

Infection prevention and control principles and recommendations for Ebola virus disease

**Including information about personal protective
equipment for clinical care of patients with suspected
or confirmed Ebola virus disease in the Australian
healthcare setting**

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Version	Date	Changes
1.0	5 December 2014	Executive summary endorsed by AHPPC
1.0	6 February 2015	Rationale document and revised executive summary endorsed by AHPPC
1.1	19 March 2015	Technical editing of combined documents

The Infection Prevention and Control Expert Advisory Group (IPCEAG) was formed to provide evidence-based infection prevention and control practice and protocols for priority communicable diseases in the Australian setting. These recommendations for Ebola virus disease (EVD) capture the knowledge of professionals experienced in infection control, clinical medicine and public health, and provide guidance on best practice, based on the best available evidence at the time of completion. Additionally, information was sourced from a range of international public health organisations.

Readers should not rely solely on the information contained in these guidelines. Guideline information is not intended to be a substitute for advice from other relevant sources, including, but not limited to, the advice from a health professional with first-hand experience in the care of patients with serious infectious diseases, including EVD. Clinical judgement and discretion may be required in the interpretation and application of these guidelines.

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Acronyms and abbreviations

ADG Code	Australian Dangerous Goods Code
CDC	Centers for Disease Control and Prevention
EVD	Ebola virus disease
HAI	healthcare-associated infection
HCW	healthcare worker
IDHC	infectious disease of high consequence
IPC	infection prevention and control
PAPR	powered air-purifying respirator
PPE	personal protective equipment

Executive summary

The main objective of this document is to describe actions and measures recommended to protect healthcare workers (HCWs) and others who may come in contact with Ebola virus, or patients with suspected or confirmed Ebola virus disease (EVD).

Principles of infection prevention and control

1. Preventing transmission of infection in healthcare settings requires **concurrent application of three main types of control**:
 - an administrative structure supporting a facility-wide infection prevention and control (IPC) program
 - environmental and engineering infrastructure
 - personal protective equipment (PPE).
2. HCWs must use **standard precautions** during all routine patient care, including before identifying any infectious disease, which may then require additional transmission-based precautions. Key components of standard precautions include:
 - hand hygiene
 - safe use and disposal of sharps
 - point-of-care risk assessment, and appropriate selection and use of PPE, to prevent the HCW's skin or mucous membranes being exposed to patients' body fluids (including blood, vomit, faeces, sweat, saliva, urine, amniotic fluid, breastmilk and semen), or to patients' mucous membranes or non-intact skin.
3. **Safeguarding the health and wellbeing of HCWs and patients** in healthcare facilities, including providing training in hand hygiene, appropriate use of PPE, and safe use and disposal of sharps (including the use of safety-engineered invasive devices, where appropriate), is a priority for, and the responsibility of, policy makers, employers, managers and HCWs themselves.
4. **Implementation** of IPC measures, including correct use of PPE, requires training that is appropriate for different categories of HCWs (including supervisors) and for different levels of risk; it also requires adequate resources (human, material and financial) to support and maintain it.

Principles of Ebola virus disease infection prevention and control

1. Ebola virus transmission

Asymptomatic people do not transmit Ebola virus by routine clinical or household contact.

The predominant mode of Ebola virus transmission is by contact (direct, or indirect via contaminated fomites) with body fluids of a patient with EVD, usually in the later stage of infection or after death. Airborne transmission between people has not been demonstrated, but spread during events that generate aerosols has not been excluded.

2. Management of HCWs who have treated a patient in the Australian healthcare setting with suspected or confirmed EVD

While they remain asymptomatic, HCWs who have been caring for patients with EVD:

- will not transmit Ebola virus by routine clinical or household contact
- can continue to work in the healthcare setting and do not require quarantine, if they have used adequate PPE with supervision. They should closely monitor their health, including twice-daily body temperature measurements, and immediately report any relevant symptoms to their designated supervisor.

3. EVD and PPE principles and recommendations

The risk of transmission is managed by IPC measures, including patient isolation, environmental hygiene (cleaning and, when appropriate, disinfection) and use of adequate PPE, supported by training.

When providing clinical care for patients with confirmed EVD or treating symptomatic patients with suspected EVD where there is potential exposure to body fluids, the following is recommended:

- PPE should be chosen to ensure that the mucous membranes of the eyes, mouth and nose are protected.
- PPE should also cover all areas of the body to prevent exposure of skin, hair or clothing to a patient's body fluids and subsequent risk of self-contamination by the HCW. Ebola virus is not thought to penetrate intact skin, but contamination of skin or hair with body fluids of a patient with EVD can result in transfer via the HCW's hands to their mucous membranes or broken skin.
- Hands are known to transmit pathogens to other parts of the body or face, and to other individuals. Therefore, hand hygiene and double gloves are essential, both to protect the HCW and to prevent transmission to others.

Recommendation 1: Mucous membrane protection

All HCWs should use:

- a face shield or goggles, and a fluid-resistant P2 or N95 mask/respirator^a

OR

- a powered air-purifying respirator (PAPR).

Recommendation 2: Whole body protection

HCWs should wear surgical scrubs or work uniform, and protective body covering that they are most familiar with and trained to use. Surgical scrubs or work uniforms should not be taken home.

In most clinical settings, the preferred protective body covering will be a long-sleeved, fluid-resistant gown to the mid-calf, in combination with shoe/leg coverings and head cover (see recommendations 3 and 4).

Coveralls are used routinely in some healthcare settings (e.g. pre-hospital/ambulance). They provide equivalent protection, but pose a risk of heat stress and contamination during removal, especially if

^a P2 or N95 respirators (which are very similar) are commonly referred to as 'masks'. The term 'P2 mask' is used throughout this document. P2 masks must comply with Australian/New Zealand standard AS/NZS 1716:2012 (Respiratory protective devices).

hooded. Therefore, they are not recommended for routine use in Australian healthcare facilities, except by HCWs who are specifically trained and confident in their use and safe removal.

A plastic apron can be worn over the protective body covering if contact with fluids (e.g. vomit) is likely.

Recommendation 3: Foot covering

All HCWs should wear enclosed, fluid- and sharps-resistant footwear, and single-use, fluid-repellent boot covers to mid-calf.

Recommendation 4: Head covering

All HCWs should wear a head cover that covers the head and neck (unless this protection is provided by using a PAPR).

Recommendation 5: Hand hygiene and protection

All HCWs should wear double gloves. The outer pair of gloves should be long enough to cover the cuff of the gown easily. Nitrile gloves are preferred.

PPE should be adequate, but not excessive. Wearing PPE in excess of that recommended, will potentially restrict movement and vision, increase the risk of heat stress, and make putting on and taking off PPE more complex. The risks (to the HCW and patient) of using items in addition to those recommended may outweigh any theoretical benefits.

HCWs should be supervised by a trained assistant ('buddy') while putting on and taking off PPE. This is to ensure that each item is put on and taken off in the correct order and with the correct technique to avoid contamination. The buddy should wear basic PPE (gown, gloves and a P2 mask) to protect their own mucous membranes and clothes.

4. Application of PPE recommendations in different healthcare settings

The PPE recommendations 1–5 principally apply to situations in which the possibility of a patient presenting with symptomatic EVD has been anticipated, all items of PPE are available and HCWs have been trained in their use. These situations will primarily be in designated EVD treatment hospitals and other major referral hospitals.

In the unlikely event that a symptomatic patient with suspected EVD (based on history at triage of recent travel to an EVD-affected country and compatible symptoms) presented to another healthcare setting (e.g. an emergency department of a smaller hospital), the following procedures are recommended:

- Place the patient in a single room and restrict access to the room.
- Perform a risk assessment to determine the risk of exposure to body fluids, while remaining at least 1 metre away from the patient.
- Contact the state communicable diseases control branch or local public health unit.
- **Perform hand hygiene before and after any contact with the patient or their immediate environment.**

If the patient needs immediate or supportive care, it is recommended that the HCW, before returning to the room, puts on the PPE appropriate to the risk assessment, such as:

- fluid-repellent P2 or surgical mask
- eye protection (face shield or goggles)
- disposable long-sleeved, fluid-resistant gown
- two pairs of disposable gloves.

5. Avoid needlestick injuries

The use of sharp objects should be avoided, if possible, without compromising clinical care. For example, while awaiting transfer of the patient to a referral hospital, or advice from the state communicable diseases control branch or public health unit, defer collecting blood or inserting an intravenous catheter in a clinically stable patient. Always provide oral fluids to the patient.

Retractable safety devices significantly reduce the risk of needlestick injury. If available, they should be used for essential invasive procedures by HCWs familiar with their use, unless technical issues make their use difficult (e.g. in small children). All HCWs being trained to care for patients with EVD should be trained in using retractable safety devices.

6. EVD testing and need for PPE

Initial polymerase chain reaction (PCR) testing for EVD may be negative in the early stages of symptomatic infection, such as when fever is the only symptom (or when fever is due to another infection and EVD is still in the incubation period).

If the initial test for EVD is negative, the risk assessment should be repeated. Note the negative result, the likelihood of high-risk exposure and any change in clinical status. If this indicates that repeat testing is required, PPE recommendations for EVD apply until the result is available. If not, the patient can be managed according to clinical status.

7. Patient care

Patient care, including urgent investigations and management, should not be unduly delayed while awaiting risk assessment or patient transfer, provided the HCW is adequately protected).

The mortality from EVD when optimal supportive care is available is likely to be substantially lower than during outbreaks in resource-constrained settings.

8. Environmental hygiene and waste management controls

HCWs responsible for environmental hygiene and waste management should wear PPE appropriate to the clinical setting.

Clinical waste contaminated with body fluids from a patient with EVD (high-risk setting) should be double bagged, appropriately packaged, secured to prevent unauthorised access, and then transported in a locked, rigid, wheeled container to be sterilised in an autoclave or by incineration.

9. Post-mortem care

Only personnel trained in handling infected human remains and wearing appropriate PPE should touch or move the body of a person who has died from EVD.

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The PPE requirements when handling a person who has died from EVD are the same as those required for contact with living (high-risk) patients. An apron should be worn over the PPE because of the increased likelihood of significant contamination with blood or other body fluids.

Autopsies on patients who die from EVD should be avoided.

Combined list of recommendations

Recommendation 1: Mucous membrane protection

All HCWs should use:

- a face shield or goggles, and a fluid-resistant P2/ or N95 mask/respirator^b

OR

- a powered air-purifying respirator (PAPR).

Recommendation 2: Whole body protection

HCWs should wear surgical scrubs or work uniform, and protective body covering that they are most familiar with and trained to use. Surgical scrubs or work uniforms should not be taken home.

In most clinical settings, the preferred protective body covering will be a long-sleeved, fluid-resistant gown to the mid-calf, in combination with shoe/leg coverings and head cover (see recommendations 3 and 4).

Coveralls are used routinely in some healthcare settings (e.g. pre-hospital/ambulance). They provide equivalent protection, but pose a risk of heat stress and contamination during removal, especially if hooded. Therefore they are not recommended for routine use in Australian healthcare facilities, except by HCWs who are specifically trained and confident in their use and safe removal.

A plastic apron can be worn over the protective body covering if contact with fluids (e.g. vomit) is likely.

Recommendation 3: Foot covering

All HCWs should wear enclosed, fluid- and sharps-resistant footwear and single-use, fluid-repellent boot covers to mid-calf.

Recommendation 4: Head covering

All HCWs should wear a head cover that covers the head and neck (unless this protection is provided by using a PAPR).

Recommendation 5: Hand hygiene and protection

All HCWs should wear double gloves. The outer pair of gloves should be long enough to cover the cuff of the gown easily. Nitrile gloves are preferred.

^b P2 or N95 respirators (which are very similar) are commonly referred to as 'masks'. The term 'P2 mask' is used throughout this document. P2 masks must comply with Australian/New Zealand standard AS/NZS 1716:2012 (Respiratory protective devices).

1 General principles of infection prevention and control

Key points

- To prevent healthcare-associated infection (HAI), healthcare facilities need to have appropriate administrative structures, and environmental and engineering infrastructure. Facilities also need to implement and maintain standard and transmission-based infection prevention and control (IPC) precautions, which include:
 - using hand hygiene
 - using appropriate personal protective equipment (PPE)
 - handling and disposing of waste and sharps safely.
- All healthcare facilities should have an organisational IPC program, including:
 - a governance structure
 - a program for surveillance of key IPC measures
 - transmission-prevention policies and implementation programs
 - environmental cleaning, disinfection and sterilisation policies and procedures
 - systems for communication with staff, patients and carers.
- Workplace health and safety programs should include measures to eliminate or mitigate risks of HAIs to staff. This can be done by implementation of policies, standard procedures and training, and surveillance of staff health.
- Infectious diseases of high consequence—such as Ebola virus disease and severe acute respiratory syndrome—are serious threats to healthcare workers who are caring for patients with these infections. These diseases often require enhanced PPE, depending on clinical circumstances.

Healthcare-associated infections (HAIs) can be prevented by concurrently applying three main types of controls:

- an administrative structure that supports an organisational infection prevention and control (IPC) program
- good environmental and engineering infrastructure
- standard and transmission-based IPC precautions, including appropriate use of personal protective equipment (PPE).

All hospitals should have an organisational IPC program consistent with the National Safety and Quality Health Service Standards. This should include:

- a governance structure
- a system for surveillance of key process and outcome indicators of IPC performance, and dissemination of results

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- policies and implementation methods for specific strategies to prevent transmission
- environmental cleaning, disinfection and sterilisation policies and procedures
- systems to communicate with staff, patients and carers (e.g. to provide information about HAI and IPC policies), and surveys to assess the systems' efficacy.

Every hospital should reinforce standard and transmission-based precautions for all transmissible infectious diseases and key pathogens. To help do this, all healthcare workers (HCWs) should be provided with PPE and trained to use it properly.

