



Public Health
England

Protecting and improving the nation's health

Middle East Respiratory Syndrome (MERS-CoV)

Infection Prevention and Control Guidance

About Public Health England

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About this guidance

This document outlines infection control and other general advice for those involved in investigating, receiving and caring for patients within healthcare settings, who are, or suspected to be, infected with MERS-CoV. It should be used in conjunction with local policies. The web page has the latest information:

<https://www.gov.uk/government/publications/respiratory-tract-infections-infection-control>.

Further information and guidance relating to MERS-CoV, including clinical and public health management, can be found on the PHE MERS-CoV webpages:

<https://www.gov.uk/government/collections/middle-east-respiratory-syndrome-coronavirus-mers-cov-clinical-management-and-guidance>.

In the absence of effective drugs or a vaccine, control of this disease relies on the prompt identification, appropriate risk assessment, management and isolation of possible and confirmed cases, and the investigation and follow up of close contacts to minimise potential onward transmission. In preparation, healthcare professionals or facilities that may be involved in the investigation or management and care of possible or confirmed cases should:

- review their local policies and ensure that operational procedures are described and staff are familiar with them; for example, where personal protective equipment is stored and how it should be used
- ensure there is a process that would ensure possible cases are identified at presentation leading to the triggering of relevant case management and infection control policies
- ensure that staff are aware of where a possible or confirmed case will be isolated and the need for a negative pressure room, if it is available
- ensure that staff who are assessing suspected MERS-CoV cases, or are likely to be caring for possible or confirmed cases, are familiar with an FFP3 respirator conforming to EN149:2001, and that **fit testing has been undertaken before using this equipment**. If an individual cannot use an FFP3 respirator due to inadequate fit, then an alternative with equivalent protection (eg powered hood respirator) must be identified, prospectively
- ensure staff know who to contact within their organisation to discuss possible cases, and there is a clear internal procedure for co-ordinating infection control,

liaising with the local health protection team and arranging testing with PHE for these possible cases to exclude MERS-CoV

- ensure staff are aware of how to access MERS-CoV **surveillance forms** on the PHE website and any local record sheets

Ensure that adequate supplies/equipment are available (with appropriate training provided), including:

- supplies of FFP3 respirators
- gloves – disposable non-latex gloves with long, tight-fitting cuffs
- gowns/aprons – disposable, fluid-resistant, full-sleeve gowns and single-use plastic aprons
- eye protection, eg tight-fitting goggles or face shield – disposable, or if non-disposable, with a wipeable surface – with non-latex straps
- leakproof, clinical waste disposal bags (or equivalent, as per local policy)
- hand hygiene supplies
- general purpose detergent and disinfectant solutions

Introduction

Coronaviruses are mainly transmitted by large respiratory droplets and direct or indirect contact with infected secretions. They have also been detected in blood, faeces and urine and, under certain circumstances, airborne transmission is thought to have occurred from aerosolised respiratory secretions and faecal material. As coronaviruses have a lipid envelope, a wide range of disinfectants are effective. Personal protective equipment and prompt good infection control are extremely effective at minimising risk but can never completely eliminate it.

Information from hospital-related outbreaks in the Middle East and Republic of Korea demonstrated the potential ease of transmission in the healthcare setting. Emerging information from these experiences has highlighted many critical aspects such as delayed infection control measures combined with the prolonged survival of MERS-CoV RNA in the clinical setting (positive PCR detection up to five days after patients' last positive respiratory specimen)(1).

Effective infection prevention and control measures, including transmission based precautions (ie airborne, droplet and contact precautions) with the recommended personal protective equipment (PPE) are essential to minimise these risks. The appropriate cleaning and decontamination of the environment is also essential in preventing the spread of this virus.

