



Proposed approach to safely transport Ebola cases in Hong Kong

Seminar on Infectious Diseases and
Infection Control Management

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Disclaimer

- ▶ No conflict of interest
- ▶ Proposed approach from medical perspective at HA level
- ▶ Sharing of international practice on pre-hospital aspects rather than recommendation

WHO Statistics: Ebola disease caused by Sudan ebolavirus – Uganda

- ▶ Number of cases and deaths (confirmed and probable) of Ebola disease caused by SUDV, as of 10 January 2023.

District	Confirmed cases	Probable cases/deaths	Deaths in confirmed cases
Bunyangabu	1	0	0
Jinja	2	0	1
Kagadi	1	0	1
Kampala	17	1	2
Kassanda	49	2	21
Kyegegwa	3	0	1
Masaka	1	0	1
Mubende	64	19	28
Wakiso	4	0	0
Total	142	22	55

Key Facts about Ebola

- ▶ Clinical Features:
 - ▶ Fever, fatigue, muscle pain, headache, sore throat, followed by vomiting, diarrhea, rash, symptoms of impaired kidney and liver function.
 - ▶ Severe cases may have both internal and external bleeding (for example, bleeding under the skin/ internal organs, from body orifices like the mouth, eyes or ears or blood in the stools), shock, nervous system malfunction, coma, delirium and seizures
- ▶ Laboratory findings include low white blood cell and platelet counts and elevated liver enzymes.

埃博拉(伊波拉)病毒病
Ebola Virus Disease

埃博拉(伊波拉)病毒病是一種嚴重且罕見的急性病毒性疾病，具有高死亡率。
Ebola virus disease is a severe acute viral illness with a high death rate.

潜伏期
Incubation period

2-21 days

病人可能出现突然性发烧、咽喉疼痛、肌肉疼痛、头痛和喉咙痛。
Patients may have sudden onset of fever, intense weakness, muscle pain, headache and sore throat.

隨後會出現嘔吐、瀉瀉、皮疹、腎臟和肝臟功能受損。
This is followed by vomiting, diarrhoea, rash, impaired kidney and liver function.

在某些情況下會出現內出血和外出血。
In some cases, both internal and external bleeding occurs.

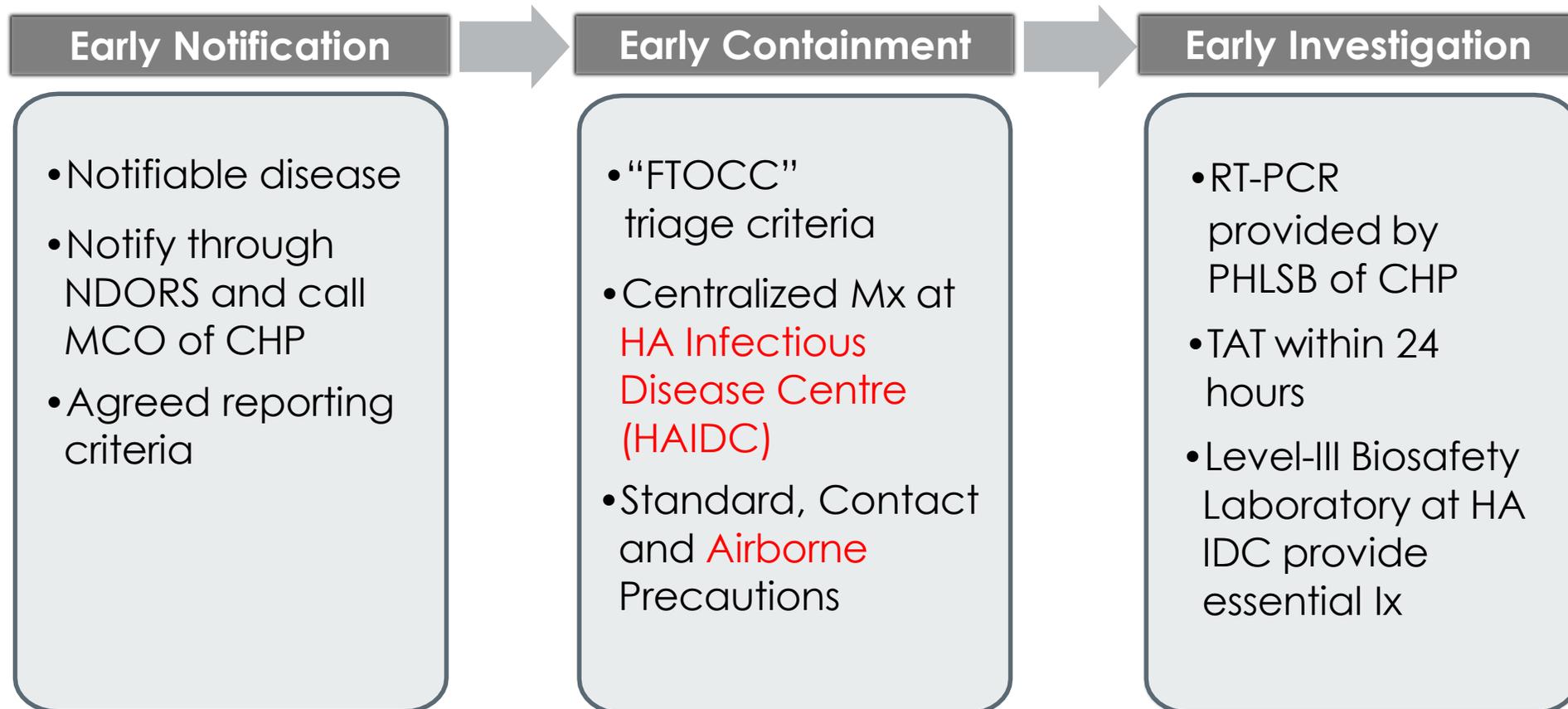
HP 香港防護中心
www.chp.gov.hk
fb.com/CentreforHealthProtection
2833 0111
衛生署
Department of Health