Appropriate environmental and engineering infrastructure should be in place to enable measures to prevent transmission, including:

- adequate numbers (based on hospital size and type) of single rooms that have en suite toilet and bathroom facilities, and differential-pressure isolation rooms (e.g. negative-pressure rooms with anterooms) to isolate patients with infectious diseases, including airborne respiratory infections
- waste management systems appropriate for a wide range of infectious diseases.

All infrastructure should be adequately maintained and periodically tested. This is especially important for differential-pressure isolation rooms.

Safeguarding the health and wellbeing of HCWs and patients in healthcare facilities, including providing training in hand hygiene, appropriate use of PPE, and safe use and disposal of sharps (including the use of safety-engineered invasive devices, where appropriate), is a priority for, and the responsibility of, policy makers, employers, managers and HCWs themselves.

An IPC program should form part of a risk management system to identify, assess, mitigate and communicate potential communicable disease threats to patients and staff. Workplace health and safety programs should identify all threats to staff health—including infectious diseases—and take measures to eliminate or mitigate risk by implementing policies and standard procedures, training staff, and monitoring staff health.

1.1 Standard and transmission-based precautions

Hospitals should implement several standard and transmission-based precautions. They include hand hygiene, according to the ['5 moments for hand hygiene'](#).

PPE must also be used appropriately, based on the circumstances and the patient's clinical condition. Specific precautions include wearing:

- **gloves** when exposure to blood, other body fluids or contaminated items is anticipated, or there is a need to touch mucous membranes or non-intact skin
- **fluid-resistant gowns** when clothing or exposed skin is anticipated to come into contact with blood or other body fluids
- **mucous membrane protection** (such as a mask, goggles or face shield, appropriate to the risk) when splashing or spraying of blood or other body fluids is anticipated (e.g. during suctioning or endotracheal intubation), or airborne transmission is anticipated
- **respiratory tract protection** when airborne transmission is likely.

In addition, equipment, wastes and sharps must be handled and disposed of safely. These include:

- soiled patient-care equipment (including reusable equipment to be disinfected or sterilised); note that gloves must be worn when handling potentially contaminated equipment
- needles and other sharps; engineered safety devices should be used when available and practicable.

Finally, environmental controls—such as routine care, cleaning, and disinfection of environmental surfaces, especially frequently touched surfaces in patient-care areas—must be used.

1.2 Infectious diseases of high consequence

Patients with an infectious disease of high consequence (IDHC)—such as Ebola virus disease (EVD) and severe acute respiratory syndrome (SARS)—typically develop severe symptoms and require a high level of care.

Case fatalities for IDHCs are often high and, frequently, no specific vaccine, prophylaxis or treatment is available. Several IDHCs are transmissible from person to person and therefore require enhanced transmission precautions to protect HCWs and other patients (see Section 3.2.2).

Enhanced PPE and additional precautions that are required for caring for patients with an IDHC will vary according to the disease, clinical circumstances and risk analysis.

Depending on their airborne or droplet transmission route (e.g. pandemic influenza; SARS in 2003) or the high infectivity of body fluids (e.g. EVD in 2014), IDHCs can generate large-scale epidemics (e.g. SARS, EVD) or pandemics (e.g. Spanish influenza pandemic in 1918).

2 Infection prevention and control of Ebola virus disease

Key points

- Asymptomatic people do not transmit Ebola virus by routine clinical or household contact.
- The predominant mode of Ebola virus transmission is by direct or indirect contact with body fluids of a patient with Ebola virus disease (EVD), especially in the later stage of illness and after death.
- It has not been demonstrated that airborne transmission of Ebola virus occurs between people, but virus spread during aerosol-generating events or procedures has not been excluded.
- Transmission risk is managed by infection prevention and control (IPC) measures, including patient isolation, environmental hygiene and use of personal protective equipment (PPE), as appropriate.
- A risk assessment approach should be used before every interaction with a symptomatic patient with suspected or confirmed EVD, to support the use of additional IPC measures (e.g. enhanced PPE) if indicated.
- PPE must be used by anyone caring for, or in contact with, patients with suspected or confirmed EVD, or their tissues or body fluids. It must include fluid-resistant protection of hands and clothing, and the mucous membranes of the eyes, mouth and nose.
- Where possible, all other equipment required for patient care should be dedicated for use with an individual patient, and be disposable.

The main objective of this document is to describe recommended actions and measures that will protect healthcare workers (HCWs) and others who may come in contact with Ebola virus. Protecting HCWs ensures that patients receive adequate and timely clinical care. Individual healthcare facilities may need to adapt these recommendations, depending on the specific clinical setting and facilities. There has been limited experience of treating patients with Ebola virus disease (EVD) outside Africa, and the advice in this document will require frequent review informed by scientific evidence and practitioner experience.

Generally, selecting the personal protective equipment (PPE) for any infectious disease follows a risk-based approach, and considers factors such as the type of planned interventions, the patient's degree of infectivity and the workplace environment (see Chapter 3). Workplace health and safety experts, and infection prevention and control (IPC) professionals with expertise in PPE should oversee the selection of the PPE and training in how to use it. Manufacturers' instructions on the use of PPE components must be read and followed carefully. These and other guidelines support, but never replace, practical training and regular refresher courses held by experienced PPE instructors.

2.1 Virology, pathogenesis, epidemiology and characteristics of Ebola virus disease

2.1.1 Ebola virus and its reservoir

Ebola virus is a member of the *Filoviridae* family, named for its filament-like structure.^c There are five Ebola virus species; all are named after the places they were first recognised—Ebola (formerly Zaire), Sudan, Côte D'Ivoire (Tai Forest), Reston and Bundibugyo.¹

Ebola virus is an RNA virus with a lipid envelope; it is inactivated by many chemical disinfectants, including sodium hypochlorite and alcohol. The infectious dose of Ebola virus may be quite low (but the only data available are based on aerosol transmission in animal experiments, not human infection).² Because of its (presumed) low infectious dose, high mortality and absence of specific therapy, Ebola virus is classified as a Category A infectious substance³ (for transportation purposes).

Ebola virus can cause asymptomatic infection in several types of fruit bat, which are believed to be the main reservoir. Many types of wild animal can be infected, presumably by contact with bats. Initially, humans are infected by coming into contact with infected animals or 'bush meat' (e.g. by hunting and/or butchering infected animals).

2.1.2 Ebola virus disease

EVD has an incubation period of 2–21 (usually 7–10) days.⁴ Once symptoms develop, the illness progresses rapidly over a few days, from an initial non-secretory ('dry') phase, characterised by fever, malaise, myalgia, arthralgia and pharyngitis, to the secretory ('wet') phase, with abdominal pain, copious secretions (diarrhoea, vomiting, gastrointestinal haemorrhage) and, in a minority of cases, multisystem failure. Death results primarily from fluid and electrolyte loss, but early correction of this can improve the outcome.^{4,5} The mortality from EVD in the current outbreak (Africa in 2014) is estimated to be 70%.⁵ Late presentation, delayed diagnosis, lack of early rehydration and unavailability of high-level supportive care all contribute to high mortality.^{4,5}

2.1.3 Ebola virus transmission

Asymptomatic people in the EVD incubation period are not contagious. The patient is most infectious in the secretory phase. HCWs caring for EVD patients and others in close contact with patients (e.g. family and friends) are at the highest risk of becoming infected, because they are most likely to come into contact with infected blood or other body fluids. To avoid contamination, especially via the hands, HCWs should adhere strictly to IPC procedures, including scrupulous use of PPE.

There is no evidence that Ebola virus penetrates intact skin. Direct or indirect exposure of mucous membranes or non-intact skin to blood, other body fluids or contaminated fomites, including self-inoculation from contaminated hands, is the primary route of infection. Potential contamination is greatest when the patient is vomiting, has diarrhoea or is bleeding. Virus has been detected (mainly by reverse transcriptase PCR) in the blood, saliva, tears, sweat, urine, faeces, vaginal fluid and semen of infected individuals. Ebola virus can be spread through needlestick injuries and via contact with objects that have been contaminated with the virus. There are few studies on transmission risks associated with invasive or aerosol-generating procedures—such as ventilation or haemodialysis—

^c The other member of this family is Marburg virus.

but these procedures have been conducted safely in patients who are seriously ill with EVD.^{6–8} The United States Centers for Disease Control and Prevention (CDC) has published guidelines for haemodialysis in EVD patients.⁹

The bodies of patients who have died from EVD are highly infectious. Traditional burial practices, which may involve touching, washing and kissing the body of the deceased, have been responsible for a significant proportion of EVD cases in Africa. Great care is required when handling the body after death from EVD in healthcare settings. An autopsy should only be performed in exceptional circumstance (e.g. if ordered by the coroner; see Chapter 6).

Ebola virus can thrive in the environment, but is known to be highly susceptible to ultraviolet light, drying and most disinfectants. It survives longer in dark and moist environments.

There is no evidence for airborne transmission of Ebola virus between humans.¹⁰ Experience with comparable viruses suggests that any major change in the route of transmission, due to mutation, is unlikely.¹¹

2.2 Principles of infection prevention and control for Ebola virus

PPE is only one aspect of IPC (see Chapter 1). All HCWs must use standard precautions for every clinical contact. Transmission-based precautions need to be adopted according to risk assessment. There is no universally agreed combination of PPE for care of patients with EVD, but several international authorities have provided guidance, including the World Health Organization, the European Centre for Disease Prevention and Control, the CDC and the Public Health Authority of Canada.^{12–15} The general principles outlined in this section, and the specific guidance provided in this document, are adapted for Australian healthcare settings from these sources, after extensive discussion within the Infection Prevention and Control Expert Advisory Group, and in consultation with colleagues from designated hospitals, and state and territory departments of health.

2.2.1 Selecting and using personal protective equipment

When caring for patients with suspected or confirmed symptomatic EVD, PPE must be used, including fluid-resistant items that protect the hands and clothing, and the mucous membranes of the eyes, mouth and nose. Enhanced PPE (see Section 3.2.2) should be used when providing clinical care for patients with confirmed or suspected EVD who are clinically unstable and/or producing copious secretions. Chapter 4 details the individual items and procedures for putting on and taking off PPE; however, there are several general principles:

- PPE should protect the mucous membranes of the eyes, mouth and nose to prevent exposure to body fluids and potential self-contamination.
- While providing care to a patient with confirmed or suspected EVD who is clinically unstable or producing copious secretions, or if an aerosol-generating procedure is urgently required, protective covering should be worn for all mucous membranes, skin and hair, head and neck (face shield or goggles, hood that covers the neck and shoulders), hands (double gloves) and clothing (fluid-resistant gown, footwear covers).
- PPE should be adequate, but not excessive. Wearing PPE in excess of that recommended, will potentially restrict movement and vision, increase the risk of heat stress, and make putting on and taking off PPE more complex. The risks (to the HCW and patient) of using items in addition to those recommended may outweigh any theoretical benefits.

- HCWs likely to be caring for patients with confirmed or suspected EVD must be adequately trained and confident in using the recommended PPE.
- Putting on and taking off PPE must be undertaken slowly and methodically according to an agreed sequence, and be supervised by a trained buddy or monitor.

2.2.2 Administrative requirements for personal protective and other equipment

Implementing enhanced IPC measures while preparing to care for a patient with an infectious disease of high consequence, such as EVD, will require additional administrative arrangements:

- Ensure that adequate stocks of PPE appropriate to the hospital's function are available, and that sufficient stock is maintained and distributed to manage patients for an appropriate length of time.
- A core group of staff should be trained in the safe use of PPE. Training should be done by specialists in IPC and/or infectious diseases, and/or workplace health and safety staff. Limiting the number of staff trained allows resources to be concentrated. However, sufficient staff—including emergency department and infectious diseases staff—should be trained to ensure their availability at any time and for an adequate duration. In designated hospitals, this will also include intensive care, laboratory and cleaning staff.
- Training should include procedures for safely putting on and taking off PPE, performing initial clinical care, collecting and transporting specimens, and placing intravenous lines.
- Technique assessment is required to establish competency, but formal certification is not recommended, as training must be repeated regularly (as determined by the healthcare facility) to maintain competency. Training records should be kept up to date.
- If PPE includes equipment that requires maintenance (e.g. charging batteries) or disinfection of reusable components, a schedule is required to ensure that this maintenance is performed regularly.
- Where possible, all other equipment required for patient care should be disposable and dedicated for use with an individual patient.
- Physical infrastructure must be checked regularly—for example, the air pressure and high-efficiency particulate air (HEPA) filters in isolation room(s).
- Procedures for disposing of highly infectious liquid waste (in consultation with local water or sewage authorities) and solid clinical waste (in consultation with the appropriate environment protection or waste management authority) must be reviewed.
- Staff must be assessed for their fitness to care for patients with EVD. Staff who may be exempt include those who
 - have underlying conditions that affect immune competence
 - are pregnant
 - have non-intact skin (from dermatitis, abrasions, wounds, etc.)
 - suffer from claustrophobia or significant anxiety.
- Rosters should be appropriate to avoid staff fatigue. HCWs can tolerate enhanced PPE for only short periods, depending on ambient temperature and intensity of activity, before developing heat exhaustion and dehydration.

- Different categories of HCWs (including supervisors) have different levels of risk. Therefore, training in use of PPE, environmental cleaning and use of disinfecting equipment must be appropriate for each category.
- Adequate resources (human, material and financial) must be provided to support and maintain appropriate IPC measures.

2.2.3 Airborne transmission

Although airborne transmission of Ebola virus between humans has not been demonstrated, it is assumed that it could potentially occur during aerosol-generating procedures, such as intubation or suctioning, or by aerosolisation through other means. A P2 mask^d or powered air-purifying respirator should therefore be used while caring for a patient with confirmed or suspected EVD who is producing copious secretions or is clinically unstable (and, therefore, may urgently require an aerosol-generating procedure). All mucous membranes, skin and clothing should be covered in these circumstances. This includes the head and neck (face shield or goggles, hood that covers the neck and shoulders), hands (double gloves) and clothing (gown, footwear covers).