This document summarises infection prevention and control advice for suspected, possible, presumptive or confirmed cases of MERS-CoV. If a suspected or possible case is disproved, then the advice in this document may be substituted by appropriate infection prevention and control precautions for the subsequent diagnosis

Isolation

- for patients in secondary care requiring risk assessment of the likelihood of MERS-CoV, clinical assessment and investigation should be conducted in a single cubicle or room
- patients requiring admission as a possible or confirmed case (hereafter referred to as 'patient') should be admitted directly to negative-pressure, single rooms, if available. If this is not possible then a single room with en-suite facilities should be used. Room doors should be kept closed. Positive-pressure, single rooms must not be used. The provider service Infection Prevention and Control team (IPCT) should advise on the criteria for priority of single rooms, based on a risk assessment. The nature of the area adjoining the side room should be taken in to account to minimise the risk of inadvertent exposure (ie high footfall areas, confused patients, vulnerable patient groups)
- if on a critical care unit, the patient should be nursed in a negative-pressure single/side room where available, or, if not available, a neutral-pressure side room with the door closed
- anterooms (otherwise known as a 'lobby') also have the potential to become contaminated and should be regularly decontaminated as described in the environmental decontamination section. It is strongly advised that staff progress through 'dirty' to 'clean' areas within the anteroom as they remove their PPE and wash hands after they leave the patient room. To this effect, movements within the anteroom should be carefully monitored and any unnecessary equipment should not be kept in this space. A buddy system to observe for inadvertent contamination is recommended, especially during high-risk procedures
- for a confirmed case, consideration should always be given to whether adequate facilities are available to enable safe removal of PPE and prevent cross-contamination of other areas. In the event that no anteroom/lobby exists for the single room used for MERS-CoV patients, local IPCTs will need to consider alternative ways of accommodating the recommendations in this document to suit local circumstances
- recommendations regarding ventilatory support are provided in the critical care section
- staff should wear protective clothing as detailed below. Rooms must be appropriately decontaminated before being used again (see section below on environmental decontamination)
- suitable written information must be placed on the isolation room door indicating the need for respiratory and enteric isolation, including the infection prevention and control precautions which must be adhered to prior to entering the room. Patient confidentiality must still be maintained
- only essential staff should enter the isolation room

- a record should be kept of all staff in contact with a possible/confirmed case, and this record should be accessible to occupational health should the need arise
- if there is no en-suite toilet, a dedicated commode (which should be cleaned as per local toilet cleaning schedule, and additionally when soiled) should be used with arrangements in place for the safe removal of the bedpan to an appropriate disposal point
- local IPCT staff may assess on a case-by-case basis if the patient can wear a surgical facemask (if tolerated), to prevent spread of large droplets, in addition to the other infection control measures recommended in this document. If used, the patient's facemask should be replaced at regular intervals. Respirator masks should not be worn by MERS-CoV patients themselves

Staff

- staff must comply with all infection prevention and control procedures as detailed throughout this document
- a timed record must be maintained of all staff involved in the assessment, care and management of the patient. The record sheet should be placed outside the door and all staff entering and leaving must complete this and record the timing and duration of exposures
- the use of bank or agency staff should be avoided wherever possible. If bank staff are used, they must be appropriately trained in use of PPE and the infection control advice within this document
- staff involved in care of presumptive or confirmed cases, should be given emergency contact details if they develop MERS-CoV compatible symptoms while away from the hospital
- following laboratory diagnosis of MERS-CoV in the patient, all staff should be vigilant for any respiratory symptoms in the 14 days following their last exposure to a confirmed case and should be provided with emergency contact details if they develop any symptoms (including fever or respiratory symptoms). In these circumstances, they should not come to work. They should follow the advice of their nominated emergency contact in relation to seeking medical attention and isolation from others.

