Command and Control Center
Ministry of Health
Kingdom of Saudi Arabia

Scientific Advisory Board

Infection Prevention and Control Guidelines for Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Infection

4th Edition

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I. Introduction

Middle-East Respiratory Syndrome (MERS) was first reported from the Kingdom of Saudi Arabia September 2012 caused by the novel betacoronavirus MERS-CoV (1). Since then more than 1400 cases were reported from KSA with substantial mortality of about 40%. Community transmission is limited and non-sustained and mostly related to close household and crowded housing. The disease mostly manifests in outbreak clusters within healthcare facilities (2, 3). The most susceptible individuals to infections are middle to old age with co-morbidities and this corresponds to higher rates of mortality. Dromedary camels are the identified reservoir of MERS-CoV and close contact with them represent risk factor for MERS (4).

II. Case definition and surveillance guidance

A. Suspected case (patients who should be tested for MERS-CoV)[1,2]

a. Adults (> 14 years) *

I. Acute respiratory illness with clinical and/or radiological, evidence of pulmonary parenchymal disease (pneumonia or Acute Respiratory Distress Syndrome) [3].

II. A hospitalized patient with healthcare associated pneumonia based on clinical and radiological evidence.

III. Upper or lower respiratory illness within 2 weeks after exposure to a confirmed or probable case of MERS-CoV infection[4,5].

IV. Unexplained acute febrile (≥38°C) illness, AND body aches, headache, diarrhea, or nausea/vomiting, with or without respiratory symptoms, AND leucopenia (WBC<3.5x10^9/L) and thrombocytopenia (platelets<150x10^9/L) [6].

V. Unexplained febrile illness with recent (14 days) exposure to camels or camel products[1].

b. Pediatrics (≤ 14 years) [7]

I. Meets the above case definitions and has at least one of the following:
   a. History of exposure to a confirmed or suspected MERS in the 14 days prior to onset of symptoms
   b. History of contact with camels or camel products in the 14 days prior to onset of symptoms

II. Unexplained severe pneumonia

* **Patients with chronic kidney disease and those with heart failure could present atypically and high index of suspicion is required**

B. Probable case

A probable case is a patient in category I or II above (Adults and pediatrics) with inconclusive laboratory results for MERS-CoV (page 6) and other possible pathogens who is a close contact[8] of a laboratory-confirmed MERS-CoV case or who works in a hospital where MERS-CoV cases are cared for or had recent contact with camels or camel's products.

C. Confirmed case

A confirmed case is a suspected case with laboratory confirmation of MERS-CoV infection.[9]

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[1]Epidemiological clues to MERS-CoV infection include: A. History of contact with camels or camel products in the 14 days before the onset of illness (5-8). Such contact may either be direct by patient, or indirect through contact with another healthy person who had contact with camels or camel products; B. History of contact with an ill patient suffering from an acute respiratory illness in the community or healthcare setting in the 14 days before the onset of illness. Several cases of MERS of febrile illness with no localization to one organ, therefore the only clue to diagnosis is exposure risk to camels. Degree of contact with camels and behavior associated with infection has not been characterized yet.

[2]All suspected cases should have nasopharyngeal swabs or sputum, and when intubated, lower respiratory secretions samples collected for MERS-CoV testing (9).

[3]Patients who meet the criteria for category I or II above should also be evaluated for common viral and bacterial causes of community-acquired pneumonia. This evaluation should be based on clinical, epidemiologic and surveillance information. Testing for MERS-CoV and other respiratory pathogens can be done simultaneously. Positive results for another respiratory organism may not preclude testing for MERS-CoV because co-infection can occur.

[4]Regardless of protected or unprotected exposure. Protected exposure is defined as contact within 1.5 meters with a patient with confirmed or probable MERS-CoV infection while wearing all personal protective equipment (Surgical or N95 mask, gloves, and gowns, and, when indicated, goggles). Unprotected exposure is defined as contact within 1.5 meters with a patient with confirmed or probable MERS-CoV infection without wearing all personal protective equipment (Surgical or N95 mask, gloves, and gowns, and, when indicated, goggles).

[5]Testing asymptomatic contacts is generally not recommended. Under certain circumstances such as unprotected high-risk exposure of health care worker and investigation of a hospital or community outbreak, such testing should be considered (3).

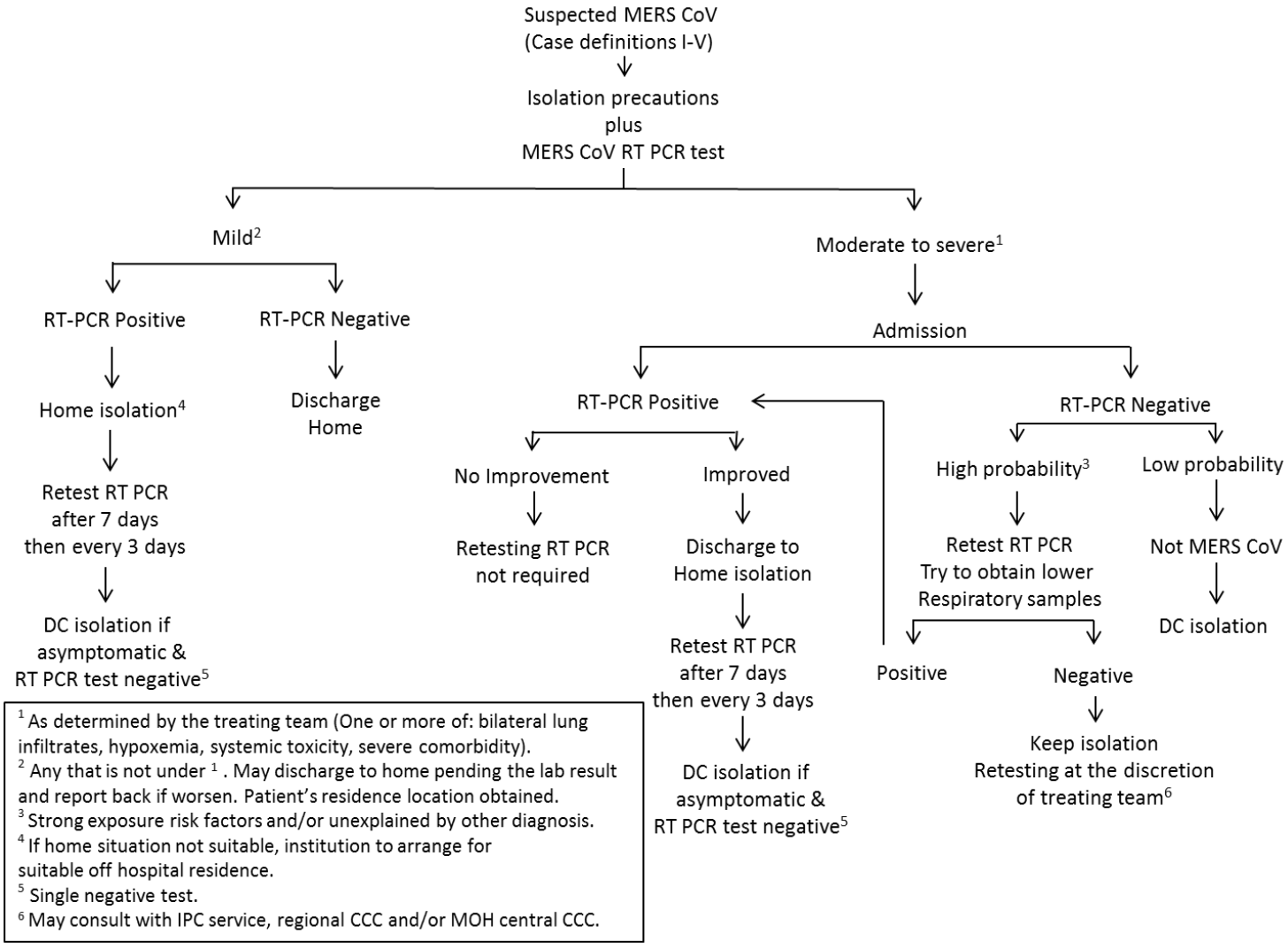
[6]Laboratory tests to exclude other causes of this clinical presentation (e.g., Dengue, Alkhumra hemorrhagic fever virus, CMV, EBV, Typhoid fever, and Malaria) should be performed when clinically and epidemiologically indicated.

[7]MERS-CoV has been rarely reported in pediatric patients. Therefore, additional risk of exposure to human case or exposure to camels or camel products is required to justify testing. Visual triage of pediatric patients at points of entry to healthcare facilities should be per checklist of Appendix A, page 28.

[8]Close contact is defined as a) any person who provided care for the patient, including a healthcare worker or family member, or had similarly close physical contact; or b) any person who stayed at the same place (e.g. lived with, visited) as the patient while the patient was ill.

[9]Confirmatory laboratory testing requires a positive PCR on at least two specific genomic targets (upE and ORF1a) OR a single positive target (upE) with sequencing of a second target (RdRpSeq or NSeq). A Ct value < 37 is considered positive and any higher value should be repeated. It is strongly advised that lower respiratory specimens such as sputum, endotracheal aspirate, or bronchoalveolar lavage be used when possible (9, 10). If patients do not have signs or symptoms of lower respiratory tract infection or lower tract specimens are not possible or clinically indicated, both nasopharyngeal and oropharyngeal specimens should be collected and combined in a single collection container and tested together. If initial testing of a nasopharyngeal swab is negative in a patient who is strongly suspected to have MERS-CoV infection, patients should be retested using a lower respiratory specimen or, if not possible, a repeat nasopharyngeal and oropharyngeal specimen. For patients in whom adequate lower respiratory samples are not possible, you may consider other types of auxiliary testing such as nasopharyngeal wash for MERS-CoV PCR and paired acute and convalescent sera for serological tests. Collection of additional specimens such as stool, urine, and serum for MERS-CoV PCR is also useful as the virus has also been demonstrated in these body fluids.

III. Algorithm for managing patients with suspected MERS-CoV [2]



[1] As determined by the treating team (One or more of: bilateral lung infiltrates, hypoxemia, systemic toxicity, severe comorbidity).
[2] Any that is not under [1] . May discharge to home pending the lab result and report back if worsen. Patient's residence location obtained.
[3] Strong exposure risk factors and/or unexplained by other diagnosis.
[4] If home situation not suitable, institution to arrange for suitable off hospital residence.
[5] Single negative test.
[6] May consult with IPC service, regional CCC and/or MOH central CCC.

IV. General infection prevention and control precautions

A. Standard Precautions

Standard Precautions, a cornerstone for providing safe health care and reducing the risk of further infection, should always be applied in all health-care settings for all patients. Standard Precautions include:

Hand hygiene

1. HCWs should apply "My 5 moments for hand hygiene": before touching a patient, before any clean or aseptic procedure, after body fluid exposure, after touching a patient, and after touching a patient's surroundings, including contaminated items or surfaces.
2. Hand hygiene includes either washing hands with antiseptic soap and water or the use of an alcohol-based waterless hand sanitizer (waterless hands rub).
3. Wash hands with antiseptic soap and water when they are visibly soiled.
4. The use of gloves does not eliminate the need for hand hygiene. Hand hygiene is necessary after taking off gloves and other personal protective equipment (PPE).

B. Respiratory precautions

To prevent the transmission of respiratory infections in the healthcare settings, including MERS-CoV and influenza, the following infection control measures should be implemented at the first point of contact with a potentially infected person. They should be incorporated into infection control practices as one component of Standard Precautions.