2.2.4 Patient rooms

Patient rooms must be considered when dealing with a suspected or confirmed case of EVD. General requirements include the following:

- A single room is required with its own toilet and bathroom facilities. (If en suite facilities are not available in a suitable location, a commode can be used for short-term patient care.)
- A negative-pressure room is not required for the care of patients with suspected EVD. However, patients with confirmed EVD who may require aerosol-generating procedures should be managed in a negative-pressure room.

2.2.5 Patient-care zones

The strict procedures required for putting on and taking off PPE (see Chapter 4) mean that patient-care location and environment need careful consideration. Using separate zones, based on the risk of environmental contamination, is useful to minimise risks to HCWs and others. Zones with colour codes are recommended (Table 1; also see Section 4.3.1).

The hospital needs two adjacent areas to the patient room (red zone): a 'clean' area (green zone) and a 'possibly contaminated' (orange zone) area. The clean area should be used for storing and putting on clean PPE. The possibly contaminated area (orange zone) should be of adequate size to safely remove PPE and dispose of clinical waste.

If there is an anteroom that is large enough to allow PPE to be safely removed, it can be used for this purpose. Alternatively, two adjoining rooms can be used, one for patient care and the other for taking off PPE. The latter should be immediately adjacent to the patient room, preferably with direct access, to reduce the risk of environmental contamination in general access areas.

^d P2 or N95 respirators (which are very similar) are commonly referred to as 'masks'. The term 'P2 mask' is used throughout this document. P2 masks must comply with Australian/New Zealand standard AS/NZS 1716:2012 (Respiratory protective devices).

Many facilities will have isolation rooms (with anterooms) engineered to allow negative-pressure airflow. Negative-pressure airflow is not required for EVD management, but such a room with its associated facilities will usually make care of the patient with EVD easier.

Table 1 Colour-coded zones

Colour	Designation	Description
Red	High risk; heavy contamination	Immediate patient environment—that is, the patient room and en suite—which requires full PPE at all times
Orange	Low risk; possible contamination	Designated area (to be marked with tape) immediately adjacent to the patient room—for taking off PPE and holding clinical waste until double bagged and surface decontaminated
Green	Outside; no contamination	All other areas, including area to put on PPE and take off scrubs, and for storing locked waste bins before removal

PPE = personal protective equipment

2.3 Operational planning and infection prevention and control

An operations group should be established to supervise and oversee administrative tasks, as well as the management of patients with suspected or confirmed EVD. The group should also define roles for key HCWs, such as:

- patient care, such as triage, initial management and risk assessment, in association with a public health unit
- communication between
 - internal departments (hospital executive, IPC, infectious diseases, microbiology and pathology, intensive care unit, imaging/radiology)
 - external agencies, including the reference laboratory, the designated hospital and the public health unit
 - other HCWs, patients and their relatives, and the media
- management and follow-up, if required (e.g. counselling, risk assessment,, contact identification), of all HCWs involved in patient care, and especially of any HCWs who are potentially exposed to EVD
 - before the diagnosis is considered (e.g. in the emergency department)
 - when a breach of PPE has occurred while caring for a patient with confirmed EVD
- general oversight to ensure continuity of other hospital services.

Sufficient financial resources, appropriate to the level of risk, are required to procure PPE, and provide resources for training and preparedness planning.

Table 2 provides an overview of issues that hospitals need to consider if they are caring for patients with suspected or confirmed EVD.

Table 2 Considerations for hospitals caring for patients with suspected or confirmed Ebola virus disease

Consideration	All hospitals	Non-designated assessment hospitals	Designated hospitals
Care capacity	Initial care (including awaiting transfer)	Care of patients with suspected EVD until diagnosis is established	Care of patient with suspected or confirmed EVD
Issues to address	<p>Triage protocols</p> <p>Initial placement and safe assessment</p> <p>Contact assessment</p> <p>Disinfection and cleaning</p> <p>Disposal of wastes, including sharps</p> <p>Communication with public health units and laboratories</p>	<p>As for all hospitals, plus:</p> <ul style="list-style-type: none"> • diagnostic tests (for EVD and alternative diagnoses) • patient transport • management of visitors (including parents of paediatric patients) • communication with staff, media and the public • waste and linen management 	<p>As for non-designated hospitals, plus:</p> <ul style="list-style-type: none"> • clinical care, including intensive care support • duration of EVD precautions • maintenance of routine hospital services • communication with other patients • care of the body after death (if required)

EVD = Ebola virus disease

3 Risk assessment approach to infection prevention and control

Key points

- A risk assessment approach should be used to assess the correct level of personal protective equipment (PPE) for providing care to every suspected and confirmed Ebola virus disease (EVD) patient.
- A risk assessment should take into account the patient's history of exposure to EVD, their symptoms, the risk of transmission, the type of healthcare activity that is to be undertaken, and the healthcare setting in which the activity will take place.
- Suspected EVD patients without secretory symptoms pose a lower transmission risk than suspected EVD patients with secretory symptoms.
- Confirmed EVD patients should be treated in designated EVD treatment hospitals that have plans and appropriate PPE to provide care to EVD patients for the duration of their illness.

A risk assessment approach aims to ensure staff safety while allowing delivery of appropriate care. This approach considers a patient's likelihood of being infected with Ebola virus and clinical condition, as well as the comfort of healthcare workers (HCWs) using personal protective equipment (PPE). It also recognises that there is a lack of evidence to support the idea that additional PPE is needed in all cases.

During triage, a history is taken from the patient to ascertain their known or possible exposure history to Ebola virus disease (EVD), and current symptoms. The patient history should include an assessment of the patient's previous exposure to EVD, and whether it was a high- or low-risk exposure.^e

The HCW should record the history while maintaining a distance of at least 1 metre from the patient, to reduce the chance of inadvertent direct contact. This is important even with patients who do not have any symptoms such as vomiting, diarrhoea or haemorrhage.

If triage identifies the patient as a person under investigation for EVD, appropriate PPE should be used according to a risk assessment that takes into consideration:

- the hazard posed by the characteristics and symptoms of the patient with potential EVD
- the type of healthcare activities to be undertaken
- any specific vulnerabilities in exposed HCWs
- the healthcare setting.

3.1 Risk of transmission during patient clinical presentation

People in the EVD incubation period are asymptomatic and not contagious. The patient is most infectious in the secretory phase.

^e Appendix 2 of the Communicable Diseases Network Australia's *National guidelines for public health units—Ebola virus disease* contains a description of the different levels of exposure.

Symptoms and transmission risk can be broadly grouped as follows:

- Fever, headache and malaise are symptoms with lower transmission risk.
- Vomiting, diarrhoea and haemorrhaging are symptoms with higher transmission risk.

Depending on the healthcare activities that are required to treat the patient, there will be different potential exposure risks:

- low risk—triaging, taking medical history, and providing food and drink
- intermediate risk—clinically examining a patient with early symptoms (non-secretory)
- higher risk—inserting a peripheral intravenous line, taking blood for diagnostic testing, clinically examining a patient with secretory symptoms and cleaning a soiled environment
- high risk—invasive monitoring and treatment (e.g. mechanical ventilation, dialysis and other organ support; circulatory support; central line insertion), and performing aerosol-generating procedures.

In Australia, people under investigation for possible infection with Ebola virus are likely to present for evaluation with mild (non-secretory) symptoms. Initial isolation and evaluation of these minimally symptomatic patients can be performed using a level of PPE that recognises the risks in that setting (see Chapter 4 for specific PPE details). The risk will change as the disease progresses, and the risk assessment should be reviewed frequently to ensure that the PPE matches the patient's current and anticipated clinical status.

Note that initial polymerase chain reaction (PCR) testing for EVD may be negative in the early stages of symptomatic infection, such as when fever is the only symptom (or when fever is due to another infection and EVD is still in the incubation period).

If the initial test for EVD is negative, the risk assessment should be repeated. Note the negative result, the likelihood of high-risk exposure and any change in clinical status. If this indicates that repeat testing is required, PPE recommendations for EVD apply until the result is available. If not, the patient can be managed according to clinical status.

3.2 Recommended levels of personal protective equipment

The Infection Prevention and Control Expert Advisory Group recommends two levels (1 and 2) of PPE for HCW protection (also see Section 4.4).

3.2.1 Level 1 personal protective equipment

The first level of PPE is used during the initial assessment of suspected EVD patients (including triage and assessment of a person under investigation), where the patient has low-risk symptoms (fever, headache, malaise).

PPE should include measures to protect hands (double gloves), clothing (fluid-resistant gown), and mucous membranes of the eyes, mouth and nose (P2 or surgical mask; face shield or goggles).

3.2.2 Level 2 personal protective equipment

The second level of PPE (enhanced PPE) is for nursing, clinical care and treatment of patients with confirmed EVD, and for patients with suspected EVD who have high-risk (secretory) symptoms (vomiting, diarrhoea, haemorrhage).

PPE should include measures to protect hands (double gloves), clothing (fluid-resistant gown), and the mucous membranes of the eyes, mouth and nose (P2 mask, and face shield or goggles; or powered air-purifying respirator [PAPR]^f). It should also provide full protection of all clothing (lower leg and footwear coverings), skin and hair (hood or PAPR).

Appendix 1 provides a number of risk assessment examples for a range of scenarios.

3.3 Healthcare worker vulnerabilities

HCWs who have medical or physical conditions that will interfere with safe use of the PPE described in these guidelines should not be involved in the direct care of patients with EVD. HCWs must be assessed for their fitness to care for patients with EVD and should be encouraged to communicate concerns about any negative effects of use of PPE on underlying health conditions (or those of their family members or household contacts).^g This needs to be done through the usual reporting mechanism within their organisation (e.g. supervisor, manager, workplace health and safety officer).

Some conditions may preclude HCWs from providing direct care for patients with EVD, including:

- underlying medical conditions that could affect the HCW's ability to exit the room quickly and safely
- underlying medical conditions that could require another HCW to enter the room to provide urgent medical assistance to the HCW (e.g. seizure disorder, hypoglycaemia)
- non-intact skin—for example, from dermatitis, abrasions or wounds
- inability to safely put on, use or remove recommended PPE, including achieving a good fit with a P2 mask (e.g. claustrophobia, significant anxiety, body morphology or mobility issues)
- problems with immune competence
- pregnancy (reported maternal mortality from EVD is more than 95%, and fetal mortality is 100%).

3.4 Healthcare settings, and infection prevention and control procedures

Different levels of assessment, treatment and care may be required, depending on the healthcare setting, including:

- hospital settings, including designated and non-designated hospitals
- ambulatory and primary care settings (including allied healthcare professionals in community settings)
- emergency medical service providers and retrieval services.

^f A powered air-purifying respirator replaces a P2 mask, face shield/goggles and hood.

^g Asymptomatic healthcare workers do not pose a risk to family or household contacts.

The PPE that is required will need to match these settings and the accompanying roles of HCWs (see Table 3). Also refer to the decision tool in Appendix 2.

Table 3 Summary of healthcare settings and associated level of Ebola virus disease care

Healthcare setting	EVD care level	PPE
EVD treatment (designated) hospitals	Identify suspected EVD patient, isolate, inform PHU, provide laboratory confirmation, treat for duration of illness, and manage all cleaning and waste disposal	Maintain sufficient PPE reserves, and appropriate training and preparation of adequate staff numbers to provide care for duration of patient's illness
EVD assessment and interim-care (larger non-designated) hospitals	Identify suspected EVD patient, isolate, inform PHU and provide short-term care until diagnosis of EVD is laboratory confirmed Arrange patient transfer to a designated EVD treatment hospital Manage all cleaning and waste disposal	Maintain sufficient PPE reserves, and appropriate training and preparation of adequate staff numbers to provide care for patient with suspected EVD while awaiting laboratory confirmation
Other healthcare facilities (smaller hospitals)	Identify suspected EVD patient, isolate, inform PHU Arrange laboratory testing through PHU, if indicated Manage cleaning and waste disposal, as directed by PHU	Apply PPE appropriate for the clinical status of the patient with suspected EVD Maintain appropriate PPE reserves, and adequate trained and prepared staff to provide care for patient until transfer is arranged
Primary and ambulatory care	Identify suspected EVD patient, isolate, inform PHU (PHU will arrange immediate transfer, if required) Manage cleaning and waste disposal, as directed by PHU	Avoid unnecessary contact; PPE is required if it is essential to contact the patient directly
Medical emergency services	Identify and transfer suspected EVD patient to EVD treatment hospital, in consultation with PHU Manage cleaning and waste disposal	Use PPE recommended for patients with suspected EVD in less controlled emergency management settings

EVD = Ebola virus disease; PHU = public health unit; PPE = personal protective equipment

As at February 2015, all travellers to Australia who have come from Ebola-affected countries in West Africa are identified at the border, and are provided with advice and regular follow-up by jurisdictional public health authorities. If these travellers develop a temperature or become unwell, they are advised to contact the appropriate public health authority, who will then arrange their transfer to a designated hospital. Designated Ebola treatment hospitals have appropriate preparedness plans, training and equipment to identify and isolate patients with EVD, and provide treatment for the duration of the patient's illness.

Therefore, the likelihood that an EVD patient will present at a healthcare facility other than a designated hospital is low, but not impossible. Preparedness in other settings will address the provision of shorter-term care in a safe manner, with appropriate use of resources and training.

For non-designated hospitals and other healthcare settings, an initial decision is required about whether patients with suspected EVD will be transferred, as soon as possible, to a designated hospital (e.g. transfers from primary care settings and smaller emergency departments), or assessed and isolated until a diagnosis is established (e.g. appropriate for larger emergency departments and hospitals). Even when early transfer is planned, arrangements for appropriate patient care while awaiting transfer will be needed.