Visitors

- visitors entering the patient's room should be avoided as far as possible while initial MERS-CoV results are awaited. If they do, appropriate PPE should be in place
- if a patient tests positive for MERS-CoV and the clinical team are considering allowing visitors, the team is strongly advised to discuss with PHE prior to agreeing to visitors entering the room
- a key consideration for decisions about visitors is the risk to their health and their ability to adhere to infection prevention and control procedures, including the use of appropriate PPE, and the responsibilities of the hospital to the health of the visitor. In this situation, any potential visitors must be warned about the significant risks of MERS-CoV infection
- the hospital should be mindful of its responsibilities to persons who are not employees, under The Control of Substances Hazardous to Health Regulations 2002 and The Management of Health and Safety at Work Regulations 1999

Contact tracing

- all contact tracing following exposures in the healthcare environment should only take place following consultation with the PHE Respiratory Diseases Department via the local health protection team (HPT), as part of an urgent incident control team-led response to a laboratory-diagnosed MERS-CoV case. This is to ensure a co-ordinated approach. In these circumstances, exact instructions appropriate to the situation will be provided

Personal protective equipment (PPE)

To be worn by ALL persons entering the room where a suspected, possible, presumptive or confirmed case is being cared for (see Appendix 1: putting on and removing personal protective equipment)

- long sleeved, fluid-repellent disposable gown – wearing scrubs underneath obviates problems with laundering of uniforms and other clothing
- non-sterile surgical gloves
- double-gloving will be required if there is a need to disinfect items from the room prior to their removal (such as in the specimens, mobile devices and handling dead bodies sections)

- an FFP3 respirator conforming to EN149:2001 must be worn by all personnel in the room. **Fit testing must be undertaken before using this equipment and a respirator should be fit-checked every time it is used.** Guidance on use of respirators and fit testing is available [online](#).
- eye protection must be worn (prescription glasses do not provide adequate protection against droplets sprays and splashes)
- it is recommended that eye protection should be single-use and disposed as clinical waste after use. This is due to the difficulties associated with cleaning to eliminate contamination

The PPE described above must be worn at all times when in the patient room.

Hand hygiene

- this is essential before and after all patient contact, removal of protective clothing and decontamination of the environment
- use soap and water; alcohol hand rub used if hands are **visibly clean**
- rings (other than a plain, smooth band), wrist watches and wrist jewellery must not be worn by staff

Aerosol-generating procedures

Procedures that produce aerosols of respiratory secretions, eg bronchoscopy, induced sputum, positive-pressure ventilation via a face mask, intubation and extubation, and airway suctioning, carry an increased risk of transmission. Where these procedures are medically necessary, they should be undertaken in a negative-pressure room, if available, or in an alternative single room with the door closed.

- only the minimum number of required staff should be present and they **must all** wear PPE as described above, **including eye protection**
- entry and exit from the room should be minimised during the procedure
- if aerosol generating procedures are undertaken in the patient's own room, then it is reasonable to decontaminate the room as far as possible, 20 minutes after the procedure has ended
- the local IPCT would generally be able to advise on how long to leave a room before decontamination
- if a different room is used for a procedure it should generally be left for 20 minutes, decontaminated and put back into use. This is because the large particles will fall out within seconds and the small aerosol particles will remain in suspension. Clearance of any aerosol is dependent on the ventilation of the

room. In hospitals, this is usually around 12-15 air changes per hour, and so after about 20 minutes there would be less than 1 per cent of the starting level (assuming cessation of aerosol generation). If it is known locally that the design or construction of a room may not be typical for a clinical space, or that there are fewer air changes per hour, then the local infection control team would advise on how long to leave a room before decontamination

Equipment

- re-useable equipment should be avoided if possible. If used, it should be decontaminated according to the manufacturer's instructions
- use dedicated equipment in the isolation room
- dispose of single use equipment as per clinical waste policy inside room
- ventilators should be protected with a high efficiency filter, eg BS EN 13328-1
- closed system suction should be used
- disposable crockery and cutlery may be used in the patient's room as far as possible to minimise the numbers of items which need to be decontaminated