1. Visual Alerts
   Post visual alerts (in appropriate languages) at the entrance to outpatient facilities (e.g., emergency rooms and clinics) instructing patients and persons who accompany them (e.g., family, friends) to inform healthcare personnel of symptoms of acute respiratory illness (including fever with cough, sore throat, rhinorrhea, sneezing, shortness of breath, and/or wheezing) when they first register for care and to practice the following Respiratory Hygiene/Cough Etiquette.

   a) Cover your mouth and nose with a tissue when coughing or sneezing.
   b) Dispose of the tissue in the nearest waste receptacle right after use.

c) Perform hand hygiene (e.g., hand washing with non-antimicrobial soap and water, alcohol-based hand sanitizer, or antiseptic hand wash) after having contact with respiratory secretions and contaminated objects or materials.

2. Masking and Separation of Persons with Respiratory Symptoms

a) Offer regular (surgical) masks to persons who are coughing. Regular (surgical) masks may be used to contain respiratory secretions (N-95 masks are not necessary for this purpose).
b) When space and chair availability permit, encourage coughing persons to sit at least 1 meter away from others in common waiting areas.
c) Healthcare facilities should ensure the availability of materials for adhering to Respiratory Hygiene/Cough Etiquette in waiting areas for patients and visitors.
d) Provide tissues and no-touch receptacles for used tissue disposal.
e) Provide conveniently located dispensers of alcohol-based hand sanitizer.
f) Where sinks are available, ensure that supplies for hand washing (i.e., antiseptic soap and disposable towels) are consistently available.

C. Prevention of overcrowding in clinical areas is essential to prevent cross infection. Many of the outbreaks of MERS has been linked to overcrowding in clinical units especially emergency room and dialysis units (3, 11). The minimum distance that should be maintained between patients' beds in general wards and intensive care, hemodialysis and emergency units as recommended by the Ministry of Health, the American Institute of Architects (AIA) Academy of Architecture for Health and the International Federation of Infection Control is shown (Appendix D, page 45).

V. Patient Transportation and Prehospital Emergency Medical Services (EMS)

Patients who may have MERS-CoV disease may be safely transported in any emergency vehicle with the proper precautions.

1. Involve the fewest EMS personnel required to minimize possible exposures.
2. Family members and other contacts of MERS -CoV patients should not ride in the ambulance. If necessary, they should be evaluated for fever and lower respiratory symptoms and, if either is present, asked to wear a surgical or procedure mask when riding in the vehicle.
3. When possible, use vehicles that have separate driver and patient compartments that can provide separate ventilation to each area. Close the door/window between these compartments before bringing the patient on board. Set the vehicle's ventilation system to the non-recirculating mode to maximize the volume of outside air brought into the vehicle. If the vehicle has a rear exhaust fan, use it to draw air away from the cab, toward the patient-care area, and out the back end of the vehicle. Some vehicles are equipped with a supplemental recirculating ventilation unit that passes air through HEPA filters before returning it to the vehicle.
4. If a vehicle without separate compartments and ventilation must be used, open the outside air vents in the driver area and turn on the rear exhaust ventilation fans to the highest setting. This will create a negative pressure gradient in the patient area.
5. If possible, place a surgical mask on the patient to contain droplets expelled during coughing. If this is not possible (i.e., would further compromise respiratory status, difficult for the patient to wear), have the patient cover the mouth/nose with tissue when coughing.
6. Oxygen delivery with a non-rebreather face mask may be used to provide oxygen support during transport.
7. If a patient has been mechanically ventilated before transport, HEPA or equivalent filtration of airflow exhaust should be available.
8. Aerosol-generating procedures (e.g., mechanical ventilation, nebulizer treatment) should be avoided during prehospital care.
9. Prehospital care providers who directly handle a patient with MERS-CoV or who are in the compartment with the patient should wear PPE as recommended.
10. Avoid touching one's face with contaminated gloves.
11. Avoid unnecessary touching of surfaces in the ambulance vehicle.

12. Arrange for the receiving facility staff to meet the patient at the ambulance door to limit the need for EMS personnel to enter the emergency department in contaminated PPE. (It may not be practical to change PPE before patient transfer into the facility.) Remove and discard PPE after transferring the patient at the receiving facility and perform hand hygiene. Treat used disposable PPE as medical waste.
13. Handle clinical specimens that must be collected during transport (e.g., blood gas) in accordance with standard operating procedures.
14. Follow standard operating procedures for the containment and disposal of regulated medical waste.
15. Follow standard operating procedures for containing and reprocessing used linen. Wear appropriate PPE when removing soiled linen from the vehicle. Avoid shaking the linen.
16. Clean and disinfect the vehicle in accordance with standard operating procedures. Personnel performing the cleaning should wear a disposable gown and gloves (a respirator should not be needed) during the clean-up process; the PPE should be discarded after use. All surfaces that may have come in contact with the patient or materials contaminated during patient care (e.g., stretcher, rails, control panels, floors, walls, work surfaces) should be thoroughly cleaned and disinfected using an MOH-approved hospital disinfectant in accordance with manufacturer's recommendations.
17. Clean and disinfect reusable patient-care equipment per manufacturer's instructions.
18. Ensure appropriate follow-up and care of EMS personnel who transport MERS-CoV patients as recommended for HCWs.

VI. Triage for rapid identification of patients with acute respiratory illness (ARI)

1. Visual triage should be used for early identification of all patients with ARI in the Emergency Room, dialysis unit and the Clinics.
2. Rapid identification of patients with ARI and patients suspected of MERS- CoV infection is key to prevent healthcare associated transmission of MERS-CoV or other respiratory viruses. Appropriate infection control precautions and respiratory etiquette (described above) for source control should be promptly applied.
3. Visual triage station should be placed at the entry point of the healthcare facility (i.e. emergency room entrance, dialysis unit entrance) or other designated areas and attended by a nurse or nurse assistant who is trained on the suspicion of MERS as per a checklist form with scoring (Appendix A, page 28-29)
4. Identified ARI patients should be asked to wear a surgical mask. They should be evaluated immediately in an area separate from other patients
5. Infection control and prevention precautions should be promptly implemented.

6. If ARI patients cannot be evaluated immediately, they should wait in a waiting area dedicated for the ARI patients with spatial separation of at least 1.2 m between each ARI patient and others.
7. Clinical and epidemiological aspects of the cases should be evaluated as soon as possible and the investigation should be complemented by laboratory evaluation.

VII. Infection prevention and control precautions when caring for patients with suspected, probable, or confirmed MERS-CoV infection

1. For patients with suspected, probable, or confirmed MERS-CoV infection who are not critically ill, standard, contact, and **droplet** precautions are recommended for management.
2. For patients who are critically ill (e.g. pneumonia with respiratory distress or hypoxemia), standard, contact, and airborne **precautions** are recommended due to the high likelihood of requiring aerosol-generating procedures.
3. Standard, contact, and airborne precautions should be used for all (critically or non-critically ill) patients when anticipating or performing aerosol- generating procedures which may be associated with an increased risk of infection transmission (including both elective procedures such as bronchoscopy, sputum induction, elective intubation and extubation, and emergency procedures such as cardiopulmonary resuscitation, emergency intubation, open suctioning of airways, manual ventilation via umbo bagging through a mask before intubation).

Selected components of recommended precautions for prevention of MERS-CoV transmission

A. Placement:

Place patients with suspected, probable, or confirmed MERS-CoV infection who are:

1. **Not critically ill** should be placed in single patient rooms in an area that is clearly segregated from other patient-care areas. The role of HEPA filter is unproven. If available, a portable HEPA filter could be used, turned on to the maximum power, and be placed at the side of the patient's bed, at the head of the bed.
2. Aerosol generating procedures should be performed in a negative pressure room.
3. **Critically ill** (e.g. pneumonia with respiratory distress or hypoxemia) should be placed in Airborne Infection Isolation rooms (Negative Pressure Rooms) due to the high likelihood of requiring aerosol-generating procedures.
4. When negative pressure rooms are not available, place the patients in adequately ventilated single rooms. When available, a portable HEPA filter, turned on to the maximum power, the side of the patient's bed, at the head of the bed.

5. When single rooms are not available, place patients with the same diagnosis together (Cohorting). If this is not possible, place patient beds at least 1.2 meters apart.
6. Avoid the movement and transport of patients out of the isolation room or area unless medically necessary. The use of designated portable X-ray, ultrasound, echocardiogram, and other important diagnostic machines is recommended when possible. If transport is required:
    a) Patients should wear a surgical mask to contain secretions.
    b) Use routes of transport that minimize exposures of staff, other patients, and visitors.
    c) Notify the receiving area of the patient's diagnosis and necessary precautions as soon as possible before the patient's arrival.
    d) Ensure that healthcare workers (HCWs) who are transporting patients wear appropriate PPE and perform hand hygiene afterwards.

A. Personal Protective Equipment (PPE) for Healthcare Workers (HCWs)

1. The following PPE should be worn by HCWs upon entry into patient rooms or care areas in the respected order:
    a) Gowns (clean, non-sterile, long-sleeved disposable gown).
    b) Surgical mask.
    c) Eye protection (goggles or face shield).
    d) Gloves.
2. For patients under airborne precautions, all persons entering the patient's room should wear a fit-tested, seal checked N-95 mask instead of a medical mask. For those who failed the fit testing of N95 masks (e.g. those with beards), an alternative respirator, such as a powered air-purifying respirator (PAPR), should be used.
3. Upon exit from the patient room or care area, PPE should be removed and discarded.
4. Except for N95 masks, remove PPE at doorway or in anteroom. Remove N95 mask after leaving patient room and closing the door.
5. Remove PPE in the following sequence: 1. Gloves, 2. Goggles or face shield, 3. Gown and 4. Mask or respirator.
6. You should note and observe the following:
    1. **Gloves**
        i. Outside of gloves is contaminated.
        ii. Grasp outside of glove with opposite gloved hand; peel off.
        iii. Hold removed glove in gloved hand.
        iv. Slide fingers of ungloved hand under remaining glove at wrist.
        v. Peel glove off over first glove.
        vi. Discard gloves in waste container.
    2. **Goggles or face shield**

i. Outside of goggles or face shield is contaminated.
ii. To remove, handle by head band or ear pieces.
iii. Place in designated receptacle for reprocessing or in waste container.

3. **Gown**
   i. Gown front and sleeves are contaminated.
   ii. Unfasten ties.
   iii. Pull away from neck and shoulders, touching inside of gown only, turn gown inside out then fold or roll into a bundle and discard.
4. **Surgical or N95 masks**
   i. Front of mask is contaminated -do not touch.
   ii. Grasp bottom, then top ties or elastics and remove.
   iii. Discard in waste container.
   iv. Never wear a surgical mask under the N95 mask as this prevents proper fitting and sealing of the N95 mask thus decreasing its efficacy.
   v. For female staff who wear veils, the N95 mask should always be placed directly on the face behind the veil and not over the veil. In this instance, a face-shield should also be used along with the mask to protect the veil from droplet sprays.

7. Perform hand hygiene before and after contact with the patient or his/her surroundings and immediately after removal of PPE.
8. If possible, use either disposable equipment or dedicated equipment (e.g. stethoscopes, blood pressure cuffs and thermometers).
9. If equipment needs to be shared among patients, clean and disinfect it after each patient use.
10. HCWs should refrain from touching their eyes, nose or mouth with potentially contaminated gloved or ungloved hands.

B. Environmental cleaning and disinfection

Recent data concluded that the environment around MERS CoV patients is widely contaminated (12, 13). To protect healthcare workers, frequent and thorough environmental cleaning and disinfection are critical to reduce spread of this contagious virus, especially in the hospital setting.