Key Facts about Ebola

- ▶ Incubation Period (IP): **2 to 21** days
- ▶ Case Fatality Rate (CFR): Average **50%**; 25% to 90%, from previous outbreaks
- ▶ Human-to-human transmission: via direct contact through broken skin or mucous membranes with:
 - ▶ the **blood/ other body fluids/ secretions (stool, urine, saliva, semen)** of the infected person
 - ▶ **Objects/ environment that have been contaminated** with an Ebola patient's infectious fluid, e.g. soiled clothing, bed linen or used needles
- ▶ Treatment: Supportive + Antivirals

Preparedness Measures in HA

Bundle approach: Early Notification, Early Containment, Early Investigation



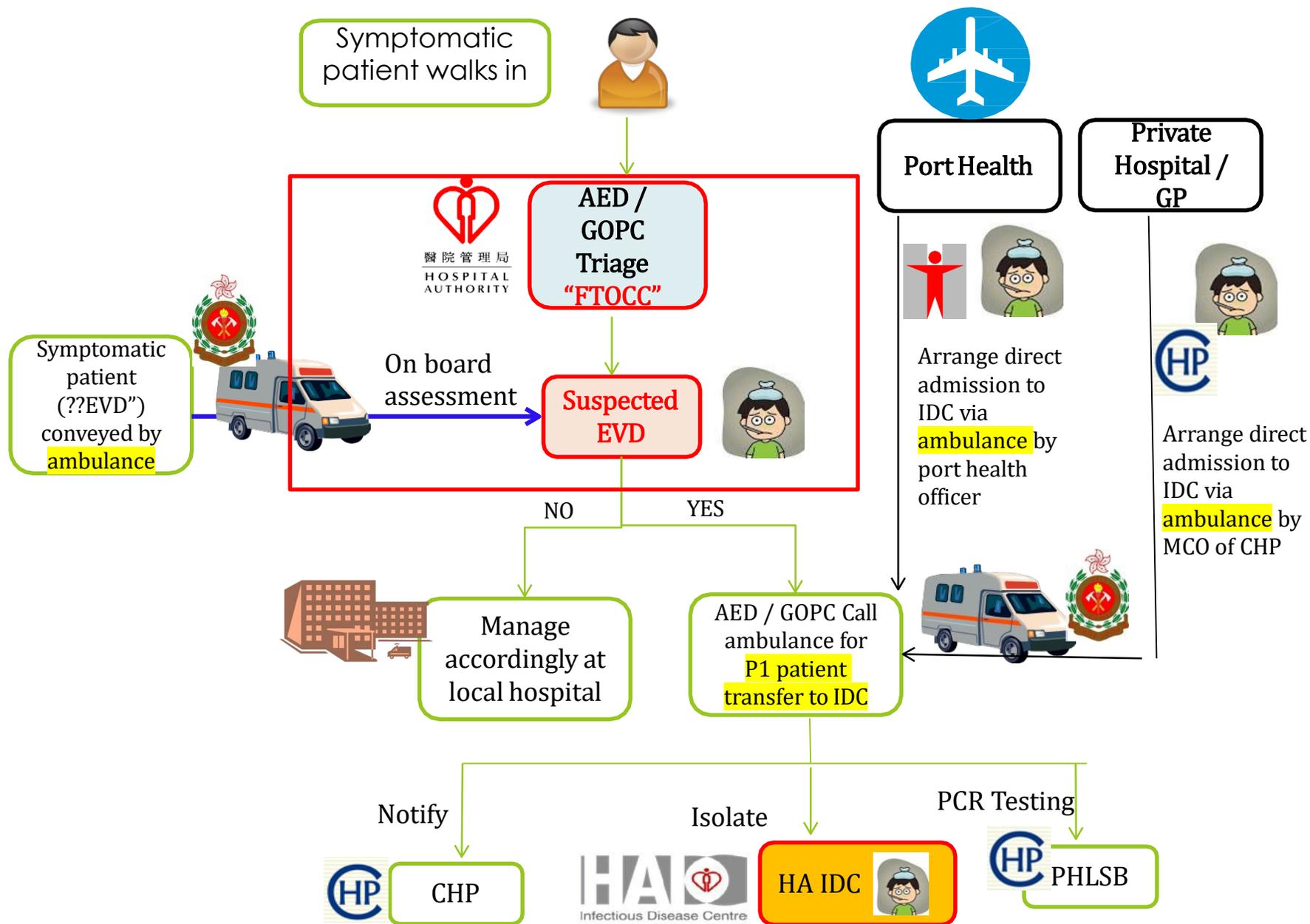
Risk Minimization

- ▶ Awareness among HCWs
 - ▶ High-risk areas (AEDs, ICUs, Isolation wards, IDC, GOPCs)
- ▶ Bundle approach of early notification, early containment and early investigation
- ▶ **Early transfer to HA IDC** of 'suspect cases' to reduce the number of HCWs & lab workers being exposed
- ▶ IC proficiency:
 - ▶ **Avoid sharps injury** and muco-cutaneous exposure
- ▶ Standard precautions
- ▶ Hand hygiene
- ▶ PPE donning and doffing procedures

Initial management of suspect case in AED/GOPC/SOPC

- ▶ If the patient fulfilled the reporting criteria for EVD:
 - ▶ Isolate the patient in a single room (in practice, Airborne Infection Isolation Room (AIIR) at AEDs, or single room in GOPCs and SOPCs),
 - ▶ Inform the patient about the arrangement, AND
 - ▶ Adopt standard, contact and airborne precautions.
- ▶ Any suspected or confirmed EVD case should be centrally isolated and managed at HAIDC.