Environmental decontamination

- it is possible that the virus can be detected by Reverse Transcription-PCR (RT-PCR) in the touched environment for up to 5 days, so environmental decontamination is vital
- domestic staff should follow the same recommendations for other healthcare staff who have contact with the case, including wearing PPE as indicated above
- domestic staff must be made aware of the need for any additional precautions and be fully trained in these; the hospital is responsible for all the individuals potentially at risk in these circumstances, such as domestic staff, even if employed by a separate organisation
- chlorine-based disinfection should be used, in the form of a solution at a minimum strength of 1,000ppm available chlorine
- the local IPCT should be consulted on appropriate disinfectants, which are effective against enveloped viruses, for disinfection of environmental surfaces following contamination with MERS-CoV
- the main patient isolation room should be cleaned at least once a day, and following aerosol generating procedures or other potential contamination
- there should be more frequent cleaning of commonly used hand-touched surfaces and of anteroom/lobby areas (at least twice daily) in addition to monitoring of 'dirty-to-clean' movements as described in the isolation section

- to ensure appropriate use of PPE and that an adequate level of cleaning is undertaken, which is consistent with the recommendations in this document, it is strongly recommended that cleaning of the isolation area is undertaken as a separate regime, to that of other clinical areas
- if the same cleaner/cleaning team is responsible for cleaning the rest of the ward and the isolation area, the isolation room should be decontaminated last
- dedicated or disposable equipment must be used for environmental decontamination. This equipment must be decontaminated after use with a chlorine-based disinfectant as described above

Linen

- bag linen inside patient isolation room in accordance with procedures for infectious linen; this should not be carried through ward or other clinical area

Waste

- large volumes of waste may be generated by frequent use of PPE; advice from the local waste management team should be sought prospectively on how to manage this
- dispose of all waste as clinical waste; in particular, ensure the appropriate disposal of faeces and urine (ie not using communal toilets)
- waste to be handled as per local policy

Specimens

All specimens must be treated as biohazard:

- label with biohazard label
- mark request form accordingly
- the specimen should be double-bagged in the isolation room by a staff member wearing recommended PPE, with the additional measure of use of double-gloves. Once taken to the anteroom/lobby, the staff member should remove their outer layer of gloves. They should then use an appropriate disinfectant product (see environmental decontamination section) to disinfect the surface of the specimen containers. The specimen container should then be placed in a zipped vinyl bag. The outer surface of the bag should then be wiped or sprayed with appropriate cleaning products. The remaining gloves and respirator can then be removed as per the overall process for removing PPE in Appendix 1. We

recommend trialling suitable process and having a printed laminated SOP in the anteroom

- in the absence of an anteroom/lobby, IPCTs will need to develop equivalent solutions to meet local circumstances
- specimens should be hand delivered to the laboratory by someone who understands the nature of the specimens. Air chutes must not be used
- guidance is available in relation to **handling laboratory specimens** from possible, presumptive and confirmed MERS-CoV patients in the laboratory setting
- transport of samples between laboratories should be in accordance with Category B transportation regulations. PHE follows the guidance on regulations for the transport of infectious substances 2013-2014, published by WHO (http://www.who.int/ihr/publications/who_hse_ihr_2012.12/en/)

Mobile healthcare equipment

The following advice applies to devices that cannot be left in the isolation room, such as portable X-ray machines:

- the use of mobile healthcare equipment should be restricted to essential functions as far as possible to minimise the range of equipment taken into and later removed from the room
- the operator of the device, if not routinely looking after the patient, must be trained and supervised in infection control procedures, including use of PPE
- the operator should wear PPE as described earlier in this document, when in the isolation room. Use of double-gloving will facilitate disinfection of devices on leaving the room
- any equipment taken in to the room which must be subsequently removed, needs to be disinfected prior to leaving the anteroom, in a similar approach to specimens (as described above). This can be achieved by removing the outer layer of gloves and then using appropriate disinfectant for surfaces (as specified in the environmental decontamination and specimens sections) to disinfect the machine
- any additional items such as a digital detector or a cassette will also need to be disinfected in a similar fashion, regardless of whether there has been direct contact with the patient or not. This is due to the risk of environmental contamination of the equipment within the isolation room
- if the mobile device has any wheels, then these will need to be disinfected by spraying a chlorine-based solution (as specified in the environmental decontamination section)