1. Cleaning and disinfection of occupied MERS patient rooms

a) Consider designating specific, well-trained housekeeping personnel for cleaning and disinfecting of MERS patient rooms/units.
b) Define the scope of cleaning that will be conducted each day; identify who will be responsible for cleaning and disinfecting the surfaces of patient-care equipment (e.g., IV pumps, ventilators, monitors. etc.).
c) Consider using a checklist to promote accountability for cleaning responsibilities.

d) Housekeeping personnel should wear PPE as described above. These staff should be trained by the infection control team in proper procedures for PPE use, including removal of PPE, and the importance of hand hygiene.
e) Keep cleaning supplies outside the patient room (e.g., in an anteroom or storage area).
f) Keep areas around the patient free of unnecessary supplies and equipment to facilitate daily cleaning.
g) Use MOH- approved disinfectants (see the Environmental Disinfection Guidelines, National IPC Manual, chapter 10). Follow manufacturer's recommendations for use-dilution (i.e., concentration), contact time, and care in handling.
h) Clean and disinfect MERS patients' rooms at least daily and more often when visible soiling/contamination occurs.
i) Give special attention to frequently touched surfaces (e.g., bedrails, bedside and over-bed tables, TV control, call button, telephone, lavatory surfaces including safety/pull-up bars, doorknobs, commodes, ventilator and monitor surfaces) in addition to floors and other horizontal surfaces.
j) Wipe external surfaces of portable equipment for performing x-rays and other procedures in the patient's room with an MOH -approved disinfectant upon removal from the patient's room.
k) After an aerosol-generating procedure (e.g., intubation), clean and disinfect horizontal surfaces around the patient. Clean and disinfect as soon as possible after the procedure.
l) Clean and disinfect spills of blood and body fluids in accordance with current recommendations for spill management outlined in the Environmental Disinfection Guidelines, National IPC Manual, chapter 10.

2. Cleaning and disinfection after MERS patient discharge or transfer

a) Follow standard procedures for terminal cleaning of an isolation room. (See the Environmental Disinfection Guidelines, National IPC Manual, chapter 10).
b) Clean and disinfect all surfaces that were in contact with the patient or may have become contaminated during patient care.
c) Wipe down mattresses and headboards with an MOH-approved disinfectant.
d) Privacy curtains should be removed, placed in a bag in the room and then transported to be laundered.
e) No special treatment is necessary for window curtains, ceilings, and walls unless there is evidence of visible soil.
f) Use hydrogen peroxide vapor or UVC machines for disinfection of the room as mandatory part of the terminal cleaning process.
g) If all the above-mentioned procedures are followed, then the patient room can be used immediately for another patient after terminal cleaning.

3. **Medical waste**
    a) Contain and dispose of MERS-CoV-contaminated medical waste in accordance with MOH-specific procedures as outlined in the Medical Waste Management Guidelines, National IPC Manual, chapter 11.
    b) Wear disposable gloves when handling waste. Perform hand hygiene after removal of gloves.

4. **Textiles (linen and laundry)**
    a) Store clean linen outside patient rooms, taking into the room only linen needed for use during the shift.
    b) Place soiled linen directly into a laundry bag in the patient's room. Contain linen in a manner that prevents the linen bag from opening or bursting during transport and while in the soiled linen holding area
    c) Wear gloves and gown when directly handling soiled linen and laundry (e.g., bedding, towels, personal clothing). Do not shake or otherwise handle soiled linen and laundry in a manner that might aerosolize infectious particles.
    d) Wash and dry linen per the Laundry Guidelines, National IPC Manual, chapter 28.

5. **Dishes and eating utensils**
    Use disposable dishes and eating utensils to serve MERS CoV patients.

VIII. Fit test and seal check

What is a respirator (N95) fit test?

1. A fit test is a test protocol conducted to verify that a respirator (N95 mask) is both comfortable and correctly fits the user.
2. Fit testing uses a test agent, either qualitatively detected by the wearer's sense of taste, smell or involuntary cough (irritant smoke) or quantitatively measured by an instrument, to verify the respirator's fit.
3. The benefits of this testing include better protection for the employee and verification that the employee is wearing a correctly-fitting model and size of respirator.
4. MOH requires a respirator fit test to confirm the fit of any respirator that forms a tight seal on the wearer's face before it is to be used in the workplace.
5. MOH prohibits tight fitting respirators to be worn by workers who have facial hair that comes between the sealing surface of the facepiece and the face of the wearer. In this case, a Powered Air Purifying Respirator (PAPR) should be used instead.
6. Because each brand, model, and size of particulate facepiece respirators will fit slightly differently, a user should engage in a fit test every time a new model, manufacture

type/brand, or size is worn. Also, if weight fluctuates or facial/dental alterations occur, a fit test should be done again to ensure the respirator remains effective. Otherwise, fit testing should be completed every two years to ensure continued adequate fit.

7. A fit test only qualifies the user to put on (don) the specific brand/make/model of respirator with which an acceptable fit testing result was achieved. Users should only wear the specific brand, model, and size respirators that he or she wore during successful fit tests. Respirator sizing is variable and not standardized across models or brands. For example, a medium in one model may not offer the same fit as a different manufacturer's medium model.

What is a respirator (N95) user seal check?

1. It is a procedure conducted by the wearer of a respirator to determine if the respirator is properly sealed to the face. A user seal check is sometimes referred to as a fit check.
2. Once a fit test has been done to determine the best model and size of respirator for a particular user, a user seal check should be done by the user every time the respirator is to be worn to ensure an adequate seal is achieved.
3. A user seal check may be accomplished by using the procedures recommended by the manufacturer of the respirator. This information can be found on the box or individual respirator packaging. There are positive and negative pressure seal checks and not every respirator can be checked using both. You should refer to the manufacturer's instructions for conducting user seal checks on any specific respirator.
4. The user seal check can be either a positive pressure or negative pressure check. The following positive and negative user seal check procedures for filtering face-piece respirators are provided as examples of how to perform these procedures.
5. Positive pressure check –Once the particulate respirator is properly put on (donned), put your hands over the face-piece, covering as much surface area as possible. Exhale gently into the face-piece. The face fit is considered satisfactory if a slight positive pressure is being built up inside the face-piece without any evidence of outward leakage of air at the seal. Examples of such evidence would be the feeling of air trickling onto your face along the seal of the face-piece, fogging of your glasses, or a lack of pressure being built up inside the face-piece. If the particulate respirator has an exhalation valve, then performing a positive pressure check may be impossible. If so, then do a negative pressure check.
6. Negative pressure check – Negative pressure seal checks are conducted on particulate respirators that have exhalation valves. To conduct a negative pressure user seal check, cover the filter surface with your hands as much as possible and then inhale. The face-piece should collapse on your face and you should not feel air passing between your face and the face-piece.

IX. Infection prevention and control precautions for aerosol-generating procedures

1. An aerosol-generating procedure is defined as any medical procedure that can induce the production of aerosols of various sizes, including small (< 5 micron) particles.
2. Aerosol-generating procedures that may be associated with an increased risk of infection transmission includes both elective procedures such as bronchoscopy, sputum induction, elective intubation and extubation, as well as emergency procedures such as cardiopulmonary resuscitation, emergency intubation, open suctioning of airways, manual ventilation via Ambo bagging through a mask before intubation, and initiation of non-invasive ventilation (e.g. Bilevel Positive Airway Pressure - BiPAP).
3. BiPAP is not recommended in MERS-CoV infected patients because of the high risk of generating infectious aerosols and lack of evidence for efficacy over elective endotracheal intubation and mechanical ventilation for patients with pneumonia.
4. Additional precautions should be observed when performing aerosol- generating procedures, which may be associated with an increased risk of infection transmission:
    a. Wear N95 masks –Every healthcare worker should wear a fit tested N95 mask (or an alternative respirator if fit testing failed). Additionally, when putting on N95 mask, always check the seal.
    b. Wear eye protection (i.e. goggles or a face shield).
    c. Wear a clean, non-sterile, long-sleeved gown and gloves (some of these procedures require sterile gloves).
    d. Wear an impermeable apron for some procedures with expected high fluid volumes that might penetrate the gown.
5. Perform procedures in a negative pressure room.
6. Limit the number of persons present in the room to the absolute minimum required for the patient's care and support.
7. Perform hand hygiene before and after contact with the patient and his or her surroundings and after PPE removal.

X. Admission criteria

1. Not all suspected MERS-CoV patients should be admitted to health-care facilities (please refer to section III, page 7. Algorithm for managing patients with suspected MERS-CoV).
2. Patients suspected to have MERS-CoV infection who have shortness of breath, hypoxemia, and/or clinical or radiological evidence of pneumonia should be hospitalized.
3. Patients with suspected MERS-CoV who have no shortness of breath, hypoxemia, or evidence of pneumonia may be cared for and isolated in their home when suitable.

4. Confirmed MERS cases at MOH and private hospitals should be transferred as soon as possible to a MERS designated center (Appendix C, page 44). The decision to transfer a highly suspected MERS case to the MERS designated hospital should be based on risk assessment and coordinated by the regional CCC.
5. Non-MOH governmental hospitals should manage confirmed MERS cases at their facilities unless regional or central CCC decide otherwise.

XI. Home isolation

Isolation is defined as the separation or restriction of activities of an ill person with a contagious disease from those who are well.

1. Before the ill person is isolated at home a healthcare professional should assess whether the home is suitable and appropriate for isolating the ill person. You can conduct this assessment by phone or direct observation.
    a) The home should have a functioning bathroom. If there are multiple bathrooms, one should be designated solely for the ill person.
    b) The ill person should have his or her own bed and preferably a private room for sleeping.
    c) Basic amenities, such as heat, electricity, potable and hot water, sewer, and telephone access, should be available.
    d) There should be a primary caregiver who can follow the healthcare provider's instructions for medications and care. The caregiver should help the ill person with basic needs in the home and help with obtaining groceries, prescriptions, and other personal needs.
2. If the home is suitable and appropriate for home care and isolation you should give the patient, the caregiver, and household members the following instructions:

For the patient

1. **Separate yourself from other people in your home**
   As much as possible, you should stay in a different room from other people in your home. Also, you should use a separate dedicated bathroom, if available.
2. **Call ahead before visiting your doctor**
   Before your medical appointment, call the healthcare provider and tell him or her that you may have MERS-CoV infection. This will help the healthcare provider's office takes steps to keep other people from getting infected.
3. **Wear a surgical mask**
   You should wear a surgical mask when you are in the same room with other people and when you visit a healthcare provider. If you cannot wear a surgical mask, the people who live with you should wear one while they are in the same room with you.

4. **Cover your coughs and sneezes**

   Cover your mouth and nose with a tissue when you cough or sneeze, or you can cough or sneeze into your sleeve. Throw used tissues in a lined trash can, and immediately wash your hands with soap and water or disinfect it with waterless alcohol-based hand sanitizer.

5. **Wash your hands**

   Wash your hands often and thoroughly with antiseptic soap and water.
   You can use an alcohol-based hand sanitizer if antiseptic soap and water are not available and if your hands are not visibly dirty. Avoid touching your eyes, nose, and mouth with unwashed hands.

6. **Avoid sharing household items**

   You should not share dishes, drinking glasses, cups, eating utensils, towels, bedding, or other items with other people in your home. After using these items, you should wash them thoroughly with soap and warm water.