Timely isolation and central management at IDC



Isolation of critically ill patient not suitable for transfer to IDC

- ▶ Clinicians should stabilize the patient's condition and then transfer the case to HAIDC of PMH for further investigation and management.
- ▶ Patient transfer under clinical escort may be required subject to the patient's condition.
- ▶ For **critically ill patient not suitable for transfer** to IDC, AED should liaise with local ICU for admission.

CENO's Case Definition of Viral Haemorrhagic Fever including Ebola (last updated on 15 Jun 2023)

▶ **Laboratory criteria**

- ▶ Any one of the following:
 - ▶ Detection of nucleic acid of a specific VHF virus in a clinical specimen;
 - ▶ Isolation of a specific VHF virus from a clinical specimen; OR
 - ▶ Seroconversion or a four-fold or greater increase in IgG antibody titre to a specific VHF virus.

▶ **Probable case**

- ▶ A clinically compatible case with any one of the following **epidemiological** evidence but with no or non-confirmatory laboratory testing:
 - ▶ History of travel to an endemic/epidemic area within the incubation period of illness onset;
 - ▶ Contact with a confirmed case; OR
 - ▶ Exposure to VHF infected blood or tissues

▶ **Confirmed case**

- ▶ A clinically compatible case that fulfils any of the above laboratory criteria.

Infection Control Measures

- ▶ Single room placement
 - ▶ use an Airborne Infection Isolation Room (AIIR) with toilet facility.
- ▶ Practice standard, contact & airborne precautions
- ▶ Prevention of sharps injury and muco- cutaneous exposure to blood, body fluids, secretion and excretions
- ▶ Meticulous hand hygiene

遇到下列情況，必須遵守

標準防護措施

Standard Precautions
must be taken in the following situations

接觸血液、體液、分泌物、排泄物、黏膜或傷口 必須戴上手套		Wear Gloves when handling blood, body fluids, secretions, excretions, mucous membrane or non-intact skin
若有可能接觸濺出血液或體液 必須戴上口罩、眼罩及穿上保護衣		Wear a Mask, Protective Eyewear and a Gown to protect yourself from splashed blood or body fluids
切勿套回已使用的針咀		No Recapping
小心處理針咀及利器		Handle Sharps Carefully
接觸血液、體液、分泌物、排泄物、黏膜、傷口，或除下手套後 應立即潔手		Perform Hand Hygiene Immediately after taking off gloves or handling blood, body fluids, secretions, excretions, mucous membrane or non-intact skin




Recommended PPE

PPE	General Patient Triage (Based on nature of encounter upon risk assessment)	Suspected/ Confirmed EVD patients
CAP	Disposable Cap (optional)	Water-resistant hood
Face and Eye protection	Face shield/ goggles/ visor	Face shield +/- goggles*
Respiratory Protection	Surgical mask	N95 respirator
Gown	Water-resistant gown (AMMI Level 1/3)	Water-resistant gown (EN 14126 Type P8 [3-B] or AMMI Level 4)
Gloves	As indicated [#]	Double pairs of long nitrile gloves
Shoe covers or boots	Shoe covers (optional)	Full length shoe covers or boots
<p>Hand Hygiene must be strictly observed, according to the WHO's 5 moments, namely (1) Before touching a patient, (2) Before clean / aseptic procedure, (3) After blood or body fluid exposure risk, (4) After touching a patient including touching his/her clothes or linens; and (5) After touching patient surroundings.</p>		
<p>Remarks: [#] For example, when presence of skin lesions or contact with blood and body fluids. [*] In addition to face shield, staff may consider wearing goggles when performing high risk procedure</p>		

PPE for suspect / confirmed EVD

Suggested sequence of doffing of PPE

- | |
|--------------------------------------|
| 1. Remove double gloves |
| 2. Hand hygiene |
| 3. Wear a new pair of gloves |
| 4. Water-resistant gown |
| 5. Remove gloves |
| 6. Hand hygiene |
| 7. Wear a new pair of gloves |
| 8. Full length shoe covers or boots |
| 9. Remove gloves |
| 10. Hand hygiene |
| 11. Wear a new pair of gloves |
| 12. Face shield +/- goggles |
| 13. Water-resistant hood |
| 14. Remove gloves |
| 15. Hand hygiene |
| 16. Wear a new pair of gloves |
| 17. N95 respirator |
| 18. Removes gloves |
| 19. Hand hygiene |



Face shield (In addition to face shield, staff may consider wearing goggles when performing high risk procedures)

N95 respirator

Water-resistant hood

Water-resistant gown

Double nitrile gloves

Boot / full length shoe cover

穿上 Donning

個人防護裝備 Personal Protective Equipment (PPE)

適用於埃博拉(伊波拉)病毒病
For Ebola Virus Disease (EVD)



- 1**

潔手
Hand Hygiene
- 2**

N95呼吸器
N95 Respirator

進行呼吸器密性檢查
Perform Seal Check
- 3**

頭套
Hood

將綁帶向後拉及打結
Tie a knot at the back
- 4**

面罩* +/- 護目鏡
Face Shield* +/- Goggles

覆蓋面部及眼睛，拉緊橡筋
Place over face and eyes, adjust to fit

*在進行高風險的程序時，醫護人員可以考慮配戴護目鏡及面罩 *In addition to face shield, staff may consider wearing goggles when performing high risk procedures.
- 5**