The majority of febrile patients in ambulatory settings do not have EVD. The risk posed by a patient with EVD who has early, non-secretory symptoms is lower than that from a patient hospitalised with severe disease. Nevertheless, because early EVD symptoms are similar to those seen with other febrile illnesses, triage and evaluation processes should consider and systematically assess patients for the possibility of EVD.

All acute healthcare facilities have an important role in preparing for identifying, isolating and evaluating patients with possible EVD, and promptly informing public health authorities. However, the roles and preparations required for readiness to perform these tasks will differ, depending on the healthcare setting.

3.4.1 General patient management

All HCWs in different healthcare settings should follow these general patient management principles:

- Standard precautions must be used in all cases, including use of appropriate PPE to protect against contact with blood and other body fluids when attending a patient who is bleeding (e.g. as a result of trauma), or has vomiting or diarrhoea from any cause.
- Ambulance officers must not have direct contact with a patient who could have EVD without wearing appropriate PPE.
- Use caution when approaching a patient with suspected EVD. On rare occasions, EVD can cause delirium and erratic behaviour (e.g. flailing or staggering), which can place ambulance officers at an increased risk of exposure.
- Keep the patient separated from other people as much as possible.
- Limit the number of providers who provide care for a patient with suspected EVD.
- Limit the use of needles and other sharps as much as possible. Any needles and sharps should be handled with extreme care and disposed of in puncture-proof, sealed containers designated for the care of this patient.
- Retractable safety devices significantly reduce the risk of needlestick injury. If available, they should be used for essential invasive procedures by HCWs familiar with their use, unless technical issues make their use difficult (e.g. in small children). All HCWs being trained to care for patients with EVD should be trained in using retractable safety devices.
- If the patient is vomiting, give them a large biohazard or emesis bag.
- If the patient has profuse diarrhoea, consider wrapping them in an impermeable sheet to reduce contamination of other surfaces.

3.4.2 Hospitals

In Australia, hospitals have appropriate infection prevention and control (IPC) preparedness according to their roles, as follows:

- **EVD treatment (designated) hospitals.** These hospitals assess and manage the care of a patient with confirmed EVD for the duration of a patient’s illness. Each state and territory jurisdiction has at least one designated EVD treatment hospital.
- **EVD assessment and interim-care (larger non-designated) hospitals.** EVD assessment hospitals are usually larger non-designated tertiary hospitals. They are prepared to receive and isolate a patient with possible EVD, and care for the patient until a diagnosis of EVD can be confirmed or ruled out, and until discharge or transfer is completed.
- **Other healthcare facilities (smaller hospitals).** Smaller hospitals are very unlikely to receive an EVD patient. However, they should be prepared to identify and isolate a suspected EVD patient and inform the public health unit. The public health unit will arrange laboratory testing and transport, if indicated, and provide advice on any further action required, including cleaning and waste disposal.

This approach—based on the likelihood of exposure of HCWs to a patient with EVD and the type of healthcare setting—will allow adequate reserves of PPE and levels of training to be provided by the facilities that are most likely to care for patients with EVD (i.e. designated hospitals). These facilities will require large stocks of PPE to care for a patient with EVD for the duration of their illness.

Effective IPC during the care of a patient with suspected or confirmed EVD involves a number of important steps, starting with triage and isolation. The relevant public health or communicable disease authorities must also be informed, so that they can assist with coordination of further assessment and care, and ensure that a risk assessment is performed to identify the appropriate PPE. These steps are described in Table 4 and Appendix 2.

Table 4 Infection prevention and control steps

Step	Action
Identify	All HCWs should be aware of the symptoms and signs of EVD, and take a patient medical history, including travel and possible exposure to EVD in the past 21 days.
Isolate	If a positive travel and exposure history is reported, the patient should be isolated in a single room. Only essential HCWs, whose movements are logged, should enter the room. Direct patient contact should be avoided.
Inform	Irrespective of the size or role of the hospital, the local PHU and infection control team (and infectious diseases physician, if available) should be informed immediately. The PHU will assist with risk assessment and coordination of further care.
Determine PPE	A risk assessment to determine the appropriate PPE should be done. The assessment should consider the patient’s exposure risk and clinical status (i.e. whether secreting body fluids), and the type of patient care and medical intervention required.

EBV = Ebola virus disease; HCW = healthcare worker; PHU = public health unit; PPE = personal protective equipment
 Note: Also see Appendix 2.

3.4.3 Ambulatory and primary care settings

Ambulatory and primary care settings include offices and surgeries of general practitioners, nurse practitioners, dentists and allied health professionals, and pathology collection centres in community settings.

As discussed above, the possibility of a patient with EVD presenting to any of these settings, for any reason, is very unlikely. Public health authorities recommend that people who are under surveillance because of possible contact or with suspected EVD do not present to primary care settings for EVD-related symptoms. If necessary, the public health unit will organise transport to, and assessment and care in, an appropriate EVD designated or assessment hospital.

Although these steps reduce the risk of a patient with potential EVD presenting to an ambulatory or primary care setting, there is a small possibility that it could happen, either by phone or in person. All primary healthcare providers should have a current triage plan that covers the roles of all members of the practice.

Detailed information for general practice is available from the [Australian Government Department of Health website](#).

Two scenarios of a patient with EVD presenting to primary care—one with and one without advance notice—are described in Box 1. Note that the same steps as for IPC for EVD—identify, isolate, inform, determine PPE—apply in the primary care setting.

Box 1 Proposed management for the primary care setting

Scenario 1—Advance notice of a patient attending a primary healthcare setting

1. The patient phones ahead to make an appointment. They report symptoms of Ebola virus disease (EVD), and a history of travel to an affected country and/or relevant exposure.
2. Advise the patient not to attend the primary care facility, but instead await further advice from the public health unit. If practicable and the problem is urgent, the patient may be asked to contact the designated EVD treatment hospital.
3. Contact the relevant public health unit, which will assist in assessment and management of the patient and, if necessary, coordinate transfer to the designated EVD hospital via ambulance.
4. If it is an emergency, contact the ambulance service on 000 and advise the operator of the patient's potential risk factors to ensure that ambulance personnel arrive wearing the correct personal protective equipment (PPE).
5. If, following discussion with the public health unit and infectious diseases physicians, it is decided that the patient does not require further assessment or testing for EVD, manage the patient as per usual practice.

Scenario 2—Patient presenting in person to a primary healthcare setting

1. **Identify.** The patient reports a history of travel to an affected country and possible contact with a patient with EVD.
2. **Isolate.**
 - Escort the patient to a single room and close the door, to avoid unnecessary direct contact.

- Do not perform any procedures unless urgently required for patient care or stabilisation.
 - Where practicable, remove unnecessary equipment from the room to reduce cleaning requirements.
 - 3. **Inform.** Contact the local public health unit to assist in risk assessment and coordinate transfer to the designated EVD treatment hospital via ambulance.
 - 4. **Determine PPE.** If direct contact is unavoidable, assign a single healthcare worker (HCW) to put on PPE.
 - Perform hygiene with soap and water, or alcohol-based hand rub, and put on PPE.
 - Standard precautions apply to all HCWs.
 - All items should be single use:
 - gloves: disposable (not vinyl)
 - long-sleeved gown: fluid resistant, single use
 - surgical or P2 mask (see Chapter 4): fluid repellent
 - eye protection: goggles or full face shield.
- See Chapter 4 for specific instructions for putting on and taking off PPE.

3.4.4 Emergency first responders

The information in this section may be used to prepare and train emergency first responders. Individual providers can use this information to stay safe while responding to patients who are suspected to have EVD.

Emergency first responders include:

- paramedics and ambulance officers
- medical first responders, such as law enforcement, and fire and retrieval service officers.

Box 2 outlines the key points for emergency first responders.

Box 2 Key points for emergency first responders

- Although inpatient hospital settings generally present a higher risk of Ebola virus transmission to healthcare workers (HCWs), transport by ambulance services presents unique challenges because of the uncontrolled nature of the work, the potential need for resuscitation procedures, the enclosed space during transport, the close proximity of the paramedic to the patient and varying levels of patient acuity.
- It is important for paramedics and ambulance officers to have a screening protocol that includes specific questions that can be asked of callers about whether the patient has been in a country or area with widespread Ebola virus transmission in the past 21 days, and if they have signs and symptoms of Ebola virus disease (EVD). These symptoms include fever, headache, muscle pain, weakness, fatigue, diarrhoea, vomiting, abdominal pain and unexplained haemorrhage.

- Managers of medical first responders should collaborate with local public health authorities to develop coordinated plans for responding to a person with possible EVD in a given jurisdiction, including the possibility of designating specific teams for this response.
- All ambulance personnel should be trained in EVD response protocols. Those who may respond to a person with possible EVD should also be trained in the use of appropriate PPE that is consistent with their response role.
- Local protocols should be developed for cleaning and disinfecting the ambulance and equipment, and waste disposal, consistent with this guidance (see Chapter 5).

Pre-hospital resuscitation procedures—such as endotracheal intubation, open suctioning of airways and cardiopulmonary resuscitation—frequently result in production of a large amount of body fluids, such as saliva and vomit. Performing these procedures in a less controlled environment (e.g. a moving vehicle) increases the risk of exposure of emergency management service providers to infectious pathogens. If these procedures are required, they should be performed under safer circumstances (e.g. a stationary vehicle, hospital destination), and the recommended PPE should be worn during aerosol-generating procedures.

Two scenarios of a patient with EVD presenting to ambulance—one with and one without advance notice—are described in Box 3. Note that the same steps as for IPC for EVD—identify, isolate, inform, determine PPE—apply in the ambulance setting.

Box 3 Proposed management for ambulance settings

Scenario 1—Advance notice of a patient requiring ambulance attendance

1. The person taking the call should ask the caller whether the patient has returned from an Ebola-affected country or has had contact with an individual with Ebola virus disease (EVD) within the past 21 days, and has signs or symptoms of EVD.
2. If the person who takes the call receives information that alerts them to a person with possible EVD, they should ensure that any first responders are aware of this possibility before they arrive on scene.
3. When advised by call centre staff that a patient with suspected EVD is to be transferred to a designated hospital, put on the recommended personal protective equipment (PPE) before attending the patient. Notify the public health unit.
4. Transport the patient—note additional points for patient management in scenario 2.

Scenario 2—No advance notice of a patient with possible EVD before arrival of the ambulance

1. During patient assessment and management, conduct a risk assessment that includes consideration of EVD exposure history, patient symptoms and anticipated healthcare activities. If EVD is a possibility, notify the public health unit at once.
2. To minimise potential exposure, only one ambulance officer should approach the patient. They should perform the initial screening from at least 1 metre away from the patient.
3. Ensure that no one has direct contact with a patient who may have EVD without wearing appropriate PPE (described in step 4).
4. Put on appropriate PPE:

- double gloves: disposable (not vinyl)
 - long-sleeved, fluid-resistant, single-use gown (head cover required); using gowns requires specific training for safe removal
 - P2 mask: fluid repellent
 - eye protection: goggles or full face shield
 - lower leg and footwear covering
 - full head covering for skin and hair.
5. Notify the receiving hospital (designated EVD hospital) of a suspected EVD patient, in advance, to ensure that the proper infection prevention and control precautions are in place before the ambulance arrives.

3.5 Laboratories

Refer to the [Australian Government Department of Health website for guidelines on specific procedures and precautions](#) for collection, transport and processing of samples collected from patients with suspected EVD, and associated IPC measures (including PPE) for laboratory staff.

These guidelines, prepared by the Public Health Laboratory Network, allow the necessary on-site testing for other possible causes of the illness, and other testing required for the immediate and ongoing management of the patient.

4 Personal protective equipment and other risk reduction measures

Key points

- A risk assessment approach should be used before every interaction with a symptomatic patient who is suspected or confirmed to have Ebola virus disease (EVD), to determine the need for additional infection prevention and control measures, such as enhanced personal protective equipment (PPE) (see Chapter 3).
- PPE must be used by healthcare workers (HCWs) caring for any patients with confirmed or suspected EVD. At a minimum, PPE should include a fluid-resistant gown, protection of the hands, and protection of the mucous membranes of the eyes, mouth and nose.
- If caring for a patient with confirmed EVD, or with suspected EVD who is clinically unstable or producing copious secretions, the HCW should have all mucous membranes, skin and clothing covered, in case an aerosol-generating procedure is urgently required.
- PPE should be adequate, but not excessive. Wearing PPE in excess of that recommended, will potentially restrict movement and vision, increase the risk of heat stress, and make putting on and taking off PPE more complex. The risks (to the HCW and patient) of using items in addition to those recommended may outweigh any theoretical benefits.
- HCWs caring for patients with confirmed or suspected EVD must be adequately trained and confident in the use of recommended PPE.
- Putting on and taking off PPE must be done slowly and methodically, according to an agreed sequence, and supervised by a trained buddy.

Asymptomatic people do not transmit Ebola virus by routine clinical or household contact. A patient infected with Ebola virus is most infectious during the secretory symptomatic phase. Strict adherence to infection prevention and control (IPC) practices, including hand hygiene and using personal protective equipment (PPE), is the key to minimising the risk of transmission (see Chapter 2).

4.1 General principles

Transmission-based precautions must be implemented for patients with suspected or confirmed Ebola virus disease (EVD). Patients who require hospitalisation must be isolated, and healthcare workers (HCWs) must use standard, contact and droplet precautions. When an aerosol-generating procedure is required, strategies to reduce aerosol generation must be implemented. Airborne transmission of Ebola virus between people has not been demonstrated, but spread during events that generate aerosols has not been excluded.

Routine practices include HCWs using PPE and other measures to protect both themselves and the patient from exposure to microorganisms (e.g. through splashes or sprays of blood or other body fluids, or secretions or excretions from the respiratory tract or other places). Assessing the risk of exposure to blood or other body fluids will determine the need for enhanced PPE (e.g. double gloving, head and neck coverings, foot and leg coverings). Exposure to blood and other body fluids will increase the HCW's risk of exposure to Ebola virus.