For caregivers and household members

If you live with or care for someone at home who is ill and being evaluated for MERS-CoV infection, you should:

1. Make sure that you understand and can help the ill person follow the healthcare provider's instructions for medication and care. You should help the ill person with basic needs in the home and provide support for getting groceries, prescriptions, and other personal needs.
2. Have only people in the home who are essential for providing care for the ill person.
3. Other household members should stay in another home or place of residence. If this is not possible, they should stay in another room, or be separated from the ill person as much as possible. Use a separate bathroom, if available.
4. Restrict visitors who do not have an essential need to be in the home.
5. Keep elderly people and those who have compromised immune systems or specific health conditions away from the ill person. This includes people with chronic heart, lung or kidney diseases, and diabetes.
6. Make sure that shared spaces in the home have good air flow, such as by air-conditioner or an opened window.
7. Wear a disposable surgical mask, gown, and gloves when you touch or have contact with the ill person’s blood, body fluids and/or secretions, such as sweat, saliva, sputum, nasal mucous, vomit, urine, or diarrhea.
8. Throw out disposable surgical masks, gowns, and gloves after using them. Do not reuse.
9. Wash your hands immediately after removing your surgical mask, gown, and gloves.

10. Wash your hands often and thoroughly with soap and water. You can use an alcohol-based hand sanitizer if soap and water are not available and if your hands are not visibly dirty. Avoid touching your eyes, nose, and mouth with unwashed hands.
11. Avoid sharing household items. You should not share dishes, drinking glasses, cups, eating utensils, towels, bedding, or other items with an ill person who is being evaluated for MERS-CoV infection. After the ill person uses these items, you should wash them thoroughly with soap and warm water
12. Clean all "high-touch" surfaces, such as counters, tabletops, doorknobs, bathroom fixtures, toilets, and bedside tables, every day. Also, clean any surfaces that may have blood, body fluids and/or secretions on them.
13. Wear disposable gloves and gown while cleaning surfaces.
14. Use a diluted bleach solution or a household disinfectant. To make a bleach solution at home, add 1 tablespoon of bleach to 4 cups of water. For a larger supply, add ¼ cup of bleach to 16 cups of water.
15. Wash laundry thoroughly.
16. Immediately remove and wash clothes or bedding that have blood, body fluids and/or secretions on them.
17. Wear disposable gloves while handling soiled items. Wash your hands immediately after removing your gloves.
18. Wash the items with detergent and warm water at the maximum available cycle length then machine dry them.
19. Place all used gloves, gowns, surgical masks, and other contaminated items in a lined container before disposing them with other household waste. Wash your hands immediately after handling these items.
20. Follow the guidance for close contacts below.

For close contacts including health care workers

If you have had close contact with someone who is ill and being evaluated for MERS-CoV infection, you should:

1. Monitor your health for 14 days, starting from the day you were last exposed to the ill person. Watch for these symptoms:
    a) Fever (38° C, or higher). Take your temperature twice a day.
    b) Coughing.
    c) Shortness of breath.
    d) Other early symptoms to watch for are chills, body aches, sore throat, headache, diarrhea, nausea/vomiting, and runny nose.

2. If you develop symptoms, follow the prevention steps described above, and call your healthcare provider as soon as possible. Before your medical appointment, call the healthcare provider and tell him or her about your possible exposure to MERS-CoV. This will help the healthcare provider's office take steps to keep other people from getting infected. Ask your healthcare provider to call the MOH.
3. If you do not have any of the symptoms, you can continue with your daily activities, such as going to work, school, or other public areas.
4. Provide "Ministry of Health's Guidance for Preventing MERS-CoV from Spreading in Homes and Communities" brochure to the ill person, the caregiver, and household members. This brochure is available in common languages (Arabic, English, Urdu, Pilipino, Indonesian, Bangladeshi, Somalian, and Ethiopian.

XII. Management of health care workers and patients who had contacts with patients with MERS-CoV infection

1. Health care facilities should trace all health care workers who had protected or unprotected contacts with patients with suspected, probable, or confirmed MERS-CoV infection.
2. **High-risk unprotected exposure** (Contact with confirmed MERS-CoV case within 1.5 meters for > 10 minutes):
    a) Testing (Nasopharyngeal swabs) for MERS-CoV is recommended even if asymptomatic.
    b) Testing should not be done before 24 hours of exposure.
    c) Single test only required unless symptomatic where repeated testing is required.
    d) Contact should be off work until the test is reported as negative.
3. **Low-risk unprotected exposure** (Contact with confirmed MERS-CoV case more than 1.5 meters and/or for < 10 minutes):
    a) Testing for MERS-CoV is not recommended if asymptomatic.
    b) Continue to work in the hospital unless they become symptomatic.
4. **Protected exposure** (Contact with confirmed MERS-CoV case and having appropriate isolation precautions including the PPE)
    a) Testing for MERS-CoV is not recommended if asymptomatic.
    b) Continue to work in the hospital unless they become symptomatic.
5. **Patients** can be exposed to MERS patients during pre-diagnosis phase or due to failure of recommended isolation precautions.
    a) Definition of exposed patients: All patients admitted in the same room with a confirmed case of MERS for at least 30 minutes.
    b) Testing for MERS-CoV should be done 24 hours or more after the last exposure.
    c) Such patients should be followed for symptoms for 14 days after exposure with testing to be done upon development of symptoms suggestive of MERS.

6. The infection control unit of the facility or equivalent thereof should trace all contacts within the HCF and proactively call by phone all contacts to assess their health daily for a total of 14 days. Contacts should also be instructed to report immediately to the Staff Health Clinic or Emergency Room if they develop upper or lower respiratory illness.

7. The Infection Control unit should be notified of all contacts that develop a respiratory illness.

   Symptomatic contacts should be assessed clinically. Nasopharyngeal swabs should be collected and tested for MERS-CoV PCR.

   Symptomatic contacts should be managed as suspected cases using the same protocol described in the MERS-CoV management algorithm in section III above.

8. **Management of Hospital outbreak of MERS-CoV (Appendix B, page 30).** Defined as evidence of secondary transmission within the hospital of single or more cases.
   a) Investigation should be under guidance of Infection Prevention and Control Unit of the hospital, Regional Command and Control Center and Central Command and Control Center.
   b) More testing of asymptomatic HCW may be required.
   c) Cohorting or closure of units should be in consultation with the regional command and control center.
   d) Surge plan to be in place in case of large outbreak.

XIII. Management of household contacts of patients with MERS-CoV infection

1. The Department of Public Health in the local Ministry of Health Directorate Office should trace all household or other contacts of patients with probable, or confirmed MERS-CoV infection.
2. Contacts should not be routinely tested for MERS-CoV unless they develop upper or lower respiratory illness and or fever, fatigue and diarrhea.
3. The Department of Public Health should proactively call by phone all contacts to assess their health daily for a total of 14 days. Contacts should also be instructed to report immediately to the nearest hospital if they develop upper or lower respiratory illness.
4. Symptomatic contacts should be assessed clinically. Nasopharyngeal swabs should be collected and tested for MERS-CoV by PCR.
5. Symptomatic contacts should be managed as suspected cases using the same protocol described in the MERS-CoV management algorithm in section III, page 7.
6. Secondary household transmission requires investigation by Field Epidemiology Training Program (FETP).

XIV. Duration of isolation precautions for MERS-CoV infection

The duration of infectivity for MERS-CoV infection is unknown; Respiratory sample should not be repeated for non-improving critically ill in-patients. However, to stop isolation, two negative deep respiratory sample is required. Testing for MERS-CoV should be repeated after one week for improving patients in the medical ward and then every 3 days. For home-isolated patients testing is to be done one week after diagnosis and then every 3 days. Discontinue isolation in the hospital or the home setting if the patient is asymptomatic and a single MERS-CoV PCR test is negative.

If the sample is still positive, and the patient is well enough to go home, he/she can be allowed to go home with instruction to isolate him/herself at home and come wearing a surgical mask to the clinic for follow up.

XV. Managing bodies in the mortuary

1. Deceased bodies may pose a potential risk of infections when handled by either family members or body washers although no confirmed case of MERS has ever been reported to be transmitted postmortem.
2. Body washing and preparation of confirmed or suspected cases should be done by the regional secretariats and municipalities of the ministry of municipal and rural affairs where washing is performed in designated areas and current universal precaution measures are adequate to prevent transmission. Washers should be continuously trained on universal precaution of washing deceased bodies and the proper use of PPEs. Infection Prevention and Control departments at regional health directorates should provide necessary training and oversight. Washing of bodies may not need to be in hospitals and should not be done at home.
3. If family members wish to perform the body washing, this should be under supervision of the regional secretariats and municipalities of the ministry of municipal and rural affairs as they must strictly adhere to standard precautions and use PPEs.

XVI. General outlines of management

1. Call MOH hotline “937” to report any suspected MERS patient or to arrange for transfer of the patient to a MERS-designated center.
2. MOH recommends transferring confirmed MERS patients admitted to any MOH or private hospitals to one of the 20 MOH MERS-designated centers (Appendix C, page 44). MERS patients admitted to non-MOH governmental hospitals (e.g. Armed Forces, National Guard, Security Force, King Faisal Specialist Hospital, and Universities) should be managed in the hospitals they are admitted to. However, when required and in consultation with central

command and control center (CCC), MOH may accept transfer of individual patients to MOH MERS-designated centers.

3. Patients admitted with suspected MERS-CoV pneumonia should be initiated on empiric antimicrobials to cover alternative causes of pneumonia.
4. For community acquired pneumonia, a 3rd generation cephalosporin (e.g. ceftriaxone) to cover *Streptococcus pneumoniae* and a macrolide (e.g. erythromycin, clarithromycin, or azithromycin) to cover atypical organisms (e.g. *Mycoplasma pneumoniae* and *Chlamydophila pneumonia)* should be initiated. The use of respiratory quinolones (e.g. levofloxacin or moxifloxacin) is NOT advisable because of their valuable anti-tuberculosis (TB) activity and the fact that TB is common in our community.
5. Oseltamivir (Tamiflu) should also be empirically added when viral pneumonia is suspected (e.g. a patient whose illness started with an influenza like illness for a few days followed by pneumonia).
6. For hospital-acquired pneumonia, Gram-negative bacteria should be primarily covered. A third-generation cephalosporin effective against *Pseudomonas aeruginosa* (e.g. ceftazidime), anti-psuedomonal penicillin (e.g. Pipaeracillin/tazobactam), or a carbapenem (e.g. imipenem or meropenem) should be used for empiric treatment and subsequently modified per the respiratory and blood culture results. If the patient is known to be colonized with methicillin-resistant *Staphylococcus aureus*, vancomycin should also be added to the anti-Gram negative coverage.
7. The use of non-invasive ventilation (e.g. Bilevel Positive Airway Pressure- BiPAP) should be avoided in patients with suspected MERS-CoV pneumonia because of the high risk of generating infectious aerosols and lack of evidence for efficacy over elective endotracheal intubation and mechanical ventilation for patients with pneumonia.
8. Supportive care is paramount to decrease mortality from MERS-CoV infection. This includes conservative fluid resuscitation and when necessary ionotropic support for hypotensive patients, mechanical ventilation for patients with respiratory failure, and renal-replacement therapy for patients with renal failure.
9. High frequency oscillatory ventilation should be avoided because of its ability to generate aerosols and the lack of effectiveness in ARDS.
10. The use of antivirals against MERS-CoV such as interferon, ribavirin, lopinavir are of possible benefit if given early in the course of MERS illness. They can be administered under supervision of Infectious Disease specialist.

XVII. Guidelines for Extra-Corporeal Membrane Oxygenation (ECMO)

ECMO is available in Riyadh, Jeddah, and Dammam MERS-designated centers. There is no evidence for clear benefit in MERS cases, however some data in influenza indicate its potential benefit in some patients. It may be considered in patients with acute severe hypoxemic respiratory failure with a ratio of arterial oxygen tension to fraction of inspired

oxygen (PaO_2/FiO_2) of <80 mmHg despite optimization of the ventilator settings, including the Fraction of Inspired Oxygen (FiO_2), positive end-expiratory pressure (PEEP), and inspiratory to expiratory (I:E) ratio.