水靴
Boots

或
OR

長鞋套
Full-length Shoe Covers

潔手
Hand Hygiene
- 6**

防水保護衣
Water Resistant Gown

保護衣須完全覆蓋背部
Cover back entirely with gown

腰帶綁在腰中央
Tie waist knot at the front
- 7**

潔手
Hand Hygiene
- 8**

雙層長手套
Double, long nitrile gloves

拉下手袖至手掌，穿上手套，手套須覆蓋保護衣袖
Pull down the cuff to the palm, extend gloves to cover cuff of gown

注意事項 Points to note:

- 選擇適合自己的個人防護裝備的型號及尺碼，包括N95呼吸器、手套、保護衣及水靴。
Select your suitable model and size of PPE, including N95 respirator, gloves, gown and boots.
- 所有傷口應以防水敷料妥善覆蓋。
All wounds should be properly covered by waterproof dressings.
- 穿著過程由熟練的觀察員監督下進行。
Engage a trained observer to supervise the donning process.

醫院管理局 感染控制主任辦事處
HAHO Chief Infection Control Officer Office
2019年11月更新
Updated in November 2019

卸除 Doffing

個人防護裝備 Personal Protective Equipment (PPE)

適用於埃博拉(伊波拉)病毒病
For Ebola Virus Disease (EVD)

- 1**

雙層長手套
Double, long nitrile gloves

→

潔手
Hand Hygiene
- 2**

穿手套
Wear gloves

→

保護衣
Gown

→

除手套
Remove gloves

→

潔手
Hand Hygiene

解開腰帶，從腰旁將保護衣向下拉至鬆開領口膠帶貼，由內向外脫下保護衣
Untie waist knot, grasp the waist area and pull down to loosen the velcro, peel the gown away from body, turning the gown inside-out
- 3**

穿手套
Wear gloves

→

長鞋套
Full-length Shoe Covers

或
OR

水靴
Boots

→

除手套
Remove gloves

→

潔手
Hand Hygiene
- 4**

穿手套
Wear gloves

→

面罩 +/- 護目鏡
Face Shield +/- Goggles

→

頭套
Hood

→

除手套
Remove gloves

→

潔手
Hand Hygiene

拉後面的橡筋，向前從頭部慢慢除去
Grasp elastic and pull it over head gently

解開結帶，低頭並閉上眼睛，輕輕地向前及向下拉走頭套
Unfasten tie, head down and close eyes when removing hood by pulling forward and downward gently
- 5**

穿手套
Wear gloves

→

N95呼吸器
N95 Respirator

→

除手套
Remove gloves

→

潔手
Hand Hygiene

先除下面的橡筋，然後到上面的橡筋
Grasp the bottom elastic, then the top

注意事項 Points to note:

 - 卸除過程由熟練的觀察員監督下進行。
Engage a trained observer to supervise the doffing process.
 - 如個人防護裝備上沾有血液或體液，先以即棄吸水物料去除，再以消毒抹布消毒後，才進行卸除步驟。
If PPE are contaminated with dribbling soils, clean with disposable absorbent material and disinfect with disinfectant wipes.
 - 建議穿戴新手套卸除裝備。
Recommend to wear new gloves for removing PPE items.
 - 進行高風險程序後或懷疑有自我污染，卸除個人防護裝備後，以肥皂和水淋浴。
Remove PPE and take shower with soap and water after high risk procedure, or if there is any suspicion of self-contamination.

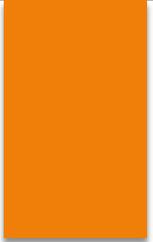
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HAHO Chief Infection Control Officer Office
2019年11月更新
Updated in November 2019

Training video can be accessed via EVD webpage.
<http://qsdportal/iec/Website/IEC%20Webpage/Ebola/Ebola%20Virus.htm>

Updated on
10/12/2019

Transfer of Cases

- ▶ Suspect cases of VHF should be transferred to the Hospital Authority (HA) Infectious Disease Centre (IDC) at Princess Margaret Hospital (PMH).
- ▶ Malaria and bacterial sepsis are the most common cause of travel-related fever and should be excluded as far as possible before transfer.
- ▶ **Early transfer** can very much reduce the chance of transmission.
- ▶ Because most ill persons requiring pre-hospital evaluation and transport are in the **early** stages of disease, they would not be expected to have symptoms that increase the chance of contact with infectious body fluids (e.g. vomiting, diarrhoea, haemorrhage). **Standard precautions are in general sufficient** in this stage.
- ▶ **If a patient has respiratory symptoms, cough, vomiting and diarrhea or bleeding, contact, droplet and airborne precautions should be practised.**
- ▶ Transportation of patient should be kept to the minimum and **only for essential purposes**. Strict isolation precautions must be followed in such circumstances.



Highlights of International Literature and Personal View

Ebola VS COVID-19

- ▶ Similarities
 - ▶ High infectivity
 - ▶ High mortality (in pre-antiviral era)
 - ▶ Certain points in precaution → Experience

Pre-hospital transportation in Western countries for Ebola patients

Table 1 Conditions of transportation of a suspected or confirmed Ebola patient, according to risk assessment

