



Guidance on Air Medical Transport for Middle East Respiratory Syndrome (MERS) Patients

This updated guidance is intended to assist air medical transport (AMT) service providers in using specialized and/or specially equipped aircraft to transport Middle East Respiratory Syndrome (MERS) patients while ensuring the safety of patients and transport personnel. This guidance does not apply to commercial passenger aircraft. The recommendations are based on standard infection prevention and control practices, AMT standards, and epidemiologic information from investigations of MERS, including experience from air transport of patients during the 2003 SARS outbreak.

Currently recommended infection prevention and control measures for hospitalized patients with MERS ([/coronavirus/mers/infection-prevention-control.html](http://www.cdc.gov/coronavirus/mers/infection-prevention-control.html)) include Standard Precautions (with eye protection to prevent droplet exposure) plus Contact and Airborne Isolation Precautions. Respiratory protection using respirators providing at least 95% filtering efficiency (e.g., NIOSH-certified N-95 or higher-level filtering facepiece respirator) with appropriate fit-testing (<http://www.osha.gov/SLTC/etools/respiratory/fittesting.html>)  (<http://www.cdc.gov/Other/disclaimer.html>) is recommended.

Air Transport of MERS Patients: General Considerations

- MERS patients should be transported on a dedicated AMT mission with the minimum number of crew members. **Whenever possible, no passengers or patients who do not have MERS should be on board.** If a parent is accompanying a sick child, the parent should use personal protective equipment (PPE) during transport as described in “Infection Control (#infection),” below.
- If possible, a primary caregiver should be assigned to the MERS patient.
 - The primary caregiver is typically designated based upon the patient’s needs for care, and who is qualified to meet those needs. A member of the AMT crew would usually be the primary caregiver, but there might be situations where a non-crew physician needs to provide care. The primary caregiver should be determined based on the patient’s needs prior to transport.
- The number of caregivers should be limited to those required to provide essential care during the trip.
- Infection control should involve the following matrix of measures:
 - Source control (i.e., confining the spread of respiratory secretions at the patient level)
 - Engineering controls to limit airborne dissemination of the virus
 - Locate patient as near as practical to the aircraft exhaust or the exhaust of the containment within which the patient is housed. The isolation perimeter should be at least 6 feet away from the patient.
 - Use of PPE as outlined below (#infection3)
 - Use of safe work practices to prevent exposure

The size and type of aircraft will influence the extent to which these measures can be implemented. When available, use of a portable isolation unit may be considered.

- Consideration must be given to the need for “PPE breaks” during long trips. Removal of respiratory protection is unavoidable. An area at the front of the plane (or “upwind” from the patient, depending on cabin air flow), as far as possible from the patient, should be designated for this purpose.
- International transport of patients with MERS should be coordinated with public health authorities at origin and destination.
- All MERS patient transport involving entry into the United States should be reported to CDC prior to arrival, preferably before travel, by calling the CDC Emergency Operations Center at +1 770-488-7100 (24-hour number). Callers will be connected with the CDC Quarantine Station (<http://www.cdc.gov/quarantine/quarantinestations.html>) responsible for the airport of arrival. U.S. federal regulations require the commander of an aircraft destined for the United States to report any deaths and certain illnesses among travelers to CDC before arrival. For more information, see Guidance for Airlines on Reporting Onboard Deaths or Illnesses to CDC (<http://www.cdc.gov/quarantine/air/reporting-deaths-illness/guidance-reporting-onboard-deaths-illnesses.html>)
 - International movement of MERS patients might additionally require special approvals by aircraft-servicing or patient rest-stop locations, if applicable.

Airframe Selection and Cabin Airflow

Cabin airflow characteristics may reduce exposure of occupants to airborne infectious particles. Whenever possible, aircraft used to medically evacuate patients with MERS should have separate air-handling systems for the cockpit and cabin, with cockpit air at positive pressure relative to the cabin.

Fixed-wing pressurized aircraft

- AMT service providers should consult the manufacturer(s) of their aircraft to identify cabin airflow characteristics, including: HEPA filtration and directional airflow capabilities, air outlet location, presence or absence of air mixing between cockpit and patient-care cabin during flight, and time and aircraft configuration required to perform a post-mission airing-out of the aircraft.
- Aircraft with forward-to-aft cabin air flow and a separate cockpit cabin are strongly preferred for transport of MERS patients. Aft-to-forward cabin air flow may increase the risk of airborne exposure of cabin and flight deck personnel. Aircraft that re-circulate cabin and flight-deck air without HEPA filtration should not be selected for MERS patient transport.
- Aircraft ventilation should remain on at all times during transport of MERS patients, including during ground delays.
- Aircraft that provide space for crew members to perform necessary personal activities (e.g., eating, drinking) in an area that does not share air with the patient-care cabin should be selected for flights likely to exceed 4 hours.