1. The following are the indications for veno-venous ECMO:
    a) Age < 60 years with a potentially reversible lung pathology
    b) PaO_2/FiO_2 of <80 on 100% FiO_2.
    c) Respiratory acidosis (PH < 7.2).
    d) Positive End Expiratory Pressure (PEEP) > 15 cm H_2O with a plateau pressure (Pplat) > 35 cm H_2O.
2. Relative contraindications for ECMO include:
    a) If anticoagulation is contraindicated (e.g., bleeding, recent surgery, recent intracranial injury).
    b) If the cause of the respiratory failure is irreversible.
    c) If the patient has been mechanically ventilated for longer than seven days.
    d) If the patient has hemodialysis-dependent end stage renal disease.
    e) End stage liver, lung, and heart disease.
3. Other characteristics that may exclude some patients from receiving ECMO include advanced age, morbid obesity (Body Mass Index-BMI > 45 kg/m^2), neurologic dysfunction, or poor preexisting functional status.

XVIII. References

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Appendix A

1. Visual Triage: Illness Checklist for MERS in Adults

Date: _____ Time: _____ MRN: _____

Name: _____ National/Residence ID: _____

Healthcare Facility name: _____ Unit: _____

	A. Clinical symptom/sign	**Points**	**Score**
1	Fever (≥38°C)	**2**	
2	Cough (New or worsening)	**2**	
3	Shortness of breath (New or worsening)	**2**	
4	Nausea, vomiting, diarrhea	**1**	
5	Sore throat and/or runny nose	**1**	
6	DM, Chronic renal failure, CAD/heart failure	**1**	
	B. Risk of exposure to MERS		
7	Exposure to a confirmed MERS case in last two weeks	**3**	
8	Exposure to camel or products (Direct or indirect*) in the last two weeks	**2**	
9	Visit to health care facility that has MERS case in last two weeks	**1**	
	Total Score		

* Patient or household

A score ≥ 4, place patient in an isolation room and inform MD for assessment

Staff name: _____ ID number: _____

Appendix A

2. Visual Triage: Illness Checklist for MERS in Pediatrics

Date: _____ Time: _____ MRN: _____

Name: _____ National/Residence ID: _____

Healthcare Facility name: _____ Unit: _____

	A. Clinical symptom/sign	**Points**	**Score**
1	Fever (≥38°C)	**1**	
2	Cough (New or worsening)	**1**	
3	Shortness of breath (New or worsening)	**1**	
	B. Risk of exposure to MERS		
4	Exposure to a confirmed MERS case in last two weeks	**3**	
5	Exposure to camel or products (Direct or indirect*) in the last two weeks	**2**	
6	Visit to health care facility that has MERS case in last two weeks	**1**	
	Total Score		

* Patient or household

A score ≥ 4, place patient in an isolation room and inform MD for assessment

Staff name: _____ ID number: _____

Appendix B

Management of MERS-CoV Outbreak in Healthcare Facilities

Definition:

MERS-CoV Outbreak: evidence of secondary transmission within a healthcare facility of one or more cases.

General Guide:

1. The primary objective in outbreak management is to protect public health by identifying the source and implementing control measures to prevent further spread.
2. Regional and Central Command and Control Center (CCC) are responsible for and leading the outbreak management of MERS in any healthcare facility at the Kingdom of Saudi Arabia.
3. Regional CCC commander (or designee) is the designated outbreak management team leader. Central CCC provides logistic and technical support as needed.
4. When an outbreak is detected, the regional CCC commander shall immediately order the formation of outbreak management team (OMT).
5. The OMT to be formed from the regional CCC and the Infection control department/unit at the healthcare facility for primary control of the outbreak.
6. The OMT has the authority for all restrictive measures to contain the outbreak including hospital units' closure.
7. Total closure of a healthcare facility in an outbreak must be discussed and approved by the central CCC.
8. Central CCC outbreak management team may be deployed to assist in medium to large outbreaks (Category B, C and D).
9. Upon request from regional or central CCC, Field Epidemiology Training Program (FETP) shall conduct outbreak investigation to provide timely information and guide that assists in control of the outbreak.
10. All healthcare facilities within the region to be timely informed of the outbreak and necessary preventive measures are implemented.
11. Administrative support at facility, health sector region's and ministerial levels has to be assured.

Outbreak size categories:

A: Limited to a single unit in a single healthcare facility
B: Multiple units in a single healthcare facility
C: Multiple hospitals in a single city
D: Multiple hospitals in multiple cities

Members Outbreak management team:

1. Regional CCC commander
2. Members of the Regional CCC
3. FETP from the Ministry of Health
4. Head of Infection Control Unit of the Healthcare Facility
5. Hospital Epidemiologist
6. Infection Control Practitioners at the Healthcare Facility
7. Central outbreak team (large outbreaks)
8. Other members as determined by the team.

Detection and control measures:

1. All measures should be in place to prevent MERS-CoV outbreaks in healthcare facilities per the published national guidelines.
2. Risk assessment to be performed early by the outbreak management team once secondary transmission have been confirmed in a healthcare facility
3. Outbreak management team to meet at least daily to discuss all outbreak management issues.
4. Rapid response team will carry out its actions of inspection, on-job training of staff, distribution of training materials, immediate corrections of IPC practices.
5. All persons who had contact with a confirmed case in the healthcare facilities and community to be identified and traced.
    a. The infection control unit of the facility will identify and trace all health care workers who had exposure to patients diagnosed with MERS-CoV and will assess their health daily for a total of 14 days. (Form 1, page 37-38)
    b. The Department of Public Health in the regional health directorate will trace all household or other community contacts of patients with confirmed MERS-CoV infection for a total of 14 days. Testing for MERS-CoV in symptomatic individuals only (Form 2, page 39-41)
    c. Line Listing Records for Household and healthcare contacts will be updated daily. (Form 3 and 4, page 42-43)
    d. Healthcare providers on the contact list should not report to work and inform their superiors if they have symptoms suggestive of MERS-CoV infection (should sign clearance in a logbook at a triage area when reporting to work).
    e. All HCW contacts, low and high risk, should be tested for MERS by PCR not less than 24 hours after exposure. Only those with high risk exposure may be tested again within 3 days of previous negative test. Any symptomatic HCW on the contact list should be tested. Repeated testing of symptomatic and MERS-negative HCW is at the discretion of the outbreak management team.
    f. Any HCW or household on the contact list should not travel outside the kingdom and do not attend mass gathering events (e.g. Hajj and Umrah) for 14 days from time of

exposure. Movement within the kingdom should be notified to the outbreak management team.

6. Outbreak management team will put in place the control measures including proper patient placement and compliance with infection control measures.
7. The Infection Prevention and Control audit team will conduct audits on the healthcare facilities within the city to ensure preparedness.
8. Emerging community cluster to be managed by the regional CCC with involvement of FETP. Home isolation should be instituted for stable patients. Those that require hospital care should be admitted to MERS designated center (Appendix C, page 45). Necessary precautions and procedures are outlined in the document.

Appendix B

Outbreak Surge plan

Any outbreak has the potential for spread within a healthcare facility, other neighbouring healthcare facilities and distant facilities. Therefore, a surge plan to assure adequate capacity for patient care and control of the outbreak is essential. This can be part of the National Emergency Operation Center. The regional and central CCC will be responsible for management of the MERS surge plan.

1. Hospital with Declared outbreak of MERS

a) MOH and Private hospitals

i. All MERS cases to be transferred to MERS designated center
ii. If outbreak is related to exposure in emergency department, downsize operation to critical cases only.
iii. If sustained transmission in a hospital unit (tertiary transmission), closure of the unit to new cases to be instituted and limit unit staff to the minimum required
iv. If multiple units are involved in a MERS outbreak, stop routine admissions and procedures. Divert patients for care to other hospitals.
v. Information about the outbreak to be disseminated to all health institutions in the city/region.
vi. Complete hospital shutdown to be decided by the central CCC.
vii. Reverting to normal operations to be decided by the regional and central CCC.

b) Government non-MOH hospitals

i. MERS cases are to stay in the hospital unless large surge of cases that overwhelm capacity. Any transfers to MERS designated centers should be discussed with the regional and central CCC.
ii. Institutions may develop their own surge plan and approved by the central CCC.
iii. If outbreak is related to exposure in emergency department, downsize operation to critical cases only.
iv. If sustained transmission in a hospital unit (tertiary transmission), closure of the unit to new cases to be instituted and limit unit staff to the minimum required
v. If multiple units are involved in a MERS outbreak, stop routine admissions and procedures. Divert patients for care to other hospitals.
vi. Information about the outbreak to be disseminated to all health institutions in the city/region.
vii. Downsizing or shutdown of services to be decided by the central CCC with discussion of the institution administration.

2. Primary MERS Centers

a) Adequate capacity must be continuously assured throughout the year.
b) Bed occupancy of isolation rooms to be monitored and at 80% target surge plan to be activated with evacuation/transfer of non-MERS patients. This may require downsizing routine operations such as elective admissions.

c) In case of influx of large number of MERS cases, establish wards with single room and HEPA filter to accommodate more MERS cases. Then cohorting MERS cases in shared rooms.
d) Arrange patients transfer to MERS backup center when the above measures are inadequate to accommodate MERS cases.