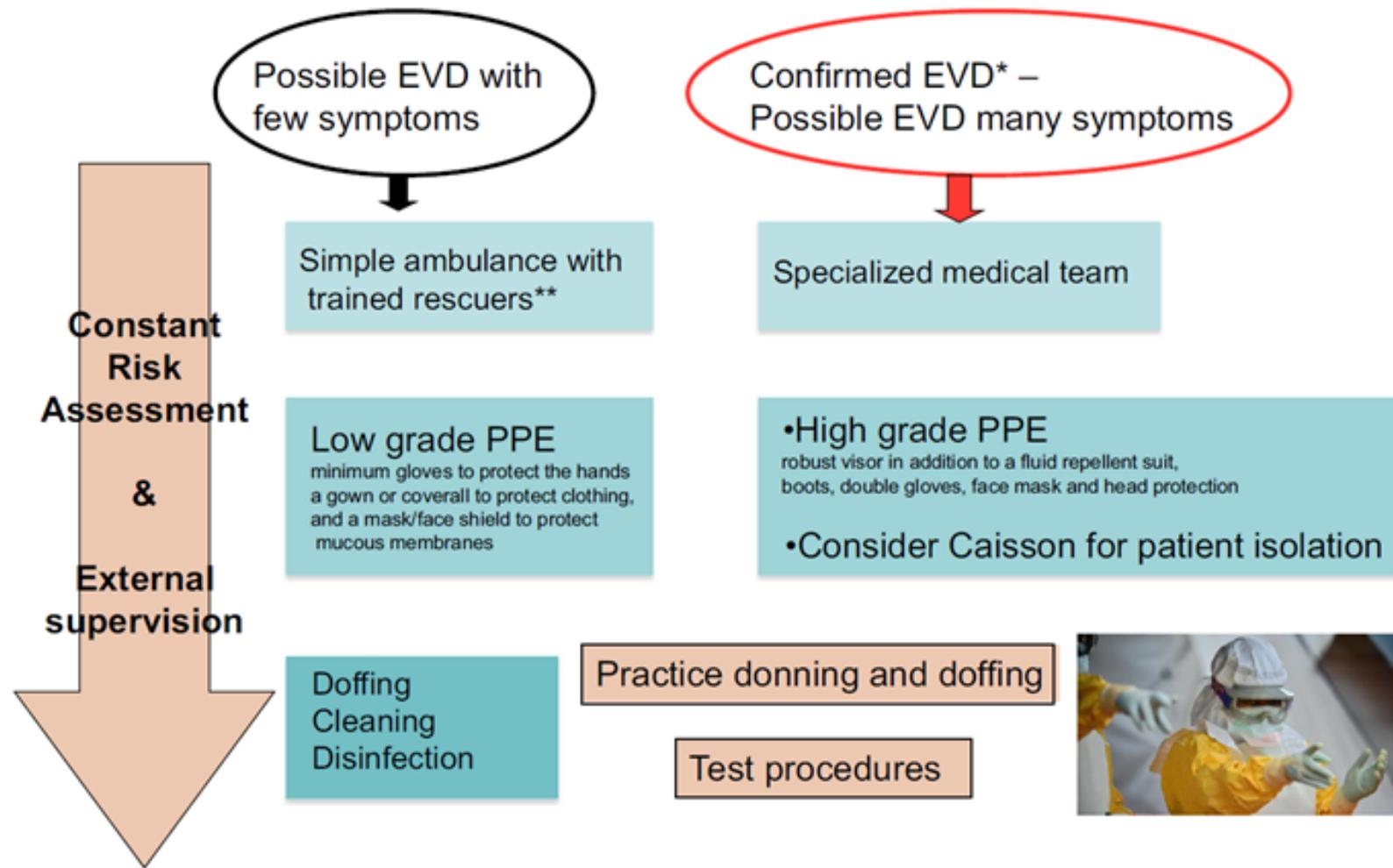
	Personnel	Personnel protective equipment	Equipment
USA			
Low-risk patient	All patients: trained rescuers	Low-grade PPE	All patients: standard ambulance shielded by application of impervious barrier drapes
High-risk patient		High-grade PPE	
UK			
Low-risk patient	Trained rescuers	Low-grade PPE	Standard ambulance team wearing universal infection control precautions
High-risk patient	Specialist ambulance medical team: hazardous area response team (HART)	High-grade PPE	Stripped out ambulance with minimal equipment
France			
Low-risk patient	All patients: medical team	All patients: high-grade PPE	All patients: mostly a vehicle has been dedicated, equipped with minimal equipment; another vehicle can escort the dedicated vehicle to assure supervision, and logistic support. Isolation with the containment of the patient in a slipcover or caisson
High-risk patient			

Low risk: a possible Ebola patient with few symptoms apart from fever can be considered to have a low risk of transmission

High risk: a patient with symptoms of profound diarrhea and vomiting, bruising, and bleeding or one with confirmed EVD several days into the course of their illness

Low-grade PPE: minimum gloves to protect the hands, a gown or coverall to protect clothing, and a mask/face shield to protect mucous membranes

High-grade PPE: robust visor in addition to a fluid repellent suit, boots, double gloves, face mask, and head protection



*time of clinical course can be considered
 ** In France, medical staff is required

Perspective from the authors

Fig. 1 Transportation of Ebola patients



FIGURE 1. Ambulance draped with 6-mil plastic for EVD transport.



Figure 5. Patient enveloped in impervious sheet.

If patient is ambulatory, he or she will be asked to wear impervious suit, surgical mask, and gloves if tolerated.

If patient is having large volumes of diarrhea, he or she will be asked to wear an adult undergarment.

If patient is nonambulatory, he or she will be shrouded in impervious sheet as tolerated, and surgical mask will be applied.

Figure 6. Patient preparation.