Rotor-wing and non-pressurized aircraft

- In aircraft with uncontrolled interior air flow, such as rotor-wing and small, non-pressurized fixed-wing aircraft, all personnel should wear disposable N-95 or higher-level respirators during transport of MERS patients. For cockpit crews, aircraft aviator tight-fitting face pieces capable of delivering oxygen that has not mixed with cabin air may be used in lieu of a disposable N-95 respirator.

Patient Placement

The airflow of each aircraft should form the basis for litter and seat assignments. In general:

- MERS patients should be positioned as far downwind with regard to cabin air flow as possible.
- A bathroom for use by the patient(s) with MERS should be close by.
- Consider the use of patient urinal or bedpan in lieu of a bathroom.
- In AMT aircraft with vertical litter tiers and top-to-bottom air flow, MERS litter patients should be placed in the lowest position in the tier.
- Ambulatory MERS patients should be seated next to the cabin sidewall.
- Patients should wear a surgical mask, if tolerated, to reduce respiratory droplet production.
- If transport of a non-MERS patient simultaneously with MERS patient(s) cannot be avoided, the non-MERS patient should wear an N-95 or higher-level respirator during transport and should be positioned upwind and as far as possible from the MERS patient. Patients unable to tolerate the use of an N-95 or higher-level respirator should not be transported with a MERS patient.
- If several confirmed MERS patients are transported, they may be moved as a group (cohorted) in an aircraft that provides appropriate airflow characteristics as described above (#airframe).

Infection Control

Designation of an “isolation area”

- Where space permits, a perimeter should be established for designating “clean” and “dirty” areas for the purpose of defining where gowns and gloves must be donned and removed. The distance will depend on the area required for patient care support; a minimum distance of 6 feet from the patient is recommended. If a bathroom is being used for the patient it should be within the isolation area.
- Materials required for patient care, including PPE, should be organized outside the isolation area. Receptacles for soiled linen, waste, and reusable equipment should be placed inside the isolation area.
- Patient movement should be restricted to the designated isolation area.
- Personnel who are within the isolation area must wear full PPE.

Source control

- If the patient is able, s/he should be instructed to wear a surgical mask at all times during transport. The surgical mask should be changed as needed (e.g., upon saturation with respiratory secretions).

Personal protective equipment and procedures

- The following PPE should be available for use by direct-care providers:
 - Non-sterile patient-care gloves
 - Disposable isolation gowns
 - Goggles or face shield (Corrective eyeglasses alone are not appropriate protection.)
 - Fit-tested, disposable respirators (at least as protective as fit-tested NIOSH-certified disposable N95 filtering facepiece respirators)
 - Hand hygiene product (e.g., alcohol-based hand rub)
- Disposable non-sterile gloves, gown, and eye and respiratory protection must be worn when entering the “isolation area” and for all patient contact.
- Eye protection, gown, and gloves should be removed and discarded in designated receptacles after patient care is completed and prior to leaving the “isolation area” (e.g.,

between patients) or when soiled or damaged. The respirator should remain on until the wearer is in the area designated as safe for respirator removal.

- Hands must be washed with soap and water or a waterless, alcohol-based hand rub immediately after removal of PPE.
- Oxygen delivery with simple and non-rebreather face masks may be used for patient oxygen support during flight.
- Manually assisted ventilation should be performed using a resuscitation bag-valve mask. If available, units equipped for HEPA or equivalent filtration of expired air should be used.
- Cough- or aerosol-generating procedures should be avoided during transport unless medically necessary (e.g., life-saving).

Patients Requiring Mechanical Ventilation

- Mechanical ventilators for MERS patients should provide HEPA or equivalent filtration of airflow exhaust.
- AMT services should consult their ventilator equipment manufacturer to confirm appropriate filtration capability and the effect of filtration on positive-pressure ventilation.

Management of Clinical Specimens

- Use recommended PPE as outlined in PPE section when collecting specimens.
- Standard Precautions should be used when transporting clinical specimens.
- Specimens should be stored only in designated coolers or refrigerators.
- Clinical specimens should be labeled with appropriate patient information and placed in a clean, self-sealing bag for storage and transport.

Waste Disposal

- Dry solid waste (e.g., used gloves, dressings), should be collected in biohazard bags for disposal as regulated medical waste in accordance with local requirements at the destination medical facility.
- Waste that is saturated with blood or body fluids should be collected in leak-proof biohazard bags or containers for disposal as regulated medical waste at the destination medical facility in accordance with local requirements.
- Sharp items such as used needles or scalpel blades should be collected in puncture-resistant sharps containers for disposal as regulated medical waste at the destination medical facility in accordance with local requirements.
- Suctioned fluids and secretions should be stored in sealed containers for disposal as regulated medical waste at the destination medical facility in accordance with local requirements. Handling that might create splashes or aerosols during flight should be avoided.
- Suction device exhaust should not be vented into the cabin without HEPA or equivalent filtration. Portable suction devices should be fitted with in-line HEPA or equivalent filters. Externally vented suction should not be used during ground operation.
- Excretions (feces, urine) may be carefully poured down the aircraft toilet. Toilet lid should be closed before flushing to avoid aerosol generation.