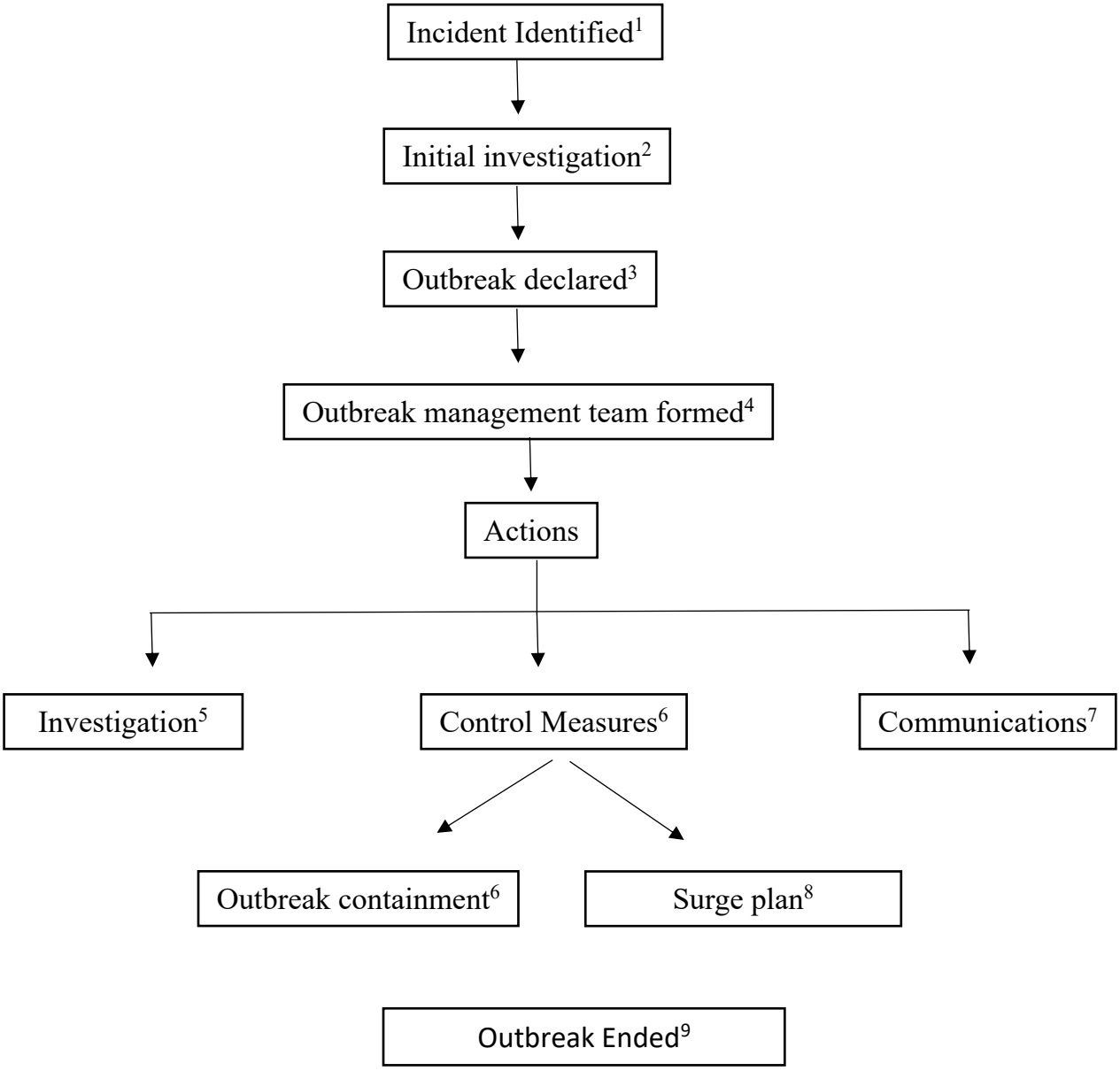
3. Backup MERS Centers

a) Primary MERS centers may function as a backup for other centers within the catchment area (Appendix C, page 44).
b) Five centers are designated to provide backup capacity for the current designated MERS centers. These are distributed to Eastern, Central, western, Northern and Southern. The list of Backup hospitals in Appendix C, page 44.
c) Backup MERS center is activated when the capacity of the current MERS centers within catchment area reach 80% occupancy.
d) The backup centers are to be equipped in personnel and supplies similar to current MERS centers with the exception of ECMO service
e) Coordination of transfer is coordinated by the regional CCC.

Surge Levels (% of total bed capacity)	**Surge Strategies**	**Response Level**	**Command Function**
Pre-Surge	Basic	○ normal function	Hospital command center
Minor Surge (5% - 10%)	Enhanced	○ closure of the unit where tertiary transmission occurred to new cases ○ limit unit staff to the minimum required	Regional CCC
Moderate Surge (11% - 15%)	Augmented	○ Establish early discharges ○ stop routine admissions and procedures. ○ Divert patients for care to other hospitals.	Regional CCC
Major Surge (16%-20%)	Optimum	○ Defer all treatment for non-life threatening conditions ○ Triage all cases out	Regional CCC
Large Scale Emergency >20%	Over capacity	○ Hospital shutdown	Central CCC
After event	Basic	○ Normal function	Central and regional CCC

Appendix B

Outbreak Management Flowchart



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1. Identified as per definition of healthcare facility outbreak
2. Confirm definition of an outbreak by the regional CCC
3. Declare outbreak by the regional and central CCC

4. Predefined team members from the regional CCC with the infection control team from the healthcare facility. Central CCC outbreak management team will assist in large outbreaks, categories B, C and D
5. Investigation to clarify the nature of the outbreak is primarily done by FETP which is part of the outbreak management team. This should be started immediately upon declaration of the outbreak and results are discussed in the daily meeting of the outbreak management team.
6. Control measures include all actions that will lead to containment of the outbreak and eventual end.
    a. Identifying and closing all gaps in infection prevention and control measures
    b. Environmental cleaning and disinfection
    c. Contact tracing, testing and management
    d. Patient flow and restrictions
    e. Units restrictions or closure
    f. Implementation of surge plan in case of increase in the size of the outbreak
    g. Health education for household contacts of the disease symptoms, transmission and isolation.
    h. Decision of household contacts not to report to work.
7. Communication with the public is coordinated by the media platform of the central CCC. Source of information will be arranged by the media platform which includes the declaration of an outbreak and the progress as needed. Communication with international health organization will be through the International Health Representation (IHR). Communication with health sectors or individual will be arranged through the central and regional CCC.
8. Surge plan as outlined above.
9. Central CCC to declare end of the outbreak when the last person on the contact list has passed the 14 days' limit with no infection with MERS-CoV.

MERS CoV Contact Tracing Assessment Form (Form # 1)

(Health Care Facilities)

(نموذج # 1) أستمارة تتبع المخالطين لحالات متلازمة الشرق الأوسط التنفسية (فيروس كورونا)

(مرافق الرعاية الصحية)

Date Investigation Start:	_ dd_ /_ mm _ / _ yyyy _	تاريخ إجراء الاستقصاء:
Form completed by:	……	اسم من قام بملء النموذج:
Phone number:	_ _ _ - _ _ _ - _ _ _	رقم الهاتف:
Health care facility:	……	مرفق الرعاية الصحية:
Sector:	القطاع :	Health Region : …… المنطقة الصحية :

Part 1. Patient personal information

Source of patient personal information: مصدر المعلومات عن المريض:

Subject	Relative	HCW
□	□	□
الحالة	أحد الأقارب ( )	أحد مقدمي الخدمة الصحية

First & Middle Name: …….....…….....…….....……	اسم المريض:
Family Name: …….....…….....…….....……	العائلة (اللقب):
National ID Number: .....…….....……	رقم الهوية الوطنية / الإقامة:
Investigation Number: .....…….....…….....……	رقم الاستقصاء:
Medical Record Number: .....…….....……	رقم الملف الطبي:
Sex: Male □ ذكر Female □ أنثى	الجنس:
Residence:	العنوان:
City: ..... المدينة: Region / Governorate:	المنطقة:
Date of Birth: _ dd_ /_ mm _ / _ yyyy _	تاريخ الميلاد:
Date of onset of symptoms: _ dd_ /_ mm _ / _ yyyy _	تاريخ بداية الأعراض:

Is the patient a close contact of a confirmed case(s)?

هل المريض مخالط مقرب لمريض أو مرضى مؤكد أصابتهم بفيروس الكورونا؟

Yes □ نعم No □ لا Unknown □ غير معروف

If (Yes), fill the following table:

إذا كانت إجابة السؤال السابق بـ **(نعم)**, قم بتعبئة الجدول التالي:

Investigation ID	Name	Date of Contact	Location of Contact
		_ dd _ / _ mm _ / _ yyyy _	
		_ dd _ / _ mm _ / _ yyyy _	
		_ dd _ / _ mm _ / _ yyyy _	
		_ dd _ / _ mm _ / _ yyyy _	
		_ dd _ / _ mm _ / _ yyyy _	
		_ dd _ / _ mm _ / _ yyyy _	
		_ dd _ / _ mm _ / _ yyyy _	

Part 2. Exposed Healthcare Workers:

Date of last Exposure	Name of HCW	ob Category	Hospital unit where potentially exposed	Admission date to the unit where exposure occurs	Low / High risk contact
/ /				/ /	
/ /				/ /	
/ /				/ /	
/ /				/ /	
/ /				/ /	
/ /				/ /	
/ /				/ /	
/ /				/ /	

Part 3. Exposed Patients:

Date of last Exposure	Name of the patient	Hospital unit where potentially exposed	Admission date to the unit where exposure occurs	
			Case	Exposed patient
/ /			/ /	/ /
/ /			/ /	/ /
/ /			/ /	/ /
/ /			/ /	/ /
/ /			/ /	/ /
/ /			/ /	/ /
/ /			/ /	/ /

MERS CoV Community Surveillance Form (Form #2)

(**نموذج # 2**) الإستقصاء الوبائي لحالات متلازمة الشرق الأوسط التنفسية (فيروس كرونا)

Date Investigation Started: _ dd_ /_ mm _ / _ yyyy _	تاريخ إجراء الاستقصاء:
Form completed by**:** ……	اسم من قام بإستكمال النموذج:
Phone number: _ _ _ - _ _ _ - _ _ _	رقم الهاتف:
Permanent job site: ……	جهة العمل الأساسية:
Sector القطاع: …… Health Region المنطقة الصحية : ……	

Part 1. Patient personal information

1. First & Father name: ……	اسم المريض :
2. Family name: ……	العائلة (اللقب):
3. GPS coordinates **N ……** **E** ……	**إحداثيات موقع سكن الحالة:**
4. **OR** Wassel (address):	**او** عنوان واصل
5. Address in detail:	العنوان بالتفصيل:
6. What type of housing? ☐ Single family home/villa **منزل منفصل/ فيلا** ☐ Apartment **شقة** ☐ Dormitory **مجمع سكني** ☐ Other, specify **أخرى، حدد**……	ما نوع المنزل الذي يسكنه المريض ؟
7. Home phone: + ( )_ _ _-_ _ _-_ _ _	8. Mobile phone: + ( )_ _ _-_ _ _-_ _ _
9. Does the patient have another home? Yes ☐ **نعم** No ☐ **لا**	هل للمريض منزل أخر؟
10. If yes: Address: …… …… …… إذا كانت الإجابة بنعم، سجل العنوان ورقم الهاتف	11. Telephone: + ( )_ _ _-_ _ _-_ _ _
12. Is the patient the head of household**?** Yes ☐ **نعم** No ☐ **لا**	هل المريض هو رب العائلة؟
If **YES**, move to part **1.2**	إذا كانت الإجابة بـ **نعم**، انتقل الى الجزء **1.2**

1.1 Head of Household Section — 1.1جزء خاص برب العائلة

1. Name of head of household: ……	اسم رب العائلة:
2. Identification Number: ……	رقم الهوية لرب العائلة:
National ID ☐ هوية وطنية Iqama ☐ إقامة Passport ☐ جواز سفر	
3. Relationship to patient: ☐ Parent والد/والدة ☐ Spouse العائل	صلة القرابة مع المريض

☐ Sibling أخ/أخت
☐ Other, **أخرى، حدد** specify……

4. Mobile phone number: + ( )_ _ _-_ _ _-_ _ _ رقم الجوال رب العائلة:

1.2 Patient Social information — 1.2 معلومات اجتماعية للمريض

1. Education (Give highest year of school completed): الحالة التعليمية للمريض (سجل اعلى مرحلة تعليمية وصل اليها المريض):
   - ☐ Child طفل
   - ☐ Illiterate غير متعلم
   - ☐ Preschool رياض أطفال
   - ☐ Elementary ابتدائي
   - ☐ Intermediate متوسطة
   - ☐ Secondary ثانوية
   - ☐ Diploma دبلوم
   - ☐ Bachelor بكالوريوس
   - ☐ Master ماجستير
   - ☐ PHD دكتوراه

2. Occupation: مهنة المريض:
   - ☐ Student طالب
   - ☐ Employed/ Government sector يعمل بالقطاع الحكومي
   - ☐ Employed/ Private sector يعمل بالقطاع الخاص
   - ☐ Retired متقاعد
   - ☐ Unemployed عاطل عن العمل
   - ☐ Other أخرى, specify……

3. If student, please provide: إذا كان طالب، سجل
   Name of the college/school اسم المدرسة/الجامعة……
   Address العنوان……

4. If employed, please provide: إذا كان موظفاً، سجل التالي:
   Name of the employer اسم جهة العمل……
   Address العنوان……

5. Does the patient have Housemaid / driver working in the home? هل المريض لديه خادمة/سائق؟ Yes ☐ **نعم** No ☐ **لا**

If yes, include on contact list
إذا كانت الإجابة نعم، اضف أسمائهم ببيان المخالطين.