Persons exposed to Ebola virus disease but remaining asymptomatic are not contagious.¹⁹

Transmission of the Ebola virus requires direct contact with infected blood or bodily fluids. The virus enters the body through breaks in the skin or through the mucous membranes.²⁰

Patients with Ebola virus disease become more contagious as the course of their disease progresses.¹² Patients in the later phase of disease in which vomiting, diarrhea, and bleeding are present are more likely to transmit the disease than those with fever alone early in the course of the disease.¹⁶

PPE should be selected according to known routes of transmission, condition of the patient, and operational requirements; for example, the PPE selected for protection against blood and bodily fluid exposure for a patient with fever only will likely be different than what is selected for the patient with uncontrolled vomiting and diarrhea.^{15,21}

Travelers from Ebola-affected countries who develop generalized signs of illness are still more likely to have malaria, acute diarrheal illness, or other infectious disease than they are to have Ebola virus disease.¹⁷

Supervised/observed decontamination, disinfection, and doffing of PPE may help avoid breaches in infection control practice.

Figure 10. Considerations when managing a patient with suspected or confirmed Ebola virus disease.

Common Indications for Transport

- ▶ Intra-hospital Transport
 - ▶ Transport from A&E to ICU
 - ▶ Transport for radiology scans
- ▶ Inter-hospital Transport
 - ▶ To HAIDC

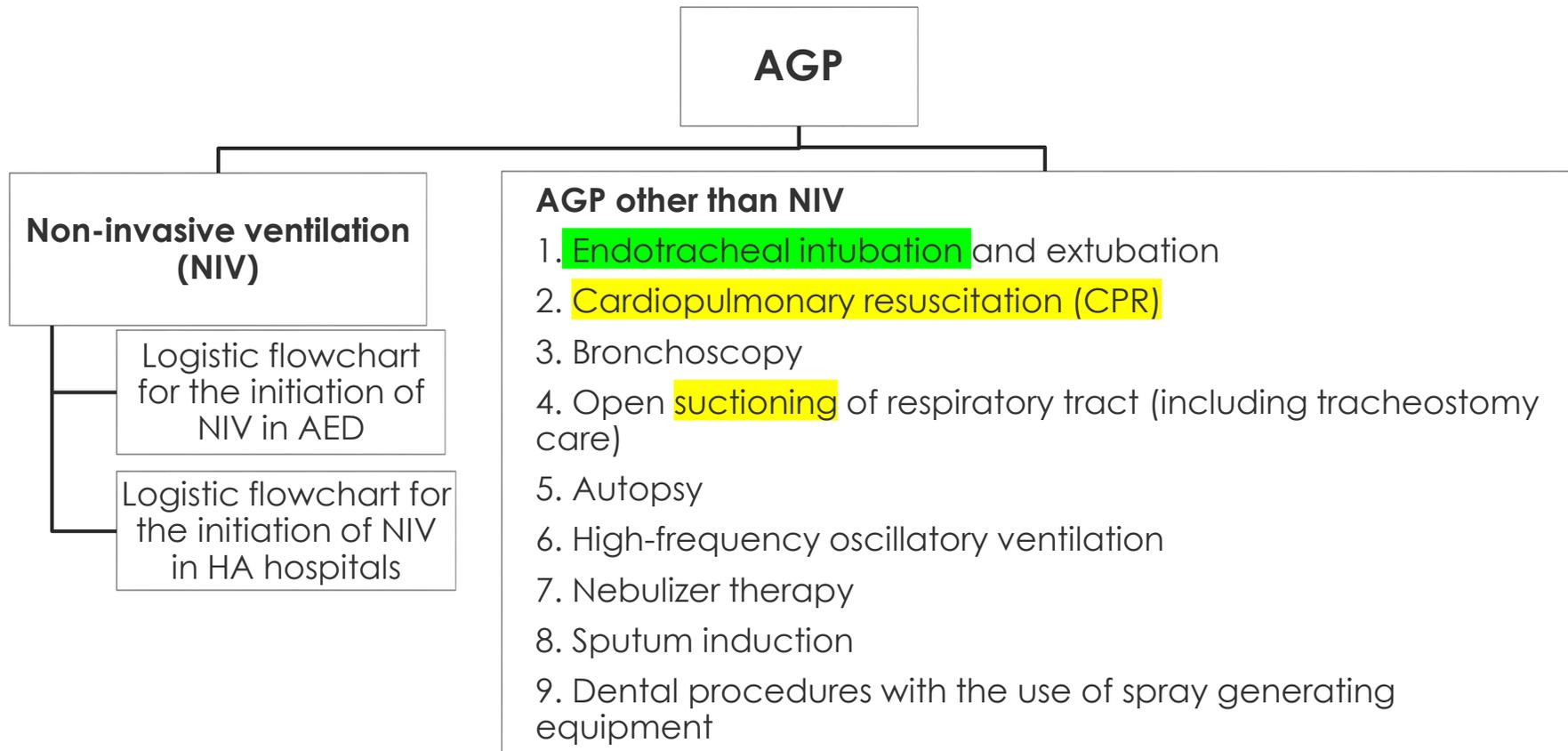
Preparation before transport (1)

- ▶ Ensure benefit > risk of transport
- ▶ To minimise avoidable transport, e.g. using bedside ultrasound for scans
- ▶ Clear workflows
- ▶ Transport patient in impervious suit if ambulatory, or in impervious sheets if non-ambulatory and stretcher-bound, as tolerated.
- ▶ Conduct brief patient assessment to determine patient's stability, "dry" or "wet" symptoms, and need for intervention before and/or during patient transport.
- ▶ Prepare transport equipment and drugs in anticipation of medical emergencies
- ▶ For deteriorating patients, to assess the need for intubation prior to transport

Preparation before transport (2)

- ▶ Entire transport route must be cordoned off to prevent unnecessary spread of disease
- ▶ Limit personnel for patient transport
- ▶ Ensure closed loop communication between team members
- ▶ Remove non-essential equipment
- ▶ Wrap transport equipment in transparent covers; ensure functionality
- ▶ Clearly label an emergency IV access
- ▶ Consider patient belongings to be contaminated, which are bagged, labelled, and transported with the patient

Aerosol-generating Procedures (AGPs)



It is recommended to follow the WHO's latest recommendations on COVID-19 and include the following **dental procedures with the use of spray generating equipment** in the list of AGPs. Therefore, healthcare workers should adopt airborne precautions, wear full PPE and perform the procedures in an adequately ventilated room.