Healthcare facilities must have systems in place to minimise the risk of disease transmission. Healthcare delivery should be undertaken in a safe and cost-effective manner; therefore, a tiered risk management approach should be implemented when selecting PPE, based on the clinical condition of the patient.

Correct use of PPE, in conjunction with physical isolation of the patient, is the key measure to reduce the risk of transmission of Ebola virus. Basic advice for using PPE includes the following:

- Hands are known to transmit pathogens to other parts of the body or face, and to other individuals. Therefore, hand hygiene and double gloves are essential, to protect the HCW and to prevent transmission to others.
- PPE should protect the mucous membranes of the eyes, mouth and nose to prevent exposure to splashes of body fluids and potential self-contamination.
- In the care of a patient with confirmed EVD, or with suspected EVD who is clinically unstable or producing copious secretions, the HCW should wear PPE that covers all mucous membranes, skin and clothing. This includes the head and neck (face shield or goggles, hood that covers the neck and shoulders), hands (double gloves) and clothing (gown, footwear covers), in case an aerosol-generating procedure is urgently required.
- PPE should be adequate, but not excessive. Wearing PPE in excess of that recommended, will potentially restrict movement and vision, increase the risk of heat stress, and make putting on and taking off PPE more complex. The risks (to the HCW and patient) of using items in addition to those recommended may outweigh any theoretical benefits.
- HCWs who are most likely to work with patients with suspected or confirmed EVD must undergo rigorous training, and be practised and competent in the use of PPE, including putting it on and taking it off in a systematic manner.
- Putting on and taking off PPE must be undertaken slowly and methodically, according to an agreed sequence (see Section 4.3), and supervised by a trained buddy or monitor (see Section 4.5). This is to ensure that each item is put on and taken off in the correct order and with the correct technique, to avoid contamination. The buddy should wear basic PPE relevant to the task they are doing (i.e. gown, gloves and face shield) to protect mucous membranes and clothes, as outlined in Section 4.5.
- The number of HCWs and visitors having contact with the suspected or confirmed case should be minimised.

4.2 Personal protective equipment items

4.2.1 Masks

Airborne spread of Ebola virus has not been demonstrated. However, a P2 mask is recommended in the care of symptomatic patients with suspected or confirmed EVD because of the mask's fluid-resistant rigid structure and the possibility that an aerosol-generating procedure may be required.

A fluid-resistant surgical mask can be used safely for short-term care of a patient with suspected EVD who is clinically stable (i.e. no secretory symptoms).

4.2.2 Face shield or goggles

Either a face shield or goggles will effectively protect the conjunctivae. Goggles can be relatively hot and subject to fogging, especially in hot, humid conditions. Goggles do not offer the same level of protection as a face shield; the latter provides extra skin coverage and reduces the risk of the HCW touching their face.

4.2.3 Head cover

Various types of head cover are available, including a balaclava-type cover, or a surgical hood with flange to cover the neck and upper chest. Depending on the design, the head cover may be worn outside or beneath the gown. Head covers with a full flange that covers the shoulders should be worn outside the gown. A powered air-purifying respirator (PAPR) is also suitable; see Section 4.2.4.

4.2.4 Powered air-purifying respirator

PAPRs are relatively expensive and in limited supply. Some components (waist strap and power pack) have reusable components that must be decontaminated after each use. However, they replace a P2 mask, goggles or face shield, and a head cover, and are more comfortable for prolonged use because they supply fresh, cool air to the face.

4.2.5 Body covering

In most Australian healthcare settings, a fluid-resistant gown will be the preferred body covering. The criteria for choice of gown are that it be sufficiently fluid resistant to prevent clothes becoming wet if splashed,^h be large enough to allow free movement, cover the wrists, reach to mid-calf and overlap at the back so that no underlying clothing is exposed.

In some settings (e.g. pre-hospital/ambulance), coveralls are used routinely and preferred. They provide equivalent protection but are more difficult to remove, especially if hooded, and are more likely to cause heat stress. They are not recommended for routine use, unless HCWs have been specifically trained, and are confident in their use and safe removal. This document refers to the use of gowns rather than coveralls.

4.2.6 Gloves

Two pairs of gloves must be worn. The inner glove is worn inside and the outer glove outside the gown's wristband; the outer glove must be long enough to cover the wristband and remain in place without a gap and without the need for taping. Gloves must be the correct size for the user. Nitrile gloves are preferred to latex gloves, as they are more resistant to the effects of alcohol and less likely to cause an allergic reaction. Sterile gloves are not required, except during invasive procedures, but are preferred by some because they provide a better fit. Taping gloves is discouraged because, during removal, the glove may be torn and hands could become contaminated.

^h Note that gowns have different levels of fluid resistance. The level should be checked before use to ensure that it is adequate to prevent the underlying clothes or skin from getting wet.

4.2.7 Shoes/boots and shoe covering

Footwear should be enclosed, and resistant to fluids and sharps. Some facilities provide clogs or rubber boots for staff who remain in the isolation zone. However, personal footwear can be adequately protected with fluid-resistant, disposable boot covers that reach to at least mid-calf and are overlapped by the gown. In the unlikely event that shoes become contaminated (e.g. by fluid leaking into the boot cover, or the boot cover splitting), they must be discarded as contaminated waste.

4.3 Putting on and taking off personal protective equipment

Before applying PPE, staff must remove all jewellery (including watches, rings, necklaces and earrings) and leave it outside the patient room. In addition, wallets, mobile phones, ID tags and other personal items must not be taken into the room. Hair should be tied back out of the face and eyes, and fully covered. This includes fringes (wearing a surgical cap may help) and beards. Those with beards may need to shave if a P2 mask cannot be properly fitted, or wear a PAPR.

Each healthcare facility should determine an appropriate sequence for putting on and taking off PPE, and train staff accordingly (see Box 4). Taking off used PPE is a high-risk process that requires a structured and systematic procedure; therefore, facilities must ensure that a step-by-step process for taking off PPE is developed and documented. The general principle is that the outermost items (which are most likely to be contaminated because they may have been in contact with the patient or their fluids) are removed first and in such a way as to avoid contact between these items and unprotected skin. The mask should be removed second last (the inner gloves are last) because of possible contamination during PPE removal.

A trained buddy and a designated area for removal is required to ensure protection (see Section 4.5). PPE must be removed slowly and deliberately in the correct sequence, to reduce the possibility of self-contamination or other exposure to Ebola virus. Specific examples are provided in Section 4.4.

Box 4 Principles when putting on and taking off personal protective equipment

Within these principles, there can be more than one 'correct' way to put on or take off personal protective equipment (PPE). Each hospital is to establish its own protocol in accordance with these principles.

Putting on

- Ensure that the PPE selected is an appropriate size and is fitted correctly.
- Visually check each item of PPE to ensure that it is not damaged or torn.
- Put on PPE carefully and in the recommended sequence to ensure protection of mucous membranes and all exposed skin.
- Put on PPE in a designated area (green zone—see Section 4.3.1).
- While wearing PPE, do not touch face protection (face shield, goggles or mask) while in the patient room.

Taking off

- Move away from the patient room (red zone—see Section 4.3.1).

- Visually check each PPE item to ensure that it is not contaminated, damaged or torn.
- Wipe away any visible contamination using a hospital-grade disinfectant wipe.
- Follow a consistent sequence for removal.
- Remove PPE in a designated area (orange zone—see Section 4.3.1).
- Remove PPE slowly and carefully to minimise the risk of contamination of scrubs and skin.
- Avoid contact with potentially contaminated outer surfaces of the PPE.
- Frequently use an alcohol-based hand rub to prevent contamination of gloved (or bare) hands by contaminated garments and, potentially, of mucous membranes by contaminated hands.
- Use hand hygiene (on clean gloves) before taking any PPE off your face.
- Do not touch used PPE or contaminated surfaces in the area where PPE is taken off with bare hands or skin.
- In the unlikely event that footwear or personal clothing (e.g. underwear, socks) becomes contaminated by a patient’s blood or other body fluids, safely remove these items and discard them with the used PPE.

4.3.1 Zones

Zones should be observed when putting on and taking off PPE (see Table 5). The clinical area may be designated with three separate zones, as detailed in Section 2.2.5. These zones are designed to reduce the risk of contamination while putting on and taking off PPE, to safely remove waste from the patient room, and to minimise the risk of contamination of supplies and other people in the immediate area.

Table 5 Colour-coded zones

Colour	Designation	Description
Red	High risk; heavy contamination	Immediate patient environment—that is, the patient room and en suite—which requires full PPE at all times
Orange	Low risk; possible contamination	Designated area (to be marked with tape) immediately adjacent to the patient room—for taking off PPE and holding clinical waste until double bagged and surface decontaminated
Green	Outside; no contamination	All other areas, including area to put on PPE and take off scrubs, and for storing locked waste bins before removal

4.4 Levels of personal protective equipment

When selecting appropriate and practical PPE to control the risk of infection, consider the tasks to be undertaken, the environment in which the PPE is being used and the person using the PPE. When selecting PPE to protect HCWs, the potential exposure routes to be considered are:

- direct contact (through broken skin or mucous membranes) with blood or other body fluids

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- indirect contact with environments that are contaminated with splashes or droplets of blood or other body fluids.

The Infection Prevention and Control Expert Advisory Group recommends two levels of PPE:

- **Level 1.** The first level of PPE is for initial assessment of patients with suspected EVD (including triage and assessment of a person under investigation), where the patient has low-risk symptoms (fever, headache, malaise). The PPE should include measures to protect hands (double gloves), clothing (fluid-resistant gown), and mucous membranes of the eyes, mouth and nose (P2 or surgical mask; face shield or goggles).
- **Level 2.** The second level of PPE (enhanced PPE) is for nursing, clinical care and treatment of patients with confirmed EVD, and for patients with suspected EVD who have high-risk symptoms (vomiting, diarrhoea, haemorrhage). The PPE should include measures to protect hands (double gloves), clothing (fluid-resistant gown), and the mucous membranes of the eyes, mouth and nose (P2 mask, and face shield or goggles; or PAPR). It should also provide full protection of all clothing (lower leg and footwear coverings), skin and hair (hood or PAPR).

PPE must be chosen to give maximum protection while ensuring minimum discomfort to the wearer. Uncomfortable or inappropriate equipment is unlikely to be worn or removed properly. The PPE selected should be of suitable quality to provide the required level of protection in the particular working conditions.

Box 5 provides a step-by-step checklist of actions to take during a level 1 PPE situation.

Box 5 Level 1 personal protective equipment checklist for low risk of exposure to blood and other body fluids

Recommended personal protective equipment (PPE) for contact and droplet precautions includes:

- fluid-resistant P2 (if available) or surgical mask
- face shield or goggles
- two pairs of gloves
- long-sleeved, fluid-resistant gown.

Note:

- Putting on and taking off PPE must be supervised by a trained buddy (see Section 4.5).
- Head and neck coverings, and foot and leg coverings are not required.
- A high risk of exposure requires enhanced precautions (see Box 6).

Putting on PPE in clean (green) zone

Perform hand hygiene before and after any contact with the patient or their surroundings according to the '[5 moments for hand hygiene](#)'.

Remove all personal items.

Visually inspect PPE to check integrity of all items.

Pull hair back from face and neck, and secure.

Perform hand hygiene.

Put on first pair of (non-sterile) gloves.

Put on long-sleeved gown; secure at neck and waist.

Put on mask (follow manufacturer's directions and perform fit-check for each application):

- Ensure headbands are positioned so that one strap is at the back of the neck and the other is on the crown of the head.
- Mould nosepiece across the bridge of the nose by firmly pressing down to ensure there is no air leakage.
- Reposition headbands, if required, to secure facial seal around the edges of the mask.

Put on disposable full-face shield.

Put on second pair of (non-sterile) gloves; ensure that gloves extend over cuffs of gown.

Visually inspect PPE to check integrity of all items.

Enter patient room.

Taking off PPE in patient care (red) (where there is a low risk of exposure to blood and other body fluids) or possibly contaminated (orange) zone

Visually inspect PPE to check integrity of all items.

Remove outer gloves; peel glove from cuff down over fingers so that glove is inside out, and discard glove into clinical waste bag.

Remove long-sleeved gown.

Perform hand hygiene (alcohol-based hand rub [ABHR] applied to gloves).

Remove face shield.

Perform hand hygiene (ABHR applied to gloves).

Remove mask.

Perform hand hygiene (ABHR applied to gloves).

Remove inner gloves; peel glove from cuff down over fingers so that glove is inside out, and discard glove into clinical waste bag.

Perform hand hygiene.

If prescription glasses are worn

Put on new pair of gloves.

Remove and clean glasses with hospital-grade disinfectant wipe and allow to dry.

Remove gloves and perform hand hygiene.

Box 6 provides a step-by-step checklist of actions to take during a level 2 PPE situation.

Box 6 Level 2 personal protective equipment checklist for high risk of exposure to blood and other body fluids

Recommended personal protective equipment (PPE) for enhanced contact and droplet precautions includes:

- P2 mask, face shield or goggles, and head cover OR a powered air-purifying respirator

- two pairs of gloves
- surgical scrubs (or equivalent), and long-sleeved, fluid-resistant gown to mid-calf or coverall
- enclosed, fluid- and sharps-resistant footwear plus fluid-resistant boot covers to mid-calf
- plastic apron if fluid contamination is anticipated.

Note:

- The mask must not be removed at any time in the presence of the patient with EVD.
- Putting on and taking off PPE must be supervised by a trained buddy (see Section 4.5).
- All exposed skin must be covered.

Putting on PPE in clean (green) zone

Perform hand hygiene before and after any contact with the patient or their surroundings according to the '[5 moments for hand hygiene](#)'.

Remove all personal items.