Part 2 Personal Risk: — الجزء 2 عوامل الخطورة الشخصية:

2.1 Smoking — 2.1 التدخين

1. Does the patient smoke? **هل المريض مدخن؟** Yes ☐ **نعم** No ☐ **لا**

2.If yes, Specify: إذا كانت الإجابة نعم، حدد ☐ Cigarettes دخان ☐ Nargghile معسل ☐ Sheesha (جراك) شيشة

3.For how many years? …… كم سنة يدخن؟

4. How many per day? …… كم مرة باليوم؟

The following exposure questions cover the 14 days before the patient developed the illness **التالي يتضمن أسئلة تغطي التعرض لعوامل خطورة قبل 14 يوماً من إصابة المريض**

2.2. Exposure to possible human sources — 2.2 التعرض لمصدر عدوى إنساني محتمل

1. Did patient attend any mass gatherings? **هل حضر المريض إي تجمع كبير؟**

- ☐ Football or other large sporting events مباراة كرة قدم أو حدث رياضي كبير
- ☐ Janadria الجنادرية
- ☐ Um Rugaibah (Mazaieem-Camel festival) **مزايين الإبل (ام رقيبة)**
- ☐ Omra عمرة
- ☐ Esterahah (extended family gathering) إستراحة (تجمع عائلي كبير)
- ☐ Hajj حج

2.3. Exposure to Human sources — 3.2 التعرض لمصدر عدوى إنساني

1. Is the patient a healthcare worker? هل المريض يعمل بالمجال الصحي؟ Yes ☐ **نعم** No ☐ **لا**

N.B1 If patients a healthcare worker, please make sure HOSPITAL FORM completed		**ملاحظة 1:** إذا كان المريض يعمل بالمجال الصحي، تأكد بأن نموذج المستشفى قد استوفى
N.B2 If not a healthcare worker, please provide answers to the following questions:		**ملاحظة 2:** إذا كان المريض لا يعمل بالمجال الصحي، استكمل الجزء التالي من الأسئلة:
2.	Did the patient visit for any reason any health care facility during the 14 days before onset of symptoms? هل زار المريض أي منشأة صحية لأي سبب كان خلال 14 يوم قبل ظهور الأعراض؟	Yes ☐ **نعم** No ☐ **لا**
3.	Does the patient have regular visits to health care to receive treatments (e.g. renal dialysis, diabetes management, pregnancy, etc) هل المريض يراجع منشأة صحية بصفة منظمة لتلقي العلاج (مثلا: غسيل كلوي، عيادة السكر، الحمل، ... الخ)	Yes ☐ **نعم** No ☐ **لا**
4.	Did the patient visit a relative, neighbour, employer, co-worker, friend, while they were sick with a respiratory illness? هل زار المريض اقربائه، جيرانه، موظفيه، زملائه بالعمل، أصدقائه أو المدرسة عندما كان مريضاً بأعراض تنفسية ؟	Yes ☐ **نعم** No ☐ **لا**
5.	**If yes,** **إذا كانت الإجابة بنعم** Where did this happen?	☐ At home في المنزل ☐ In a health care facility في منشأة صحية
6.	Did the patient provide care for that person?**هل قام المريض برعاية ذلك الشخص**	Yes ☐ **نعم** No ☐ **لا**
7.	Was any family member diagnosed with MERS Corona virus infection **before** patient became sick? هل تم تشخيص أحد افراد العائلة بالكرونا **قبل** ظهور الأعراض على المريض	Yes ☐ **نعم** No ☐ **لا**
8.	Was any family member diagnosed with MERS Corona virus infection **After** patient became sick? هل تم تشخيص أحد افراد العائلة بالكرونا **بعد** ظهور الأعراض على المريض	Yes ☐ **نعم** No ☐ **لا**
9.	Was any other person who the patient knows personally diagnosed with MERS Corona virus? هل هنالك اشخاص يعرفهم المريض تم تشخيص حالتهم بالكرونا	Yes ☐ **نعم** No ☐ **لا**
10.	Before patient became sick?**قبل** ظهور الأعراض على المريض	Yes ☐ **نعم** No ☐ **لا**
11.	After patient became sick? **بعد** ظهور الأعراض على المريض	Yes ☐ **نعم** No ☐ **لا**

MERS-CoV Outbreak

Line Listing Record for Household and Other Contacts (Form 3)

Region: _____ Public Health Investigator: _____

	Personal Data Record name once and do not remove name from line list				**Daily Progress Use Legend:** SF=Symptoms Free; F=Fever; C=Cough; N/V=Nausea/Vomiting; BA= Body Aches; H=Headache Died=Death HOS=Hospitalization													
	Name (To be typed in English and Arabic)	**ID/ Iqama number**	**Age**	**Nationality**	**Day 1** DD/MM/YY	**Day 2** DD/MM/YY	**Day 3** DD/MM/YY	**Day 4** DD/MM/YY	**Day 5** DD/MM/YY	**Day 6** DD/MM/YY	**Day 7** DD/MM/YY	**Day 8** DD/MM/YY	**Day 9** DD/MM/YY	**Day 10** DD/MM/YY	**Day 11** DD/MM/YY	**Day 12** DD/MM/YY	**Day 13** DD/MM/YY	**Day 14** DD/MM/YY
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16																		

MERS-CoV Outbreak

Line Listing Record for Healthcare Workers Contacts: (Form 4)

Facility: _____ Facility Contact: _____

	Personal Data Record name once and do not remove name from line list					**Daily Progress Use Legend:** SF=Symptoms Free; F=Fever; C=Cough; N/V=Nausea/Vomiting; BA= Body Aches; H=Headache Died=Death HOS=Hospitalization, Test=MERS-CoV tested													
	Name (To be typed in English and Arabic)	**ID/ Iqama number**	**Age / Sex**	**Nationality**	**Exposure risk (high or low)**	**Day 1 DD/MM/YY**	**Day 2 DD/MM/YY**	**Day 3 DD/MM/YY**	**Day 4 DD/MM/YY**	**Day 5 DD/MM/YY**	**Day 6 DD/MM/YY**	**Day 7 DD/MM/YY**	**Day 8 DD/MM/YY**	**Day 9 DD/MM/YY**	**Day 10 DD/MM/YY**	**Day 11 DD/MM/YY**	**Day 12 DD/MM/YY**	**Day 13 DD/MM/YY**	**Day 14 DD/MM/YY**
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Appendix C

MERS-designated hospitals

No	Region	Primary MERS Hospital	MERS Backup Hospital*
1	Riyadh	Prince Mohammed bin Abdul-Aziz Hospital	Alemam Abdulrahman Alfaisal Hospital
2	Makkah	Al-Noor Hospital	East Jeddah Hospital
3	Jeddah	King Abdullah Medical Complex	
4	Taif	King Faisal Hospital	
5	Madinah	Ohud Hospital	
6	Eastern Region	Dammam Medical Complex	Qatif Central Hospital
7	Ahsa	King Fahd General Hospital in Hafoof	
8	Hafr Al-Batin	King Khalid General Hospital	
9	Al-Qassim	Buraidah Central Hospital	King Saud Hospital-Qassim
10	Tabuk	King Fahd Hospital	
11	Hail	King Khalid Hospital	
12	Al-Jouf	King Abdulaziz Specialist Hospital	
13	Northern Borders	Arar Central Hospital	
14	Al-Qurayyat	Qurayyat General Hospital	
15	Asir	Asir Central Hospital	Khamis Mushait General Hospital
16	Bisha	King Abdullah Central Hospital	
17	Albaha	King Fahd Hospital	
18	Jazan	Abu-Areesh General Hospital	
19	Najran	King Khalid Hospital	
20	Al Qunfudah	Al-Qunfudah General Hospital	

*Primary MERS designated hospitals may function as backup for other MERS centers within the catchment area.

Appendix D

Spacing of Patients

The minimum distance that should be maintained between patients' beds in selected clinical units as recommended by the Ministry of Health (MOH), the American Institute of Architects (AIA) Academy of Architecture for Health (1), and the International Federation of Infection Control (IFIC) (2).

Unit	**Distance between beds recommended by:**		
	MoH	**AIA**	**IFIC***
General Ward	A minimum of 1.2 meters between beds	A minimum of 1.22 meters (4 feet) between beds. Minimum of 9.29 square meters (100 square feet) of clear floor per bed.	Basic: 1 meter. Standard: 2 meters. Ideal: 2 meters.
Critical Care Unit	A minimum of 2.4 meters between beds	Minimum 2.44 meters (8 feet) between beds for both pediatric and adult ICUs Minimum of 18.58 square meter (200 square feet) of clear floor area per bed.	Basic: 1.5 meters. Standard: 2 meters. Ideal: 2 meters.
Hemodialysis Unit	A minimum of 1.2 meters between beds	A minimum of 1.22 meters (4 feet) between beds and/or lounge chairs A minimum 7.43 square meters (80 square feet) of clear floor area per patient cubicle.	No recommendation published.
Emergency Unit	A minimum of 1.2 meters between beds	A minimum of 1.22 meters (4 feet) between beds/stretchers A minimum 7.43 square meters (80 square feet) of clear floor area per patient cubicle.	Standard: 1.5 meters. Ideal: 2 meters.

*IFIC recommendations are given in three levels:

- Basic – Even with severely limited resources, this is what you should do as a minimum.
- Standard – this is what you should aim for in less wealthy countries.
- Ideal – if you have the resources, this is what you could do.

1. The American Institute of Architects Academy of Architecture for Health. Health and Human Services Guidelines for Design and Construction of Hospital and Healthcare Facilities, 2001 Edition.

2. Walter Popp, Peter Hoffman, Judene Bartley. Design of a general ward (Version 3). International Federation of Infection Control (IFIC) Construction, Design and Renovation Interest Group. 1 February 2010: page 1. Available at: http://www.theific.org/pdf_files/SIGs/recommendation_design_of_ward.pdf

Appendix E

Guidance for MERS-CoV sampling, packaging, and shipment

1. Before collecting and handling specimens for Middle East Respiratory Syndrome Coronavirus (MERS-CoV) testing, determine whether the person meets the current case definition for a Suspect, Probable or Confirmed case.
2. All specimens should be regarded as potentially infectious, and HCWs who collect or transport clinical specimens should adhere rigorously to standard precautions to minimize the possibility of exposure to pathogens.
3. Ensure that HCWs who collect specimens should be properly trained on the technique and wear PPE appropriate for aerosol generating procedures. Institutions will be responsible in assigning and training personnel to perform nasopharyngeal swabbing.
4. Ensure that personnel who transport specimens are trained in safe handling practices and spill decontamination procedures.
5. Place specimens for transport in leak-proof specimen bags (secondary container) that have a separate sealable pocket for the specimen (i.e. a plastic biohazard specimen bag), with the patient's label on the specimen container (primary container), and a clearly written request form.
6. Ensure that health-care facility laboratories adhere to appropriate biosafety practices and transport requirements per the type of organism being handled.
7. Deliver all specimens by hand whenever possible. Do not use pneumatic-tube systems to transport specimens.
8. State the name of the suspected ARI of potential concern clearly on the accompanying request form. Notify the laboratory as soon as possible that the specimen is being transported.
9. For further information on specimen handling in the laboratory and laboratory testing for MERS-CoV, see CDC and WHO Laboratory bio-risk management (1, 2), and the Laboratory testing for MERS-CoV (3, 4), and CDC and WHO laboratory biosafety manuals (5, 6).

Specimen type and priority

To increase the likelihood of detecting infection, lower respiratory specimens (sputum, endotracheal secretions, or bronchoalveolar lavage) are preferred such as blood, and serum should be collected on presentation and when convalescent. Collection of stool and urine is also recommended.

Points to consider when collecting specimens from a patient under investigation for MERS include:

1. Maintain proper infection control practices when collecting specimens.
2. Use approved collection methods and equipment when collecting specimens.
3. Handle, store, and ship specimens following appropriate protocols.