- Procedures that use three-way air/water spray;
- Dental cleaning with ultrasonic scaler and polishing;
- Periodontal treatment with ultrasonic scaler;
- Any kind of dental preparation with high or low-speed hand-pieces;
- Direct and indirect restoration and polishing;
- Definitive cementation of crown or bridge;
- Mechanical endodontic treatment;
- Surgical tooth extraction and implant placement

Transport process (1)

- ▶ Transport team should don appropriate PPE outside the patient room before transport
- ▶ Pre-treatment with (oral) anti-emetics
- ▶ Provide patient care, as needed, and **minimize the contact** with patient
- ▶ **Unless absolutely essential, aerosol generating procedures should be avoided**
- ▶ **Risk of deterioration necessitating AGP (CPR, suction) should be considered**
- ▶ Avoid sharps handling in a moving environment

Transport Process (2)

- ▶ Non-intubated patient should wear a surgical mask
- ▶ Intubated patients—avoid transport if possible; otherwise
 - ▶ Add on HEPA filters to endotracheal tubes if bagging is required via BVM
 - ▶ Gentle bagging by BVM to reduce aerosolization if worsening hypoxemia.
 - ▶ Add on HEPA filters to expiratory limbs of the breathing circuits for ventilators
 - ▶ Avoid unnecessary breathing circuit disconnection during transport
- ▶ Radiology scans to be performed at the end if really indicated, to allow for terminal cleaning of radiology

After arrival

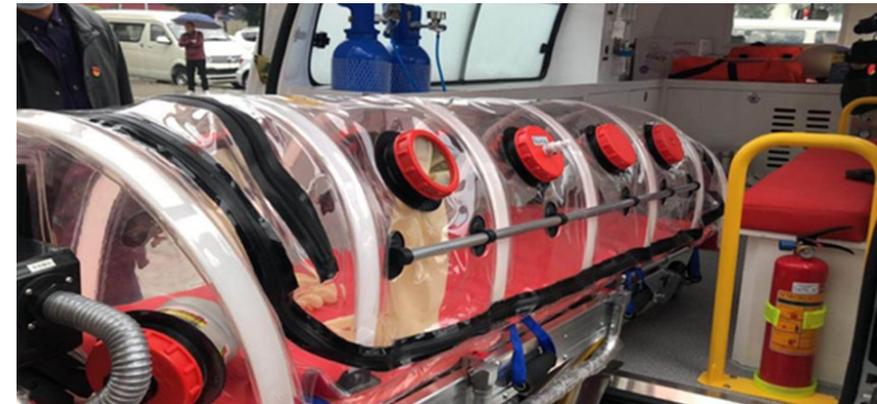
- ▶ Ensure patient delivery to relevant professionals in designated area
- ▶ Remove all protective equipment covering
- ▶ Doff PPE in a nearby clinical area with observer
- ▶ Complete patient handover outside the patient's room
- ▶ Return the equipment to the area of initiation for decontamination
- ▶ Caution to avoid contamination of clinical documents

Post transfer decontamination

- ▶ Dedicate a housekeeping team equipped with appropriate PPE to decontaminate the transfer route (including elevator), room of the patients and all transport equipment.
- ▶ Decontaminate the transport ambulance
- ▶ Prepare all the equipment for the next transport

Overseas Experience of Portable Medical Isolation Unit

新冠疫情期間負壓救護車內的專用隔離艙
圖據福州晚報



Portable Medical Isolation Unit (PMIU)

Five PMIUs in Singapore as of 2014.



Medical workers dressed in protective suits transport a "patient" out of Changi Airport Terminal 2 using a portable medical isolation unit. Photo: Don Wong

Published August 15, 2014
Updated August 15, 2014



NEWS

Italy stages Ebola evacuation drill _ just in case

ASSOCIATED PRESS

Published 9:55 p.m. ET Sept. 24, 2014 | Updated 9:57 p.m. ET Sept. 24, 2014



Participants in a drill, learning how to transport contagious patients using a self-contained mobile isolation unit, carry a colleague Wednesday at the military airport of Pratica di Mare, Italy. *Times Herald-Record*

South Africa

Savion emergency isolation care



Mobile isolation chamber for Ebola, airborne infections and other contagious diseases