Change into scrubs (surgical attire)

Visually inspect PPE to check integrity of all items.

Pull hair back from face and neck, and secure.

Perform hand hygiene.

Put on boot covers.

Put on first pair of (non-sterile) gloves.

Put on long-sleeved gown; secure at neck and waist.

Put on mask (follow manufacturer's directions and perform fit-check for each application):

- Ensure headbands are positioned so that one strap is at the back of the neck and the other is on the crown of the head.
- Mould nosepiece across the bridge of the nose by firmly pressing down to ensure there is no air leakage.
- Reposition headbands, if required, to secure facial seal around the edges of the mask.

Put on head cover that covers all hair, ears and neck, and ensure that it extends to the shoulders.

Put on plastic apron (if required).

Put on full disposable face shield.

Put on second pair of (non-sterile gloves); ensure gloves extend over cuffs of gown.

Visually inspect PPE to check integrity of all items.

Enter patient room.

Taking off PPE in possibly contaminated (orange) zone

Before leaving patient care (red) zone, visually inspect PPE to check integrity of all items. Wipe away any visible contamination using a hospital-grade disinfectant wipe.

Move to designated PPE removal (orange) zone.

Remove outer gloves; peel glove from cuff down over fingers so that glove is inside out, and discard glove into clinical waste bag.

Remove apron (if used).

Perform hand hygiene (alcohol-based hand rub [ABHR] applied to gloves).

Remove face shield.

Perform hand hygiene (ABHR applied to gloves).

Remove boot covers.

Perform hand hygiene (ABHR applied to gloves).

Remove head covering (if it is the type with a flange worn outside the gown).

Perform hand hygiene (ABHR applied to gloves).

Remove long-sleeved gown.

Perform hand hygiene (ABHR applied to gloves).

Remove mask.

Perform hand hygiene (ABHR applied to gloves).

Remove inner gloves; peel glove from cuff down over fingers so that glove is inside out, and discard glove into clinical waste bag.

Perform hand hygiene.

Visually inspect scrubs:

- If contaminated, remove and discard as per Chapter 5.
- If not contaminated, discard them as non-infectious used linen after taking them off in an uncontaminated ('green') zone.

If prescription glasses are worn

Put on new pair of gloves.

Remove and clean glasses with hospital-grade disinfectant wipe and allow to dry.

Remove gloves and perform hand hygiene.

4.5 Trained buddies

The 'buddy' is a trained, experienced HCW who observes, guides and documents activities of HCWs caring for patients with EVD. This includes alerting the HCW to any potential breaches of IPC, while supervising putting on and taking off PPE.

The level of PPE required by the buddy will depend on whether they are physically assisting with the removal of the PPE or only observing. In general, this will include at least a face shield, gown and gloves. If the buddy is required to assist in the patient room in the case of an emergency, they must put on appropriate PPE.

The role of the buddy includes the following:

- Check and record that the PPE is put on properly, in the correct order according to the checklist, and before the HCW enters the patient room; specifically
 - check that the PPE covers all body surfaces and remains in place during bending or stretching
 - fit-check the P2 mask
 - assist if required (e.g. with tying the apron or gown).
- Observe the HCW at all times while in the patient room (via window or video monitor), checking for any breaches in PPE (e.g. HCW touches their own face, dislodges PPE).
- Record all people entering the patient room.
- Check and record that the PPE is removed slowly and methodically, to avoid contamination; specifically
 - check for visible contamination or damage to the PPE before starting removal
 - read out and check off each item to be removed in the correct order
 - if necessary, assist with untying of apron or gown ties, or taking off boot covers—perform hand hygiene after this has been done
 - wipe down surfaces (e.g. chair used by the HCW while taking off PPE).
- Ensure that the HCW—who is likely to be tired, hot and, possibly, distressed at the end of a shift—remains calm and focused while taking off PPE.
- Identify (and record, if appropriate) any potential breach of procedure during patient care or PPE removal, and advise on further action, such as showering (or clinical follow-up).
- Ensure that correct hand hygiene technique is followed while taking off PPE; the buddy should dispense the alcohol-based hand rub onto the HCW's hands (to prevent contamination of the dispenser).
- Ensure that the removed PPE items are discarded into a clinical waste bag and not allowed to come into contact with any environmental surface (see Section 4.7 and Chapter 5).

4.6 Visitors

In general, visitors are not permitted while the patient is in isolation. In particular, no child should visit because of difficulty in ensuring adherence to PPE. If a visit from someone other than immediate healthcare staff is required, for any reason, they must be trained and supervised during the visit in the correct use and safe removal of the same PPE as used by healthcare staff.

4.7 Disposal or decontamination of personal protective equipment

Following removal, disposable PPE must be double bagged and placed into suitable rigid, lockable waste bins for disposal as Category A clinical infectious waste (see Chapter 5).

If certain parts of the PPE must be reused (e.g. motorised power packs for PAPRs), they should be protected from contamination as much as practicable and decontaminated using an appropriate method before reuse.

5 Environmental hygiene and waste management controls

Key points

- Staff responsible for environmental hygiene and waste management should wear personal protective equipment appropriate to the clinical setting and relevant patient zone (red, orange or green).
- Environmental hygiene should be undertaken using either a two-step cleaning with detergent followed by disinfectant, or a combined 2-in-1 cleaning with detergent and disinfectant.
- Only disinfectants approved by the Therapeutic Goods Administration should be used. They must be used at the recommended strength.
- Environmental cleaning and waste disposal should be tiered, as for clinical management, according to a risk assessment (see Chapter 3).
- If required by local authorities, a strong chlorine solution should be added to the toilet after a patient with Ebola virus disease (EVD) uses it (high-risk setting), and left for 30 minutes before flushing. The toilet lid should be closed before flushing.
- Clinical waste contaminated with body fluids from a patient with EVD (high-risk setting) should be double bagged, appropriately packaged, secured to prevent unauthorised access, and then transported on wheels in a locked, rigid container to be sterilised in an autoclave or incinerated.
- If a patient with suspected EVD is not producing secretions (low-risk setting), clinical waste and equipment not contaminated with blood or other body fluids should be disinfected (if reusable), or discarded as routine clinical waste.
- Linen should be treated in the same way as clinical waste.
- A record should be kept of staff involved in packaging, handling and transport of waste material or linen.

All personnel involved in environmental hygiene and waste management should wear appropriate personal protective equipment (PPE). In environments in which patients with Ebola virus disease (EVD) are being cared for, healthcare workers (HCWs), and staff responsible for environmental hygiene and waste management should wear PPE appropriate to the relevant patient zone in which they are working (red, orange or green; see Section 4.3.1). Bags should never be slung over a shoulder or carried in a manner that permits contact with the carrier's body or legs. Bags should always be transported in a rigid container on wheels.

Environmental hygiene should use either a two-step cleaning with detergent followed by disinfectant, or a combined 2-in-1 cleaning with detergent and disinfectant. Only disinfectants that are effective and approved by the Therapeutic Goods Administration should be used, and they must be used at the recommended strength. This guidance document does not provide an approved list of products; rather, infection control practitioners engaged in planning and preparing for care of patients with EVD should refer to procurement lists of their hospital and/or area health service that contain the imprest products available.

Chlorine-based disinfectants are most commonly used for environmental hygiene. Different concentrations (expressed as percentages or parts per million [ppm] of available chlorine, usually as sodium hypochlorite) are used in different situations, depending on the presence of organic matter and the likely microbial load. Household bleach is approximately 5% or 50 000 ppm sodium hypochlorite. The exact concentrations depend on the starting preparations used. In this chapter, they are referred to as:

- ‘strong’ or ‘high concentration’, which means 5000–10 000 ppm or 0.5–1% available chlorine
- ‘weak’ or ‘low concentration’, which means 500–1000 ppm or 0.05–0.1% available chlorine.

Once diluted, chlorine solutions lose potency rapidly and so must be prepared at least daily, in small volumes, as required for use. Spray bottles should be avoided because of the danger of creating wet and slippery surfaces (from the overspray), as well as the risk of inhaling toxic chlorine-containing droplets.

5.1 Codes and regulations

5.1.1 Australian Dangerous Goods Code

Chapter 2.6 of the Australian Dangerous Goods (ADG) Code contains information about transporting dangerous goods. Infectious substances are in Division 6.2 under Class 6—Toxic and infectious substances.³

Ebola virus in any form is a ‘Category A infectious substance’. Category A is defined as ‘an infectious substance which is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals’.³ Thus, any waste material or linen that is contaminated with blood or other body fluids from a patient with EVD is currently covered by these definitions and will be classified in Category A.

Infectious substances meeting these criteria that cause disease in humans must be labelled and transported as UN 2814—INFECTIOUS SUBSTANCE, AFFECTING HUMANS.

Dangerous goods must be packaged, transported and disposed of correctly. The waste generator (i.e. the hospital) is responsible for safe and secure packaging in compliance with the requirements of the competent authority in the relevant jurisdiction. For UN 2814 substances, a minimum of three layers of packaging are required—that is, a leak-proof primary receptacle, a leak-proof secondary packaging and a rigid outer packaging (drum, box or rigid bin).

Medical waste rendered safe by steam sterilisation in an autoclave, incineration or high-level chemical disinfection is not regarded as dangerous and is not bound by the ADG Code.

5.1.2 Regulators

The National Transport Commission is the Australian Government agency that hosts the ADG Code, but it is not the national ‘competent authority’ for the purposes of packaging, transporting and disposing of infectious substances. Within Australia, state and territory government agencies are responsible for the regulation of dangerous goods, and there are ‘competent authorities’ in each jurisdiction. However, their roles and responsibilities are not uniform. The appropriate authorities in each state and territory can provide exemptions to permit safe and secure packaging, transport and

disposal under the ADG Code. Exemptions are important during a potentially dangerous situation when handling of dangerous goods does not fit neatly within the ADG Code.

5.2 Assumptions about Ebola virus-containing waste

The body fluids of patients with EVD who have symptoms of diarrhoea, vomiting and/or haemorrhage may contain high concentrations of viable and infectious Ebola virus, and must be treated as potentially highly infectious. Any object (fomite) contaminated with Ebola virus-containing body fluids should be assumed to be a potential vector of infection.

Clinical waste, including any equipment from an EVD patient's isolation room, will be potentially contaminated with Ebola virus. These include:

- all items of PPE used by HCWs
- linen (sheets, blankets, pillowcases, other absorbent material)
- the patient's personal items (towels, toothbrush, toothpaste tube, shaving equipment, hair comb and brush)
- environment cleaning equipment (mop heads, absorbent material used for cleaning surfaces).

For the purposes of packaging and transport by rail or road, all such clinical waste from an EVD patient room should be treated as a Category A infectious substance under the ADG Code until it can be sterilised or decontaminated (e.g. by autoclaving, incineration or chemical disinfection).

Single-use equipment should be used whenever possible. Large, reusable pieces of equipment, such as mattresses and critical medical equipment, are safe for reuse if their surfaces can be properly cleaned and decontaminated. They should be discarded if they are so heavily contaminated that inactivation of viable Ebola virus is deemed impossible. Risk mitigation should always be undertaken. For example, mattresses should be checked before use to ensure that they are intact and impermeable, and after patient discharge to ensure that no or damage and consequent leakage has occurred during use.

Clinical waste may also be generated in the home, community or ambulatory healthcare settings, if a symptomatic person with EVD has vomiting, diarrhoea or bleeding before admission to a hospital isolation unit. Any items contaminated with blood or other body fluids in these settings are likely to contain Ebola virus and should be treated as a Category A infectious substance.

If a person with suspected EVD is later shown to have EVD, but was in the non-secretory phase, there is negligible risk that items they have used in the home, community or ambulatory care settings would be contaminated with Ebola virus. These items should be cleaned and reused in the normal way, unless there is another reason to discard them.

5.3 Waste disposal, and equipment and environment cleaning

5.3.1 Patient with suspected Ebola virus disease, while awaiting results

If a patient with suspected EVD is producing secretions (vomiting, diarrhoea, haemorrhage) while awaiting laboratory results, contaminated waste should be placed in sealed bags and treated in one of the following ways:

- left in the patient room until EVD has been excluded or confirmed

- stored (double bagged and in a rigid, sealed container; see Section 5.4) adjacent to the patient room in the orange zone
- discarded immediately as Category A infectious waste if there is insufficient room for storage.

If a patient with suspected EVD is not producing secretions while awaiting laboratory results, clinical waste (e.g. PPE, bedding) can be placed in sealed bags and handled according to the hospital's waste management policy.

In most circumstances, this will be as general rubbish. If a patient is not producing secretions, there is negligible risk that items they have used in the home, community or ambulatory care settings would be contaminated with Ebola virus. These items should be cleaned and reused in the normal way, unless there is another reason to discard them.

Any contaminated equipment should be cleaned and disinfected as described in Section 5.4.

5.3.2 Patient with confirmed Ebola virus disease

All waste generated during the care of a patient with confirmed EVD should be managed as Category A infectious waste according to the ADG Code.

The equipment in the patient room must be limited to what is essential for patient care. All equipment must be dedicated for that patient's sole use and remain within the room for the duration of their hospitalisation. Disposable products should be used, if available.

Any reusable equipment should be decontaminated before it is removed from the isolation room or reused. Any visible contamination should first be removed using a hospital-grade disinfectant wipe (e.g. strong chlorine disinfectant).

The item should be cleaned and disinfected using a two-stage process: a neutral detergent followed by a strong sodium hypochlorite solution.ⁱ Vaporised hydrogen peroxide (if available) is also suitable for terminal cleaning of equipment or the patient room after cleaning with neutral detergent. The manufacturers' instructions should be followed.

5.3.3 Staff training, and allocation of environmental cleaning and waste management duties

All staff involved in environmental hygiene and waste management should be trained in appropriate use of PPE, including safe putting on and taking off procedures (see Chapter 4).