Respiratory specimens should be collected as soon as possible after symptoms begin ideally within 7 days and before antiviral medications are administered. However, if more than a week has passed since onset of illness and the patient is still symptomatic, respiratory samples should still be collected, especially lower respiratory specimens since respiratory viruses can still be detected by rRT-PCR.

General guidelines

Samples should be stored in hospital for less than 4 hours before collection by SAMSA. **ONLY** SAMSA delivery is allowed for MERS-CoV samples. Pick up **MUST** be requested at the following number (800 6149999).

Label each specimen container with the unique MERS number, patient's hospital ID number, specimen type and the date the sample was collected.

1. Diagnostic samples

A. Upper respiratory tract

Nasopharyngeal AND oropharyngeal swabs (NP/OP swabs) MUST BE TAKEN TOGETHER. Use only synthetic fiber swabs with plastic shafts. Do not use calcium alginate swabs or swabs with wooden shafts, as they may contain substances that inactivate some viruses and inhibit PCR testing. Place swabs immediately into sterile tubes containing 2-3 ml of viral transport media. NP/OP specimens MUST BE combined, placing both swabs in the same vial. Refrigerate specimen at 2-8°C up to 72 hours; if exceeding 72 hours, freeze at -70°C and ship on dry ice.

a) Nasopharyngeal swabs: Insert a swab into the nostril parallel to the hard palate. Leave the swab in place for a few seconds to absorb secretions. Swab both nasopharyngeal areas.

Figure 1: Correct technique for taking a nasopharyngeal swab

For more information see NEJM Procedure: Collection of Nasopharyngeal Specimens with the Swab Technique: http://www.youtube.com/watch?v=DVJNWefmHjE

b) Oropharyngeal swabs: Swab the posterior pharynx, avoiding the tongue.
c) Nasopharyngeal wash/aspirate or nasal aspirates: Collect 2-3 ml into a sterile, leak-proof, screw-cap sputum collection cup or sterile dry container. Refrigerate specimen at 2-8°C up to 72 hours; if exceeding 72 hours, freeze at -70°C and ship on dry ice.

B. Blood samples

1. Serum for serologic testing

For serum antibody testing: Serum specimens should be collected during the acute stage of the disease, preferably during the first week after onset of illness, and again during convalescence, ≥ 3 weeks after the acute sample was collected. However, since we do not want to delay detection, a single serum sample collected 14 or more days after symptom onset may be beneficial. Serologic testing is NOT currently available but will be implemented within the next 2 months at key regional laboratories.

Please be aware that the MERS-CoV serologic test is currently under investigation and is for research/surveillance purposes and not yet for diagnostic purposes - it is a tool developed in response to the MERS-CoV outbreak. Contact Labs@mohfeedback.com for consultation and approval if serologic testing is being considered.

2. Serum for rRT-PCR testing

a) For rRT-PCR testing (i.e., detection of the virus and not antibodies), a single serum specimen collected optimally during the first week after symptom onset, preferably within 3-4 days, after symptom onset, may be also be beneficial.

Note: These time frames are based on SARS-CoV studies. The kinetics of MERS-CoV infection in humans is not well understood and may differ from SARS-CoV. Once additional data become available, these recommendations will be updated as needed.

b) Children and adults. Collect 1 tube (5-10 ml) of whole blood in a serum separator tube. Allow the blood to clot, centrifuge briefly, and separate sera into sterile tube container. The minimum amount of serum required for testing is 200 µl. Refrigerate the specimen at 2-8°C and ship on ice- pack; freezing and shipment on dry ice is permissible.

c) Infants. A minimum of 1 ml of whole blood is needed for testing of pediatric patients. If possible, collect 1 ml in an EDTA tube and in a serum separator tube. If only 1 ml can be obtained, use a serum separator tube.

3. EDTA blood (plasma)

Collect 1 tube (10 ml) of heparinized (green-top) or EDTA (purple-top) blood. Refrigerate specimen at 2-8°C and ship on ice-pack; do not freeze.

C. <u>Stool samples</u>

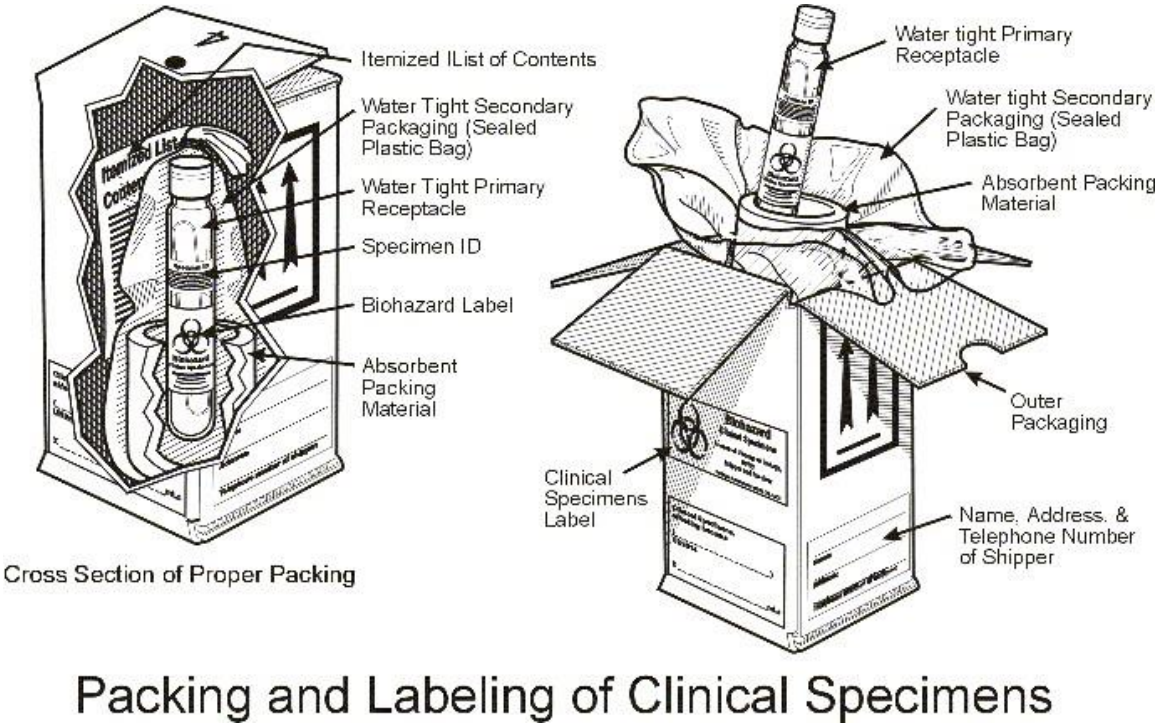
Collect 2-5 grams of stool specimen (formed or liquid) in sterile, leak-proof, screw-cap sputum collection cup or sterile dry container. Refrigerate specimen at 2-8°C up to 72 hours; if exceeding 72 hours, freeze at -70°C and ship on dry ice.

2. Packaging

Diagnostic and clinical specimens must be triple-packaged and compliant with IATA

Packing Instructions 650 are detailed in Figure 2. The maximum quantity for a primary receptacle is 500 ml or 500 g and outer packaging must not contain more than 4 L or 4 kg.

Figure 2 Packing instruction 650



Packing containers

1. Packages must be of good quality, strong enough to withstand the rigors of transport

6. Triple packaging consisting of leak proof primary receptacles (for liquid shipments), silt-proof primary receptacles (for solid shipments), leak-proof secondary packaging, outer packaging of sufficient strength to meet the design type test (1.2-meter drop test)
7. For liquid shipments, primary receptacle or secondary packaging capable of withstanding a 95Kpa internal pressure differential
8. Absorbent material sufficient to absorb the entire contents of the shipment
9. An itemized list of contents must be included between the secondary and outer packaging
10. "Biological Substance, Category B" must appear on the package
11. Minimum dimension 100 mm

Samples containing multiple samples will be packaged so that the samples are organized in numerical order of patient hospital ID. Patient Data Sheets and an Itemized List of

Contents will accompany the package. The paperwork will be packaged inside the outer package NOT the secondary container.

3. Labeling

The outer container of all diagnostic/clinical specimen packages must display the following on two opposite sides:

a) Sender's name and address
b) Recipient's name and address
c) The words "Biological Substance, Category B"
d) UN 3373 label
e) Class 9 label, including UN 1845, and net weight if packaged with dry ice

All specimens must be pre-packed to prevent breakage and spillage. Specimen containers should be sealed with Parafilm® and placed in ziplock bags. Place enough absorbent material to absorb the entire contents of the Secondary Container (containing Primary Container) and separate the Primary Containers (containing specimen) to prevent breakage. Send specimens with cold packs or other refrigerant blocks that are self-contained, not actual wet ice. This prevents leaking and the appearance of a spill. When large numbers of specimens are being shipped, they should be organized in a sequential manner in boxes with separate compartments for each specimen.

For additional information, consultation, or the appropriate shipping address, contact the Labs@mohfeedback.com or the Regional MERS Laboratory.

4. Shipping

Any human or animal material including, but not limited to, excreta, secreta, blood and its components, tissue and tissue fluids, being transported for diagnostic or investigational purposed, but excluding live infected animals.

Specimens from suspected MERS-CoV cases must be packaged, shipped, and transported per the current edition of the International Air Transport Association (IATA) Dangerous Goods Regulations. At present MERS-CoV diagnostic specimens must be assigned to UN3373 and must be packaged as Category B infectious substances.

Category B infectious substances should have the proper shipping name "Biological Substance, Category B" and the identification number UN 3373.

5. Rejection of packages and samples

Samples and packages will be rejected if:

a) Samples are not packaged per packing instruction P650 as UN3373 Diagnostic Specimens.
b) An itemized list of samples organized by hospital patient ID number is NOT included inside the outer package.
c) The patient data sheets are incomplete, missing or incorrectly filled out.
d) If the primary container has leaked
e) If dry ice is placed in the "Primary Container" or "Secondary Container", foam envelopes, ziplock bags, cryovial boxes, or hermetically sealed containers.
f) If the Primary Containers sideways or upside down in ziplock bags.
g) Primary containers must be packaged securely in an upright position and in the numerical order used on the Itemized List of contents
h) If red top Secondary Containers for Category-A Infectious Substances are used.
i) If any paperwork in the Secondary Containers or ziplock bags, so as not to damage the paperwork.
j) If biohazard/autoclave bags to prepack your materials due to the inadequate seal of these bags.

References:

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3. Interim Laboratory Biosafety Guidelines for Handling and Processing Specimens Associated with Middle East Respiratory Syndrome Coronavirus (MERS-CoV). Centers for Disease Control and prevention (CDC). Available at: http://www.cdc.gov/coronavirus/mers/guidelines-lab-biosafety.html.
4. Biosafety in Microbiological and Biomedical Laboratories (BMBL) 5th Edition. Dec 2009. Centers for Disease Control and prevention (CDC). Available at: http://www.cdc.gov/biosafety/publications/bmbl5/BMBL.pdf.
5. Laboratory biorisk management for laboratories handling human specimens suspected or confirmed to contain novel coronavirus: Interim recommendations. World Health

Organization (WHO). 19 Feb 2013. Available at: http://www.who.int/csr/disease/coronavirus_infections/Biosafety_InterimRecommendations_NovelCoronavirus_19Feb13.pdf?ua=1.

6. Laboratory Biosafety Manual - Third Edition. World Health Organization 2004. Available at: (WHO).http://www.who.int/csr/resources/publications/biosafety/Biosafety7.pdf?ua=1