Critical care

- all respiratory equipment must be protected with a high efficiency filter (eg BS EN 13328-1). This filter must be disposed of after use
- disposable respiratory equipment should be used wherever possible. Re-usable equipment must, as a minimum, be decontaminated in accordance with the manufacturer's instructions
- a closed suctioning system must be used
- ventilator circuits should not be broken unless absolutely necessary
- ventilators must be placed on standby when carrying out bagging
- protective clothing detailed above must be worn (see page 8)
- water humidification should be avoided and a heat and moisture exchanger should be used if possible

Theatres

- theatres must be informed in advance of a patient transfer
- the patient should be transported directly to the operating theatre and should wear a surgical mask if it can be tolerated. The patient must not wear a respirator mask
- the patient should be anaesthetised and recovered in the theatre. Staff should wear protective clothing as detailed above
- considerations about the use of respiratory/anaesthetic equipment are indicated in the critical care section above
- instruments and devices should be decontaminated in the normal manner in accordance with manufacturers' advice
- instruments must be transported safely to decontamination, following use
- the theatre should be cleaned as per local policy
- theatres should not be used by staff or patients for 20 minutes after the patient leaves if conventionally ventilated, or 5 minutes if ultraclean ventilation is used

Transfers to other departments

Where possible, all procedures and investigations should be carried out in the single room with a minimal number of staff present. Only if clinical need dictates, and in consultation with the infection control team, should patients be transferred to other departments; the following procedures then apply:

- the trolley used to transport the patient from the isolation room, should be disinfected as far as possible (as discussed in the environmental decontamination section) immediately before leaving the room by an individual wearing protective clothing and PPE as described previously
- the wheels must also be disinfected by spraying with a chlorine-based solution or alternative appropriate disinfectant recommended by local infection control and prevention teams (as specified in the environmental decontamination section)
- the department receiving the patient must be informed in advance of the patient's arrival
- the patient must be taken straight to and from the investigation/treatment room, and must not wait in a communal area
- the patient should wear a 'surgical ' mask if this can be tolerated - this will prevent large droplets being expelled into the environment by the wearer
- the treatment/procedure room, trolley/chair and all equipment should be decontaminated after use, as per the cleaning instructions above
- to enable appropriate decontamination after any procedure, patients should be scheduled at the end of a list, as far as possible. After the procedure, access to such spaces should be restricted and environmental decontamination implemented as described in previous sections
- during patient transfers, a process to ensure that no individuals not wearing PPE come within 2 metres of the patient should be followed. Anyone in the vicinity of the patient (eg carrying out procedures, transferring the patient or standing within 2m of the patient) must wear the PPE previously described; it would be prudent to avoid such exposure for all non-essential personnel

Transfer to other institutions

- transfer of cases to another hospital should be avoided unless it is necessary for medical care
- if there are insufficient facilities for isolating a possible or confirmed MERS-CoV case in a hospital, then the risks of transfer should be carefully considered against the risks of a lapse in infection control procedures due to insufficient facilities
- if transfer is essential, the IPCT at the receiving hospital and the ambulance staff must be advised in advance of the special circumstances of the transfer, so that appropriate infection control measures can be taken