Cleaning and Disinfection

- After transporting a MERS patient, exits and doors should be closed and aircraft air conditioning turned on at maximum capacity for several minutes in accordance with the airing time specified by aircraft manufacturers to provide at least one complete air exchange. Non-pressurized aircraft should be aired out, with exits and doors open long enough to ensure a complete air exchange. Blowers and high-powered fans that might re-aerosolize infectious material should not be used for airing out aircraft.
- Cleaning should be postponed until airing out is complete.
- Compressed air that might re-aerosolize infectious material should not be used for cleaning the aircraft.
- Non-patient-care areas of the aircraft should be cleaned and maintained according to manufacturers' recommendations.
- Patient-care areas (including stretchers, railings, medical equipment control panels, and adjacent flooring, walls and work surfaces likely to be directly contaminated during care) should be cleaned and disinfected using an EPA-registered disinfectant approved by the aircraft manufacturer.
- Personal protective equipment to prevent contact with germicides should be worn according to existing organization procedures for environmental cleaning and disinfection while cleaning patient-care areas. Cleaning personnel should, at a minimum, wear protective gear as directed on the label instructions of the disinfectant product. Spills of body fluids during transport should be cleaned by placing absorbent material over the spill and collecting the used cleaning material in a biohazard bag. The area of the spill should be cleaned using an EPA-registered disinfectant approved by the aircraft manufacturer. Ground service personnel should be notified of the spill location and initial clean-up performed.
- Contaminated web seats or seat cushions should be placed in a biohazard bag and labeled with the location and type of contamination for later disposal or cleaning.
- Contaminated reusable patient care equipment should be placed in biohazard bags and labeled for cleaning and disinfection at the AMT service medical equipment section.
- Reusable equipment should be cleaned and disinfected according to manufacturer's instructions.
- Following completion of cleaning tasks, including cleaning and disinfection of reusable equipment, cleaning personnel should carefully remove and dispose of personal protective gear and wash hands thoroughly with soap and water or an alcohol-based hand rub (<http://www.cdc.gov/handhygiene/>).

Logistical Planning and Post-Mission Follow-Up

- Sufficient infection control supplies should be on board to support the expected duration of the mission plus additional time in the event that the aircraft experiences maintenance delays or weather diversions.
- Flight planning should identify emergency or unexpected diversion airfields and coordinate with authorities in advance.
- Upon termination of the mission, the AMT team should provide the following information to their medical director: mission number/date; address of the team/aircraft basing; duration of patient transport; names, contact information, and crew positions (including estimated duration of direct patient care provided) of mission personnel; and description of any recognized breach(es) in infection control precautions.
- AMT services should designate persons responsible for performing post-mission monitoring of mission personnel and reporting results to the AMT service medical director.
- Designated mission personnel with unprotected exposure to the MERS infected patient should be advised to monitor for and immediately report any signs or symptoms of acute illness to their supervisor for a period of 14 days after the last known contact with the sick patient.

Ground/In-Flight Emergency Procedures

AMT service providers should have a written plan addressing patient handling during in-flight and/or ground emergency situations. Activities such as donning life vests and litter-patient emergency egress may create special exposure risks. Use of respirators must be weighed against time constraints and on-board emergency conditions (e.g., smoke in the cabin, sudden cabin decompression). Gowns and latex gloves represent a fire/flash hazard and should not be worn during ground or in-flight emergency situations.

Related Pages

- [MERS Interim Guidance for Health Professionals \(/coronavirus/mers/interim-guidance.html\)](/coronavirus/mers/interim-guidance.html)
- [Interim Infection Prevention and Control Recommendations for Hospitalized Patients with Middle East Respiratory Syndrome Coronavirus \(MERS-CoV\) \(/coronavirus/mers/infection-prevention-control.html\)](/coronavirus/mers/infection-prevention-control.html)
- [MERS Preparedness for Healthcare Providers and Healthcare Facilities \(/coronavirus/mers/preparedness/index.html\)](/coronavirus/mers/preparedness/index.html)
- [Guidance for Airlines on Reporting Onboard Deaths or Illnesses to CDC \(http://www.cdc.gov/quarantine/air/reporting-deaths-illness/guidance-reporting-onboard-deaths-illnesses.html\)](http://www.cdc.gov/quarantine/air/reporting-deaths-illness/guidance-reporting-onboard-deaths-illnesses.html)
- [CDC Travel Health Notice: MERS in the Arabian Peninsula \(http://wwwnc.cdc.gov/travel/notices/alert/coronavirus-saudi-arabia-qatar\)](http://wwwnc.cdc.gov/travel/notices/alert/coronavirus-saudi-arabia-qatar)

Page last reviewed: July 3, 2014

Page last updated: July 3, 2014

Content source: [National Center for Immunization and Respiratory Diseases, Division of Viral Diseases](#)

Centers for Disease Control and Prevention 1600 Clifton Rd. Atlanta, GA
30333, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - [Contact CDC-INFO](#)

