MERS-CoV proficiency testing to ensure the quality of MERS-CoV testing.
4. Establish/strengthen internal and external shipping and transportation systems for routine and emergency activities.

Recommendations to WHO

1. Provide coordination between a group of laboratories/technical agencies and countries to facilitate development of a standard panel of sera for validation and standardization of serological assays for MERS-CoV.

2. Develop/update, finalize and disseminate laboratory guidance for MERS-CoV investigations.

Infection prevention and control

Recommendations to Member States

1. Reinforce the establishment of infection prevention and control programmes comprising all core components.
2. Ensure that health-care facilities are prepared to provide safe care to patients with acute respiratory infections, including MERS-CoV, and prevent amplification of the disease.
3. Support collaborative investigations and research to better understand the risk of health-care-associated transmission of MERS-CoV and its mechanisms.

Recommendations to WHO

1. Review and update the current WHO guidance on infection prevention and control based on new evidence.
2. Provide support to countries for organizing training courses for medical doctors in intensive care units, community doctors, nurses, laboratory workers and Infection Prevention and Control committees.

Media and risk communication

Recommendations to the Member States

1. Practise WHO outbreak communication principles in order to increase confidence in preparedness and response to MERS-CoV, and to increase trust in public health advice.

Recommendations to WHO

1. Support Member States in the building of outbreak communications practice and capacity, including comprehensive communications plans, outbreak communications materials and messages.

International Health Regulations

Recommendations to Member States

1. Strengthen national coordination mechanisms and capacity for detection, investigation, communication and response to suspected MERS-CoV cases.
2. Ensure that the International Health Regulations National Focal Point has the necessary resources and authority – including 24/7 availability, a sufficient legal and political mandate for timely reporting to WHO, rapid access to necessary information from all sectors, and timely access to decision-makers – to fulfil its requirements in

communicating and coordinating internally and with the relevant WHO International Health Regulations Contact Point on events.

3. Ensure that International Health Regulations National Focal Points collaborate and exchange appropriate information in MERS-CoV cases where international travel has occurred.

Recommendations to WHO

1. Continue to support Member States to implement the International Health Regulations core capacities for surveillance and response, infection prevention and control, and clinical management, and in particular to support countries to review and test alert and response plans and capacity for MERS-CoV.
2. Enhance organization-wide surge capacity, and coordination with partners in the Global Outbreak Alert and Response Network (GOARN), to rapidly deploy international response experts and teams to support preparedness and in the event of any large-scale outbreak in any country.

12. CLOSING

Following discussion, it was agreed that the Regional Office would send a draft set of recommendations covering the themes of the meeting to all participants for their input. Participants were reminded that the recommendations from the meeting would not be binding on Member States.

Dr Ala Alwan said the meeting was called to update countries on MERS-CoV, to share information, and to discuss the current level of public health preparedness and practical steps for strengthening surveillance. He was confident that the meeting had achieved its objectives.

Dr Alwan concluded the meeting by thanking all participants for attending and for making their valuable contributions to the discussions. He said that the meeting had clarified the next steps for collaborative action and that there was now a unique opportunity for prompt action to strengthen surveillance and protective steps. He emphasized WHO’s commitment to keeping all informed as knowledge about MERS-CoV increases.

Annex 1

PROGRAMME

Thursday, 20 June 2013

08:00–08:30	Registration	
08:30–09:00	Opening session	
	Address by Dr Ala Alwan, WHO Regional Director for the Eastern Mediterranean	
	Introduction to the meeting	Dr Jaouad Mahjour
	Nomination of Officers	

Session 1: Overview and update on the current outbreak of MERS-CoV infection

09:00 – 09:45	Global overview of MERS-CoV	Dr Keiji Fukuda
	Summary of the scientific meeting	Dr Tony Mounts
09:45 – 10:00	Discussions	
10:00 – 10:30	Overview and updates from selected affected countries:	
	Saudi Arabia	Dr Ziad Memish
	Jordan	Dr Mohmmed Abdallat
11:00 – 12:00	Overview and updates from selected affected countries:	Dr Benoit Guery
	France	Dr Afif Bensalah
	Tunisia	Dr Mohammed Al-Hajri
	Qatar	
	Germany	Dr Osamah Hamouda

Session 2: Technical guidance on MERS-CoV surveillance – current approach and practice

12:00 – 12:30	Introduction to the WHO interim surveillance recommendations for human infection with MERS-CoV	Dr Tony Mounts
12:30 – 13:00	ILI/SARI surveillance guidance and approaches to early detection of human infection with MERS-CoV – Country experience:	Dr Samir A Refaey
	Egypt (Focusing on SARI surveillance)	Dr Payman Hemmati
	Islamic Republic of Iran (SARI surveillance)	
14:00 – 14:30	Guidance for investigation of human illness caused by MERS-CoV	Dr Tony Mounts
14:30 – 15:00	MERS-CoV: Consideration for surveillance at the animal-human interface	Dr Peter Ben Embarek
15:00 – 15:30	Discussions	

Session 3: MERS-CoV outbreak and preparedness for mass gatherings

16:00 – 16:15	MERS-CoV outbreak preparedness for mass gatherings	Dr Maurizio Barbeschi
16:15 – 16:30	Public health measures implemented by Saudi Arabia for Umra and Hajj 2013	Dr Ziad Memish
16:30 – 17:00	Discussions	

Friday, 21 June 2013

Session 4: Technical support and interim guidance for management of MERS-COV cases

08:30 – 09:00	Technical update on case management	Dr Nikki Shindo
09:00 – 09:30	MERS-CoV Updates on WHO interim guidance for management of MERS-CoV and research opportunities	Dr Nikki Shindo
09:30 – 10:00	Management of Middle East Respiratory Syndrome Coronavirus – Country experience of United Kingdom	Dr Maria Zambon
10:30 – 11:30	Discussions	

Session 5: Technical guidance and support for laboratory diagnostics: MERS-CoV

14:00 – 14:20	Technical presentation on laboratory diagnostics: Testing algorithms for MERS-CoV assay protocol and reagents availability	Dr Susan Gerber
14:20 – 14:40	Update on laboratory testing for suspected MERS-CoV; WHO interim recommendations and biorisk management	Dr Pierre Formenty
14:40 – 15:00	Shipping and transportation system, current situation and challenges	Dr Hala Esmat
15:30 – 16:30	Discussions	

Saturday, 22 June 2013

Session 6: Interim guidance on infection prevention and control for MERS-CoV

08:30 – 09:00	Introduction to the WHO interim guidance on infection prevention and control practices for MERS-CoV	Dr Sergey Eremin
09:00 – 09:15	Infection prevention and control of MERS-CoV: Country experience – United Kingdom	Dr Maria Zambon
09:15 – 09:30	Infection prevention and control of MERS-CoV: Country experience – Saudi Arabia	Dr Ziad Memish
09:30 – 10:00	Discussions	

Session 7: The roles of media and risk communications in MERS-CoV outbreak

10:00 – 10:15	Media and risk communication	Dr Gregory Hartl
10:15 – 10:30	Discussions	

Closing ceremony

11:00 – 11:15	Overview of MERS-CoV	Dr Tony Mounts
11:15 – 11:45	Implementation of IHR (2005) – The rights and obligations of State Parties and WHO	Mr Bruce Plotkin
12:15 – 12:45	Adoption of the recommendations of the meeting	Dr Mamunur Malik
12:45 – 13:00	Closing address by Dr Ala Alwan, Regional Director, WHO Region for the Eastern Mediterranean	

Annex 2

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