Handling dead bodies

- the act of moving a recently deceased body onto a hospital trolley for transportation to the mortuary might be sufficient to expel small amounts of air from the lungs and thereby present a minor risk
- a body bag should be used for transferring the body and those handling the body at this point should use full PPE with double-gloving. In addition, any hospital porters who have contact with an unbagged body should also wear full PPE
- the outer surface of the body bag should be decontaminated (see environmental decontamination section) immediately before the body bag leaves the anteroom area. This will need to be completed by an individual who has removed the outer layer of the double-gloves, after which there has not been further contact with the room environment. This may require at least two individuals wearing such protective clothing, in order to manage the remains easily
- the trolley carrying the body would need to be disinfected prior to leaving the anteroom, including the wheels. The wheels may be disinfected by spraying a chlorine-based solution or alternative disinfectant (as discussed in the environmental decontamination section)
- prior to leaving the anteroom, the staff members would need to remove their protective clothing as per Appendix 1
- once in the hospital mortuary it would be acceptable to open the body bag using full PPE (including gloves, apron and thorough hand hygiene) if required to view the body
- washing or preparing the body is acceptable if those carrying out the task wear long-sleeved gowns and gloves which should then be discarded. Use of facial protection should be guided by a local risk assessment. Mortuary staff and funeral directors must be advised of the biohazard risk. Embalming is not recommended because of the potential presence of virus in blood

- If a post-mortem is required, it needs to be undertaken using safe working techniques (eg manual rather than power tools) and wearing full PPE, as per pandemic influenza, in the event that power tools are used. High security post-mortem suites are available if needed, and can be discussed with the PHE incident team
- after use, empty body bags should be disposed of

Summary of advice

Infection control personnel should be notified immediately of any suspected, possible, presumptive or confirmed cases of MERS-CoV admitted or diagnosed whilst in care. In addition to standard infection control precautions, MERS-CoV specific infection control measures for inpatients should include:

- airborne precautions, eg:
 - either an isolation room with negative-pressure relative to the surrounding area or a neutral pressure single room. Both should have en-suite bathroom and toilet facilities, and preferably anterooms
 - use of FFP3 respirators conforming to EN 149:2001 for persons entering the room. Fit testing should be undertaken prior to using this equipment
- contact and droplet precautions (including use of long-sleeved, fluid-repellent gown and latex or similar non-latex gloves with long tight-fitting cuffs for contact with the patient or their environment)
- standard precautions to include careful attention to hand washing and hygiene
- clinicians should wear eye protection for all patient contact
- specimens should be double-bagged and delivered by hand to the laboratory
- standard precautions when handling any clinical waste, which must be placed in leak-proof clinical waste bags or bins and disposed of safely
- used laundry should be classified as infectious

References

1. Bin SY, Heo JY, Song M-S, Lee J, Kim E-H, Park S-J, et al. Environmental Contamination and Viral Shedding in MERS Patients During MERS-CoV Outbreak in South Korea. Clin Infect Dis Off Publ Infect Dis Soc Am. 2016 Mar 15;62(6):755–60.

Appendix 1 : Putting on and removing personal protective equipment

Putting on PPE

Staff should wear the following PPE, put on in the following order:

1. Gown.
2. FFP3 respirator and fit check.
3. Eye protection, ie goggles or face shield.
4. Disposable gloves.

The order given above is practical but the order for putting on is less critical than the order of removal given below.

Removal of PPE

PPE should be removed in an order that minimises the potential for cross-contamination. Before leaving the side room, gloves, gown and eye protection should be removed (in that order, where worn) and disposed of as clinical (also known as infectious) waste. After leaving the area, the respirator can be removed and disposed of as clinical waste. The order of removal of PPE is suggested as follows, consistent with WHO guidance, as follows:

1. Peel off gloves and gown together and roll inside out. Dispose in clinical waste.
2. Perform hand hygiene.
3. Remove goggles from behind and dispose in clinical waste.
4. Remove respirator from behind.
5. Perform hand hygiene.

Figure 1 below, summarising the removal of PPE, is reproduced with permission under licence from WHO. It comes from the document [Infection prevention and control of epidemic- and pandemic-prone acute respiratory tract infections in health care](#).