Negative & Positive Pressure Modes

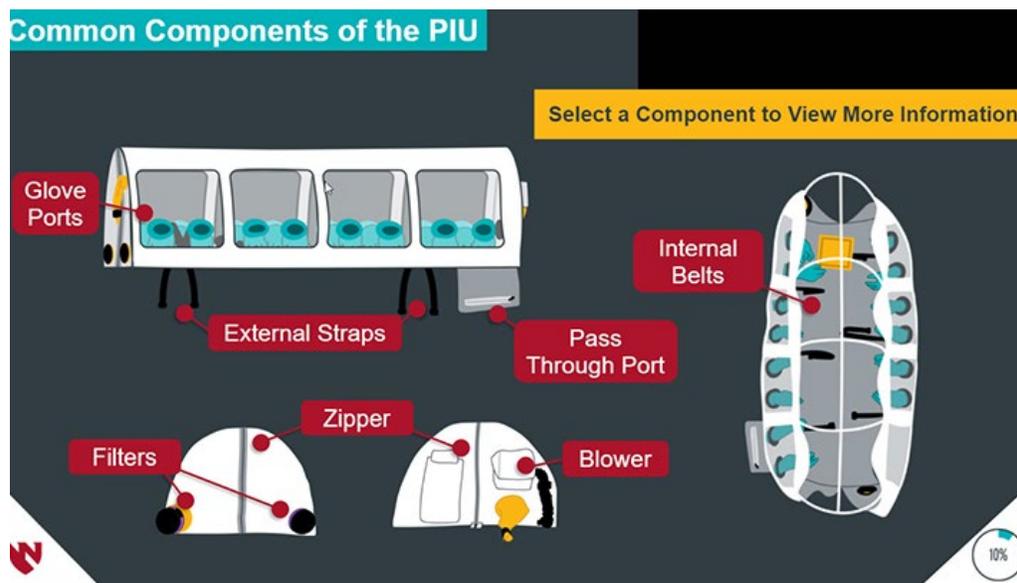
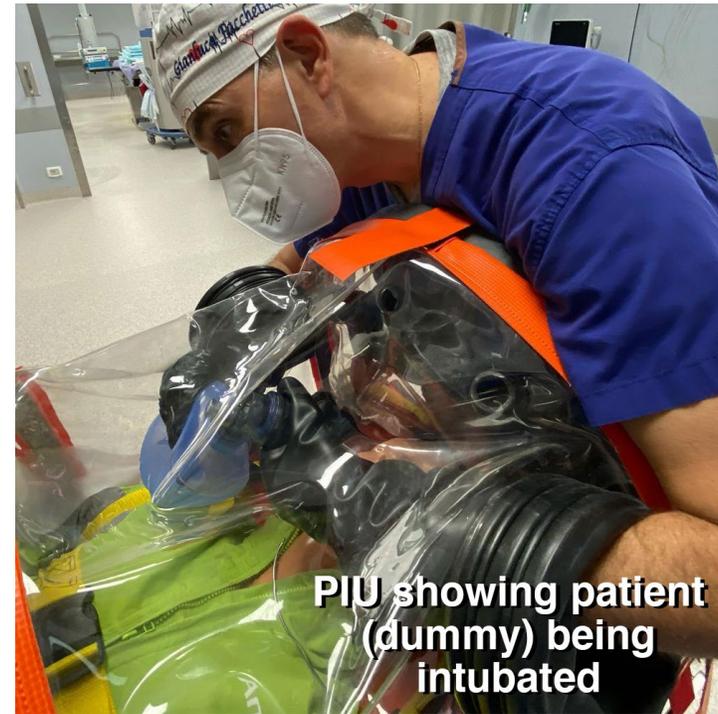


Fig. 1. Negative pressure isolation stretcher (A) and CT scanning of a patient in the negative pressure isolation stretcher (B).

American Journal of Emergency Medicine 45 (2021) 483–489



PROCEDURES & CAVEAT



WORLDWIDE REACH. HUMAN TOUCH.

- Technically possible
- **Maximum isolation during transport**, depending on status & scoring
- In flight & on the ground
- Requires perfect internal & external coordination
- Subject to approval by multiple health national authorities

EVACUATION SOLUTIONS



- Dedicated Intl.SOS aircrafts in South Africa
- Appropriate for asymptomatic high risk exposed or early stable EVD cases
- Not suitable for secretory phase or unstable EVD patients due to limited monitoring and intervention capability



- Need for a PMIU or walk-in isolation chamber for ALL types of patients (Exposure cases ?)

Infection Control

Designation of an “isolation area”

- Use of a disposable, portable isolation unit is recommended to contain infectious waste (such as soiled absorbent pads, emesis [vomit] basins, portable toilet) and to prevent contamination of the aircraft cabin. Aircraft interiors are complex surfaces that are difficult to clean and disinfect thoroughly and avionic equipment may prohibit the use of surface disinfectants. After use, the portable isolation unit should be discarded. If an isolation unit is not available, a perimeter should be established for designating “clean” and “dirty” areas that identifies where PPE should be put on and removed. The distance will depend on the area required for patient care support as well as designated space for safe removal of PPE. All individuals not providing care should remain at least 6 feet (2 meters) away from the patient. Surfaces should be smooth, nonporous, and fluid-impermeable to allow appropriate cleaning and disinfection.
- Materials required for patient care, including PPE, should be stored outside of the isolation area.
- Containers for soiled linen, waste, and reusable equipment should be placed inside the isolation area. Supplies for cleaning spills should be kept in the area, including appropriate disinfectants.
- A portable chemical toilet with a solidifying agent should be dedicated for patient use within the isolation area. The lid of the toilet should be kept closed when not in use.

Personnel who are within the isolation unit or designated isolation area should wear PPE as described in the CDC guidance:

[Guidance on Personal Protective Equipment \(PPE\) in U.S. Healthcare Settings during Management of Patients Confirmed to have Selected Viral Hemorrhagic Fevers or Patients Suspected to have Selected Viral Hemorrhagic Fevers who are Clinically Unstable or Have Bleeding, Vomiting, or Diarrhea.](#) Outside of the isolation unit or designated isolation area, PPE is not needed.

Other Considerations

- ▶ Cost ~ 2200 Euro – USD 11000
- ▶ Likelihood of application
- ▶ Time for preparation
- ▶ Prior Training for Staff – paramedic, nurse, doctor
- ▶ Equipment Maintenance

Summary

- ▶ Hospital Authority Guidelines
- ▶ Highlights of International Literature
- ▶ My personal view and experience
- ▶ Overseas Experience of PMIU

References

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Thank You