The number of staff members entering the patient room should be limited. Therefore, in general, the nursing team should be responsible for cleaning within the patient room and en suite toilet/bathroom (red zone; see Section 4.3.1) for the duration of the patient's admission or until Ebola virus precautions are no longer needed.

Environmental service staff should be responsible for cleaning and disinfection of the potentially contaminated area where PPE is removed (orange zone), staff changing and showering facilities (green zone), and corridors in the designated isolation unit/area (green zone), and for terminal

ⁱ In this document, strong sodium hypochlorite solutions are those containing 5000–10 000 ppm available chlorine (0.5–1%), depending on the starting product; weak solutions contain 500–1000 ppm (0.05–0.1%). See the factsheet at the [South Australian Department of Health website \[PDF, 66KB\]](#).

cleaning and disinfection of the patient room and en suite (red zone). All cleaning staff must wear PPE appropriate to the relevant zone.

Nursing staff assigned to patient care should manage spills of blood and other body fluids within the patient room or en suite bathroom/toilet. Any spill occurring outside the patient room or en suite should be cleaned immediately, with appropriate precautions, by whichever member of staff is present at the time.

In circumstances when the attending nursing staff are unable to clean the patient room and en suite (red zone), cleaning personnel can do so, provided that they are properly trained, and confident in the use and removal of full PPE in a patient care environment.

5.4 Handling of Ebola virus–contaminated waste

Records should be kept of staff involved in packaging, handling and transport of clinical waste, and performing environmental cleaning in rooms occupied by patients with EVD (or those with suspected EVD who are producing body fluids).

5.4.1 Inactivation/sterilisation

Solid clinical waste can be double bagged and transported on wheels in a locked, rigid container for immediate steam sterilisation in an autoclave or burning in an on-site incinerator, if available.

Medical waste rendered safe by steam sterilisation, incineration or high-level chemical disinfection (e.g. with strong hypochlorite solution) is not regarded as dangerous goods or bound by the ADG Code, and so can be disposed of as general rubbish.

5.4.2 Double bagging

Healthcare facilities should have a system of double bagging in place for clinical waste from patients with EVD. This should involve keeping the first clinical waste bags inside the patient room and then placing these bags inside a second clinical waste bag kept immediately outside the patient room in the orange zone. The outside of the inner bag should be inspected for visible contamination or damage before it is placed in the second bag in the orange zone. If contaminated, an additional bag should be used (i.e. triple bagged).

Clinical waste bags should be sealed before being placed in a rigid outer container for transport. If the waste includes a liquid component, the inner and outer bag, or the space between them, should contain absorbent powder or material to contain any spill. Bags should not be filled to capacity, because this will prevent them from being adequately sealed.

Sharps containers must be certified to AS 4031:1992 and placed in an outer bag that contains absorbent material for disposal.

Double-bagged waste must be transferred directly to the facility's on-site sterilisation area, or be placed into a dedicated clinical waste bin that carries labelling consistent with UN 2814/ADG Code Division 6.2 for transport.

5.4.3 Autoclaving (steam sterilisation)

If there is an on-site autoclave facility close to the patient room, double-bagged waste—in a secure, rigid bin—can be sent for steam sterilisation. Autoclaves for the treatment of Ebola virus–contaminated wastes should be dedicated to the treatment of biohazardous wastes (i.e. not used for sterilising reusable devices) and validated for that purpose. Sterile waste can then be disposed of as routine clinical waste.

The receipt, treatment and disposal of each load must be documented, including confirmation that the necessary temperature and time for complete inactivation were achieved.

5.4.4 Incineration

Double-bagged wastes for transport and destruction via incineration must be placed and secured in a dedicated rigid container that is puncture resistant, able to be secured and in line with the ADG Code—that is, it is either leak-proof or contains an equally effective means of containing leakage.

The rigid container used to transport Category A waste must carry labelling consistent with UN 2814/ADG Code Division 6.2 (see Figure 1).

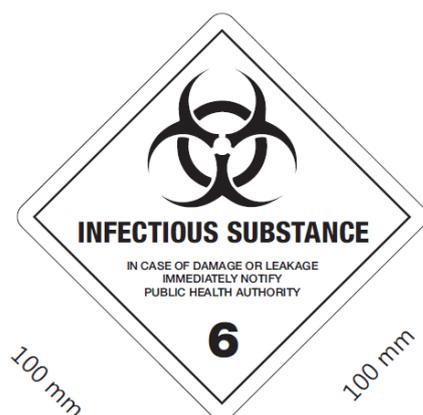


Figure 1 Labelling for Dangerous Goods Division 6.2, UN 2814—INFECTIOUS SUBSTANCES, AFFECTING HUMANS

Waste that needs to be temporarily stored before transport must be secured in a locked, dedicated area to prevent unauthorised access, tampering or accidental spillage.

The transfer of Ebola virus–contaminated waste into the custody of an appropriately trained and licensed waste management company should be documented.

5.4.5 Spill management

Spills of blood, vomit, faeces and other Ebola virus–containing body fluids or other material should be covered with absorbent paper towels, soaked with strong hypochlorite solution and left for 30 minutes before being wiped up. Paper towels are discarded into the clinical waste. The contaminated area is then again covered with strong hypochlorite solution and left for 30 minutes before rinsing with a mop.

5.4.6 Environmental cleaning

The recommended chemical disinfectant for cleaning surfaces and equipment is sodium hypochlorite.

Lipophilic viruses, including Ebola virus, are susceptible to chlorine compounds. Weak sodium hypochlorite is suitable for general disinfection of the environment and equipment in hospitals; strong hypochlorite is necessary when high viral loads are expected in the presence of organic material—for example, for cleaning contaminated environments and equipment. If available, vaporised hydrogen peroxide can be used as an alternative (after removal of gross contamination/spills and initial cleaning with neutral detergent), according to the supplier's instructions.

5.4.7 Toilet waste

Toilet waste from patients with EVD can be safely flushed into the sewerage system. As an enveloped virus, Ebola virus is more susceptible to environmental stresses and chemical germicides than most enteric viruses.¹⁶

Plumbers and other workers potentially exposed to human sewage should always wear appropriate PPE. HCWs should be wearing PPE, appropriate to the care of the patient, when they flush the toilet.

If required by local authorities, a strong chlorine solution should be added to the toilet after a patient with EVD uses it (high-risk setting), and left for 30 minutes before flushing. The toilet lid should be closed before flushing.

If a patient is unable to use the en suite toilet, a disposable bedpan/urinal should be used. The contents of the pan can be solidified with high-absorbency gel, then both the pan and contents disposed of into clinical waste. Alternatively, if a pan sanitiser is available in the isolation unit (red zone), a reusable pan can be disinfected by heat.

6 Post-mortem care and examination

Key points

- Transmission of Ebola virus from deceased patients has occurred frequently in Africa. The virus can be found in high concentrations in blood, many body secretions and tissues.
- Autopsies on patients who die from Ebola virus disease (EVD) should be avoided. Autopsies should only be done if directed by the coroner, and following discussion with the public health unit.
- Only healthcare workers trained in handling infected human remains and wearing appropriate personal protective equipment (PPE) should touch or move the body of a person who has died from EVD.
- The PPE requirements when handling a person who has died from EVD are the same as those required for contact with living (high-risk) patients. An apron should be worn over the PPE, because of the increased likelihood of significant contamination with blood or other body fluids.
- When a deceased person has suspected, but not confirmed, EVD, any post-mortem procedures should be delayed until testing for Ebola virus is completed. The body should be handled as if Ebola virus is present until the definitive test result is available.

There are two circumstances in which contact with a deceased body of a known or suspected case of Ebola virus disease (EVD) may occur. The most likely is where the person has been cared for in a hospital or other healthcare setting and died in that institution. The second is where a person has died at home or another location outside a healthcare setting, and is known or strongly suspected to have had EVD. This chapter relates to the former circumstance. Deaths outside a healthcare setting are covered by other guidelines.

It is expected that all healthcare workers (HCWs) who may be involved in handling the bodies of deceased people have been trained in, and will follow, standard precautions as part of their routine practice. Standard precautions protect staff and others against acquiring bloodborne viruses. This chapter describes the additional measures required to mitigate the risk of acquiring Ebola virus infection within healthcare settings, although these measures are also applicable to other settings.

6.1 Ebola virus in deceased patients

Transmission of Ebola virus from deceased victims has occurred frequently in Africa, as the virus can be found in high concentrations in blood, many body secretions and tissues. The virus is usually at its highest levels in people with progressive severe illness and at death. The virus may survive for several days in the body, and on surfaces contaminated with blood or other body fluids. When surfaces are physically cleaned, the likelihood of virus survival is greatly lowered.

Transmission most often occurs by direct contact with infectious material that leaks from the body and contaminates a mucosal or damaged skin surface, or directly or indirectly via a person's contaminated hands (or gloves) through self-inoculation. Ebola virus can also be transmitted through lacerations or puncture wounds from contaminated instruments or the sharp end of bones during post-mortem examinations (if performed). Appropriate personal protective equipment (PPE) will

protect people when they have direct contact with human remains, and against splashes of blood or other body fluids (e.g. urine, saliva, faeces) to unprotected mucosae (e.g. eyes, nose or mouth).

Some general precautions for handling patients who have died from EVD include the following:

- Autopsies should be avoided. An autopsy should only be done if directed by the coroner and following discussion with the public health unit.
- Only HCWs trained in handling infected human remains and wearing appropriate PPE should touch or move the body of any person who has died from EVD. In most circumstances, this would require the assistance of trained mortuary staff. This will include their assistance in making the body of a deceased person safe while still in a clinical care area.
- Handling of human remains should be kept to a minimum.
- Precautions for handling a person who has died from EVD are the same as those required for contact with living patients. An apron should be worn over the PPE because of the increased likelihood of significant contamination with blood or other body fluids. Mortuary staff and others likely to have contact with the body of a person who has died from EVD should be trained in putting on, wearing, taking off and disposing of PPE **before** contact with the body. Training should be the same as that recommended for care in designated hospitals (see Chapter 4), including using a buddy to ensure that PPE is applied and removed correctly.
- The number of staff involved in handling, or in the same room as, the body should be kept to a minimum.
- The body should be properly prepared (see Section 6.2) at the site of death. It should only be moved after this has been completed, and the outer surface of the body bag or other outer covering has been decontaminated.
- In the unlikely event that the patient dies outside an appropriate room (e.g. during transfer between facilities or rooms), the body should first be taken to an appropriate room (e.g. an isolation room) for preparation.
- When a deceased person has suspected, but not confirmed, EVD, any post-mortem procedures should be delayed until testing for Ebola virus is completed. The body should be handled as if Ebola virus is present until the definitive test result is available.

6.2 After-death care in hospitals

The body and immediate environment of the deceased are likely to be heavily contaminated with Ebola virus, and therefore scrupulous attention to appropriate PPE and cleaning procedures is required. Particular care needs to be taken to avoid injuries from sharp objects in or around the body.

Steps for after-death care procedures are as follows:

- Complete any identification procedures (including those needed for cremation) before the body is prepared, to avoid the need to reopen body bags later. Body bags should only be reopened if directed by the coroner and following discussion with the public health unit. A person required to identify the body must not have direct contact with the deceased. Any viewing should be done from a separate room, either through a window or via a video link. Anyone entering the room must wear appropriate PPE.

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- Do not remove intravenous lines, endotracheal tubes or other types of medical devices and tubing that are present at the time of death.
- Leave behind, in the patient room, any of the patient's personal belongings. This includes mobile phones and other equipment. These should be treated as contaminated waste.
- Do **not** wash or clean the body.
- Before a body is handled, use a surgical mask to cover the nose and mouth of the deceased. During manipulation and handling of bodies (e.g. while they are being placed into body bags), fluids can be expelled from body cavities. A mask should reduce the risk that fluids will travel any distance from any upper body cavities.
- Place the body in a sealed, leak-proof body bag. Preferably, this should be an impermeable plastic body bag, not less than 150 µm thick, that can be sealed with heat, adhesive or adhesive tape to make it leak-proof. If other bags are used (e.g. with zippers), they must have been tested and shown to be leak-proof. The particular body bags to be used should be selected in consultation with the receiving mortuary (as designated by the local public health unit).
- Once the body is enclosed in the first bag, change the outer gloves and apron worn by the HCW handling the body. Disinfect the inner gloves with an alcohol-based hand rub before new outer gloves are donned.
- Place the first bag sequentially into two further sealable leak-proof body bags not less than 150 µm thick.
- Decontaminate the surface of the outer body bag before transport to the mortuary. Remove any visible contamination on the bag surfaces with low-concentration hypochlorite solution, and then reapply the hypochlorite disinfectant to the entire outer body bag surface and allow to air dry.
- Take particular care to ensure that the bags are adequately protected from puncture by either any sharp objects inside the bags (e.g. medical devices left in place) or any external objects.
- Once the body bag has been decontaminated, staff should move to the area to take off PPE, and follow the sequence for taking it off (see Section 4.3).
- Clearly and indelibly write the name or identification of the deceased on the top surface of the outer bag.
- Clearly mark the outside of the body bag to show that the deceased is a suspected or confirmed case of EVD.
- Orientate bodies in bags with the seal pointing up, and to avoid pitch and roll of the body during transport to a morgue.

After the body is made safe for transportation (i.e. secured to prevent unauthorised access) using the procedures outlined above, continue as follows:

- Move the body from the patient room to the mortuary or to the parked funeral vehicle via a trolley with side walls to prevent accidental penetration of the body bags during movement on the trolley. Most facilities have a trolley designed to transport deceased people, which will have sides (not dissimilar to an open-lid coffin). These will need to be appropriately cleaned and disinfected after use.
- Ensure that the room or other site of death is cleaned and disinfected by a HCW trained in the use of PPE for EVD and environmental cleaning.

- Transport the body bag, once decontaminated. Now, the body bag is non-infectious and can be transported in the usual manner without any additional precautions, following the approval of the responsible public health unit.