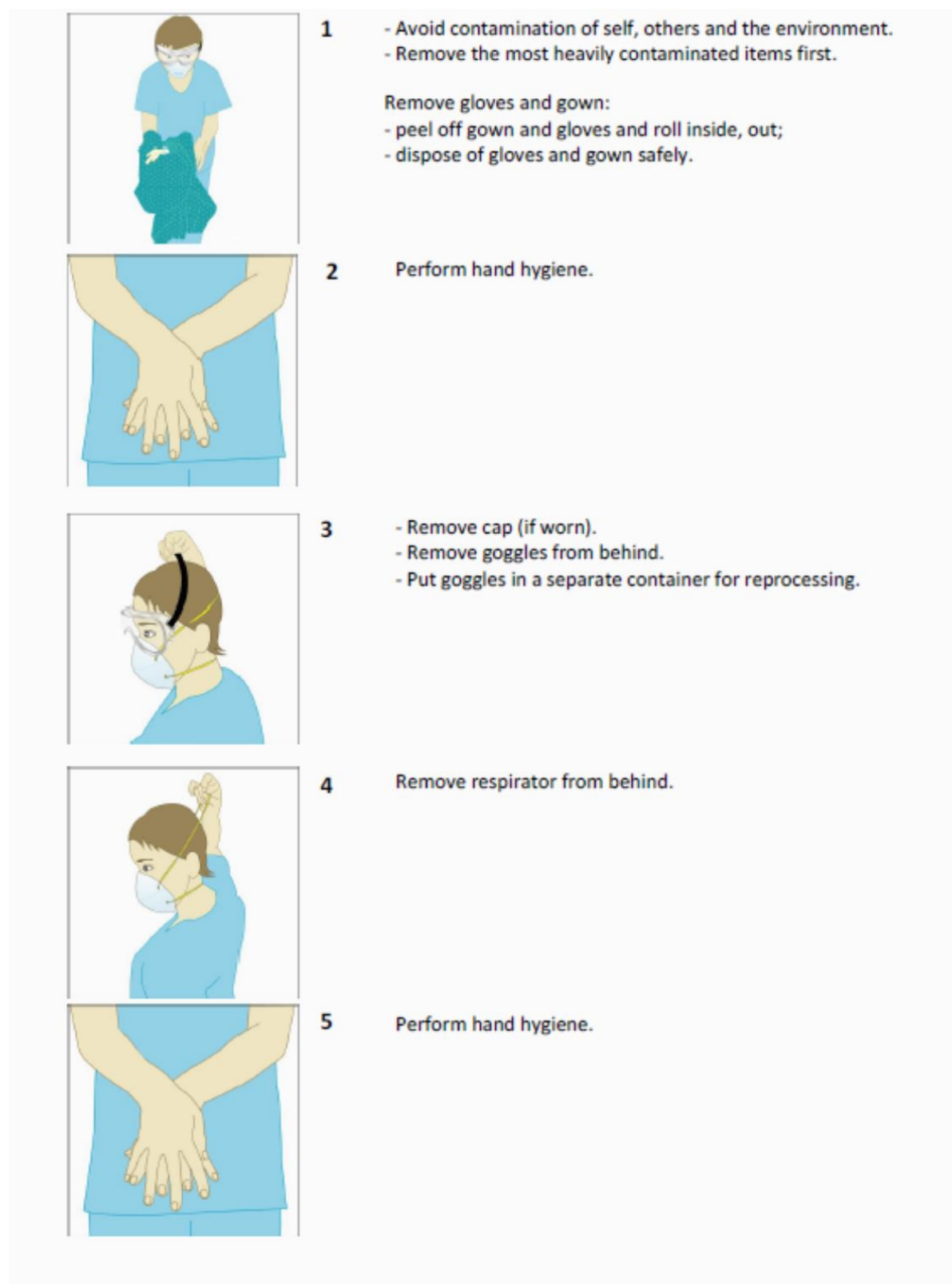


Figure 1. Removal of PPE