6.3 Cremation and certification

In the case of cremations, in addition to the doctor certifying death, some jurisdictions require a government medical officer to sign the crematorium certification and view the deceased. This will present difficulties if the deceased has been sealed in body bags that cannot be later opened for safety reasons. In these jurisdictions, it is advisable to have a number of doctors in the areas caring for very ill patients with EVD (i.e. intensive care units) to apply to be accredited as a government medical officer. There should also be a label, signed by a doctor and secured to the outside of the body near the identification label or papers, stating whether the patient does or does not have a pacemaker. If a pacemaker is present, the label must state 'The pacemaker has NOT been removed'.

If the above process is not followed, and a government medical officer or other appropriate person who can sign the necessary certificates is not available at the time of death, the situation must be discussed with the coroner and the public health unit.

If there is a legal requirement for the body bag to be opened again for identification purposes, the body bag will have to be returned to the mortuary and the process undertaken there, using the procedures described in Section 6.4.

6.4 Handling bodies in the mortuary

Post-mortem examinations of patients with known or suspected EVD should be avoided wherever possible.

Basic procedures for handling bodies in the mortuary include the following:

- Carefully check for any evidence of leakage or soiling of the outer bag. If contamination is present, again place the bag in three sealed, leak-proof body bags as per the protocol for bodies.
- Do not perform embalming.
- Do not open the body bag or handle the remains.
- In the event that a body bag must be opened (e.g. under instruction from the coroner's office for identification purposes), follow the PPE procedures used for performing a post-mortem examination (see Section 6.5). Do not permit direct viewing of the body. Have the identifier view the body through a window or via a remote device, such as a closed-circuit or web camera.
- In the event of leakage or where the body bag is required to be opened, clean and disinfect any equipment used and the environment. Staff members doing this must be trained in PPE and cleaning for EVD.
- Place the body bag into a hermetically sealed casket for cremation or burial.
- No special precautions are required when transporting the hermetically sealed casket.

6.5 Post-mortem examinations

Non-coronial post-mortem examinations should not be performed on patients with confirmed or suspected EVD who have a known alternative cause of death. A post-mortem examination should only be carried out if there is a specific instruction from the coroner's office.

If a post-mortem is required, general procedures include the following:

- Try to use non-invasive procedures, such as imaging, with minimal invasive physical examination.
- In the event that a limited or full autopsy is necessary, following specific written instruction from the coroner's office, it should be conducted by appropriately trained senior staff in a physically separate room using precautions as required for surgical procedures on a patient with EVD.
- Leave the body in the body bag, if possible.
- Minimise the use of sharp instruments and the number of people in the room.
- If body incisions are needed, consider using added protection for staff, such as chainmail gloves or approved orthopaedic protective gloves, to help prevent sharp injuries from instruments or bones.
- After the examination is complete, seal the remains again in three body bags. Clean and decontaminate the outer bag before the body is moved.
- Ensure that the autopsy room or mortuary is cleaned and disinfected by a staff member trained in PPE and environmental cleaning for EVD.

6.6 Staff monitoring

All staff members who have come into contact with the body need to be monitored and documented. The procedure should follow the same requirements as for HCWs caring for living patients with EVD, after consultation with local public health authorities.

Appendix 1 Risk assessment scenarios for suspected Ebola virus disease

Table A1 provides a range of possible scenarios for the assessment of a person under investigation or a patient with suspected Ebola virus disease (EVD), and the recommended personal protective equipment (PPE). This is provided to assist with the risk assessment process, but does not replace the need for a careful description and analysis of risks for each individual patient.

Note that all confirmed EVD patients require level 2 (enhanced) PPE.

Table A1 Possible assessment scenarios and corresponding PPE level

Exposure history	Symptoms	Healthcare activity	PPE level
Travel to an Ebola virus disease-affected country in the past 21 days and high- or low-risk exposure	Lower transmission risk—fever, malaise and headache only	History and triage, examination, IV line insertion, venepuncture for diagnostic testing	1
	Lower transmission risk—fever, malaise and headache only	Invasive or aerosol-generating procedure	2
	Higher transmission risk—vomiting, diarrhoea and haemorrhage	History and triage, examination, IV line insertion, venepuncture for diagnostic testing	2
	Higher transmission risk—vomiting, diarrhoea and haemorrhage	Invasive or aerosol-generating procedure	2

IV = intravenous; PPE = personal protective equipment

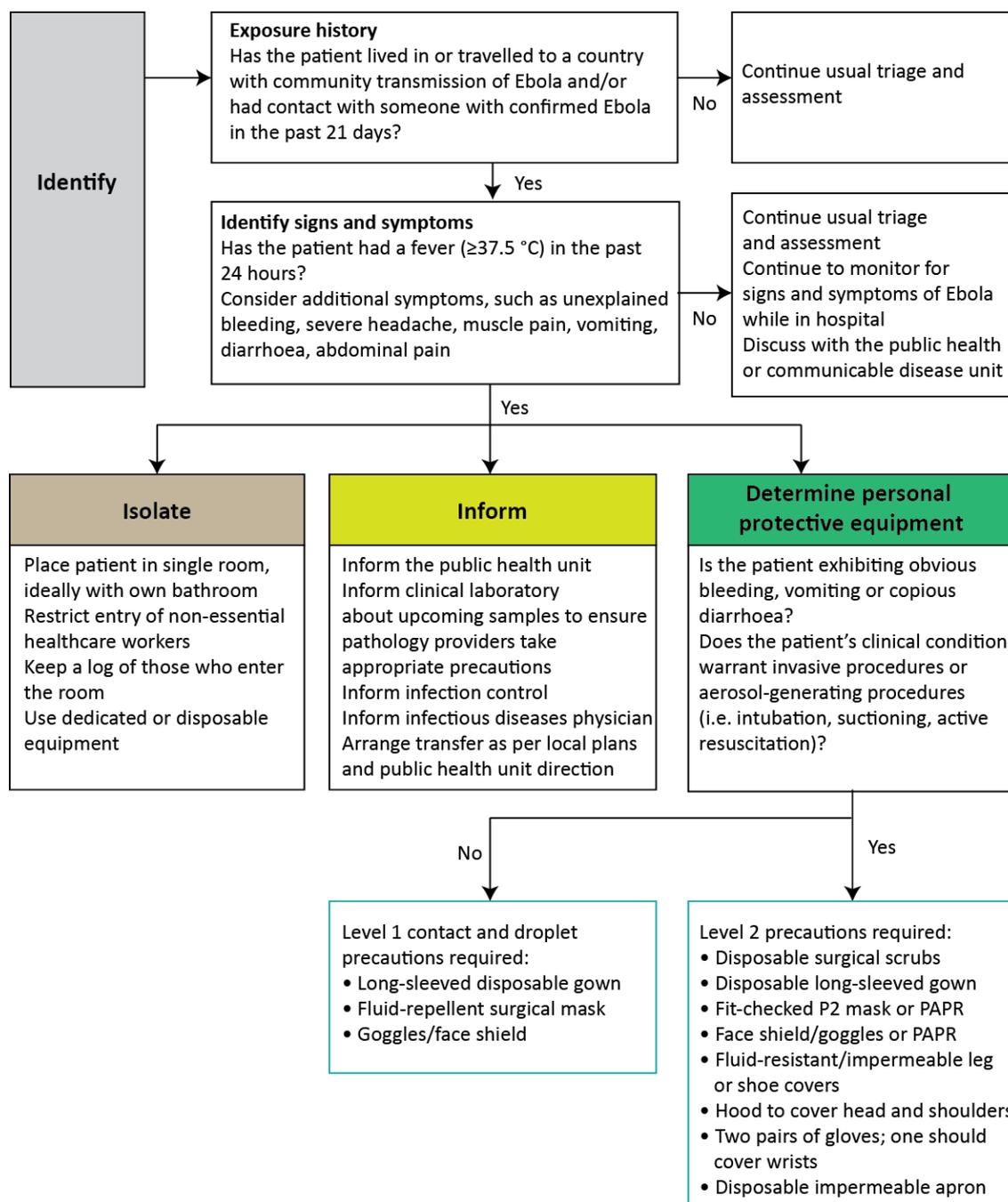
A careful risk assessment should be done to consider the exposure history and clinical status of the patient. Examples of levels of exposure risk (modified from the [EVD guidelines of the Communicable Diseases Network Australia](#)) are as follows:

- EVD lower-risk exposures
 - ordinary household contact with a person under investigation or patient with suspected EVD (in some circumstances, this might be classified as higher risk, such as if the household is in a resource-poor setting)
 - being within approximately 1 metre of a patient with suspected EVD in the early, non-secretory phase of illness, or within that patient’s room or care area for a prolonged period (e.g. healthcare provider, household carer), while not wearing recommended PPE (see Chapter 4)
 - having direct brief contact (e.g. shaking hands) with a person with suspected EVD while not wearing recommended PPE.
- EVD higher-risk exposures

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- being within approximately 1 metre of a person under investigation or patient with suspected EVD who is producing copious secretions (e.g. vomiting, diarrhoea), or within that patient's room or care area for a prolonged period (e.g. healthcare provider, household carer), while not wearing recommended PPE (see Chapter 4)
- percutaneous (e.g. needlestick) or mucous membrane exposure to blood or other body fluids of a patient with suspected or confirmed EVD
- direct skin contact with blood or other body fluids of a patient with EVD while not wearing recommended PPE.

Appendix 2 Decision tool for determining required personal protective equipment



PAPR = powered air-purifying respirator

Note: Answering 'yes' to any of the points in the box means that the decision should be 'yes' for that entire box.

Figure A1 Decision tool for personal protective equipment required for initial assessment of patients with suspected Ebola virus disease in hospital settings

Glossary

Alcohol-based hand rub

A Therapeutic Goods Administration–registered alcohol-containing preparation designed for reducing the number of viable microorganisms on the hands without the use or aid of running water. It is included on the Australian Register of Therapeutic Goods as a medicinal product.

Anteroom

A small room leading from a corridor into a room.

Buddy

A trained, experienced healthcare worker who observes, guides and documents activities of clinical staff caring for patients with Ebola virus disease, including warning of any breaches in infection prevention and control, and supervising putting on and taking off personal protective equipment.

Chlorine-based disinfectants (hypochlorite)

Hypochlorites are available as sodium hypochlorite (including household bleach) and as powder (e.g. calcium hypochlorite). They have a broad antimicrobial spectrum, but are inactivated by organic material and rapidly lose potency when diluted. In high concentrations, they cause skin and mucous membrane irritation, metal corrosion and fabric bleaching, and release toxic chlorine gas when mixed with acid or ammonia.

Clinical waste

Waste material that consists wholly or partly of, or is contaminated with, human or animal tissue, blood or body substances, excretions, drugs or other pharmaceutical products; includes swabs, dressings, syringes, needles and other sharp instruments.

Disinfectant

A Therapeutic Goods Administration–registered chemical product that is intended for disinfecting surfaces or medical devices.

Fit-check

A quick check to ensure that a mask or respirator, referred to in this guideline as a P2 mask, is fitting correctly each time it is put on.

Fit test

A method of ensuring that a mask or respirator, referred to in this guideline as a P2 mask, is fitted correctly and suitable for use by a specific individual. A fit test is used if a seal cannot be achieved using fit-checking.

Fluid resistant

In this document, ‘fluid resistant’ refers to protective clothing, including respirators and masks, tested against water as the liquid challenge.

Fomite

An object or substance capable of carrying an infectious organism. Examples of fomites in healthcare settings include patient care devices and equipment, used personal protective equipment and contaminated environmental surfaces.

Hand hygiene

A general term applying to processes that aim to reduce the number of microorganisms on hands. This includes:

- applying a waterless antimicrobial agent (e.g. alcohol-based hand rub) to the surface of the hands
- using soap or soap solution (plain or antimicrobial) and water (if hands are visibly soiled), followed by patting dry with single-use towels.

Healthcare worker (HCW)

All people delivering healthcare services, including students and trainees, who have contact with patients, or with blood or other body substances.

Impermeable

In this document, 'impermeable' refers to materials that provide demonstrated blockage of microorganisms using a recognised standard test method.

Negative-pressure room

A single-occupancy patient-care room used to isolate people with a suspected or confirmed airborne infectious disease. Environmental factors are controlled in negative-pressure rooms to minimise the transmission of infectious agents that are usually transmitted from person to person by droplets associated with coughing or aerosolisation of contaminated fluids.

P2 masks

A close-fitting mask worn for airborne precautions, which is capable of filtering 0.3-µm particles. A P2/N95 respirator/mask must comply with AS/NZS 1716:2009.

P2 or N95 respirators (which are very similar) are commonly referred to as 'masks'. The term 'P2 mask' is used throughout this document. The difference between the N95 and P2 classifications for respirator face masks is that the N95 classification means the mask complies with United States testing requirements, whereas the P2 classification indicates compliance with European testing requirements. In practical terms, these differences have virtually no impact on the level of respiratory protection provided to wearers.

Powered air-purifying respirator

Powered air-purifying respirators (PAPRs) pass contaminated air through a HEPA filter and supply clean air to the wearer's face. PAPRs should conform with AS/NZS 1715 and AS/NZS 1716, and must only be used by healthcare workers who are trained in their use. The manufacturer's instructions for cleaning, decontaminating and maintenance must be followed. PAPRs may be suitable for healthcare workers with facial hair and those who fail fit testing for P2 respirators.

Sharps

Instruments used in delivering health care that can inflict a penetrating injury (e.g. needles, lancets, scalpels).

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Standard precautions

Work practices that constitute the first-line approach to infection prevention and control in the healthcare setting. These are recommended for the treatment and care of all patients.

Surgical masks

Loose-fitting, single-use items that cover the nose and mouth. They include products labelled as dental, medical procedure, isolation and laser masks.

Suspected case

Refers to both a person under investigation and a suspected case.

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