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Guide to Infection Prevention and Control (IPAC) Management of Suspected or Confirmed Viral Haemorrhagic Fever (VHF) in Acute Care

1st Revision: July 2019

Public Health Ontario

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Summary of Revisions

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The evidence in this document is current to 2019. Changes in this revision are summarized in the table below.

Summary of changes in 1st revision:

Date of Implementation	Description of Major Changes	Page(s)
July 2019	New title	Title page
July 2019	Updated geographic locations to reflect current affected areas	11
July 2019	Added information on current VHF treatment and vaccines	15
July 2019	Updated laboratory section	20
July 2019	Combined contents of Tables 3 and 4 into one table for better presentation	27
July 2019	Added section on recommendations for recovering patient presenting for care or readmission	36
July 2019	Revised the occupational health and safety section considerations to align with the ministry guidance on Ebola virus disease for public health units	38
July 2019	Added appendix 2 to provide information on triage assessment	46

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Disclaimer

This document was developed by Public Health Ontario (PHO). PHO provides scientific and technical advice to Ontario's government, public health organizations and health care providers. PHO's work is guided by the current best available evidence at the time of publication.

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Preamble

About This Document

This document has been produced by Public Health Ontario (PHO) in order to ensure that health care providers (HCP) and acute care settings are able to identify when a risk of a viral haemorrhagic fever (VHF) infection (e.g., Lassa, Ebola, Marburg) may exist, initiate infection prevention and control (IPAC) measures to protect staff and patients, and manage the patient through the investigation and clinical management phases as appropriate for the acute care setting.

This document outlines guidance for IPAC management of suspect or confirmed cases of VHF, with provisions to ensure that appropriate IPAC measures are put in place based on a risk assessment. The Ministry of Health may establish standards through policy or directives that go beyond the recommendations contained in this document. Refer to the Ministry of Health Ebola Virus Disease webpage for additional information on Ebola-specific public health guidance.

Evidence for Recommendations

This document has been developed based on the best available evidence. It is current to July 2019.

Assumptions and Best Practices for Infection Prevention and Control

The guidance in this document is based on the assumption that health care settings in Ontario already have basic IPAC systems and programs in place[1] and that an organizational risk assessment has been conducted to determine its readiness when dealing with emerging pathogens. Additional resources, tools and links will be available on the Public Services Health & Safety Association (PSHSA) site to aid in training and ensuring health care settings are prepared should a suspect/confirmed VHF case be identified in their facility.

Occupational Health and Safety Requirements:

Health care facilities are required to comply with applicable provisions of the *Occupational Health and Safety Act (OHSA), R.S.O. 1990, c.O.1* and its regulations. Employers, supervisors and workers have rights, duties and obligations under the OHSA. Specific requirements under the OHSA and its regulations are available at:

- *Occupational Health and Safety Act (OHSA), R.S.O. 1990, c.O.1*
- *Health Care and Residential Facilities, O. Reg. 67/93*

Requirements related to the use of hollow-bore needles that are safety-engineered needles are available at *Needle Safety, O. Reg. 474/07*.

Additional information is available at the Ministry of Labour Health and Community Care page.

Abbreviations

AP	Additional Precautions
AGMP	aerosol-generating medical procedure
AIIR	airborne infection isolation room
ARO	antibiotic-resistant organism
CDC	Centers for Disease Control and Prevention
ES	environmental services
EVD	Ebola virus disease
HPPA	*Health Protection and Promotion Act*
HCP	health care provider
ICP	infection prevention and control professional
IPAC	infection prevention and control
MEOC	Ministry Emergency Operations Centre
OHS	occupational health and safety
OHSA	*Occupational Health and Safety Act*
PAPR	powered air purifying respirator
PHAC	Public Health Agency of Canada
PHO	Public Health Ontario
PHU	public health unit
PIDAC	Provincial Infectious Diseases Advisory Committee
PPE	personal protective equipment
PUI	person under investigation
RP	Routine Practices
VHF	viral haemorrhagic fever
WHO	World Health Organization

Glossary

Additional Precautions (AP): Precautions (i.e., Contact Precautions, Droplet Precautions and Airborne Precautions) that are necessary in addition to Routine Practices for certain pathogens or clinical presentations. These precautions are based on the method of transmission (e.g., contact, droplet, airborne).

Aerosol: Small droplet of moisture that may carry microorganisms. Aerosols may be light enough to remain suspended in the air for short periods of time, allowing inhalation of the microorganism.

Aerosol-Generating Medical Procedure (AGMP): A medical procedure that generates droplets/aerosols which may expose staff to respiratory pathogens and are considered to be a potential risk for staff and others in the area.

Airborne Infection Isolation Room (AIIR): A room that is designed, constructed and ventilated to limit the spread of airborne microorganisms from an infected occupant to the surrounding areas of the health care setting. This is also known as a negative pressure room. NOTE: The Canadian Standards Association uses the term Airborne Isolation Room (AIR).

Airborne Precautions: Used in addition to Routine Practices for clients/patients/residents known or suspected of having an illness transmitted by the airborne route (i.e., by small droplet nuclei that remain suspended in the air and may be inhaled by others).

Alcohol-Based Hand Rub (ABHR): A liquid, gel or foam formulation of alcohol (e.g., ethanol, isopropanol) which is used to reduce the number of microorganisms on hands in clinical situations when the hands are not visibly soiled. ABHRs contain emollients to reduce skin irritation and are less time-consuming to use than washing with soap and water.

At a minimum: Minimal precautions are the most basic measures that are to be taken; this does not preclude taking higher levels of protection (for example fluid impermeable gown or powered air purifying respirator) based on an institutional and/or point of care risk assessment.

Cleaning: The physical removal of foreign material (e.g., dust, soil) and organic material (e.g., blood, secretions, excretions, microorganisms). Cleaning physically removes rather than kills microorganisms. It is accomplished with water, detergents and mechanical action (e.g. scrubbing).

Client/Patient/Resident: Any person receiving care within a health care setting.

Contact Precautions: Used in addition to Routine Practices to reduce the risk of transmitting infectious agents via contact with an infectious person.

Contamination: The presence of an infectious agent on hands or on a surface, such as clothing, gowns, gloves, bedding, toys, surgical instruments, care equipment, dressings or other inanimate objects.

Detergent: A synthetic cleansing agent that can emulsify oil and suspend soil. A detergent contains surfactants that do not precipitate in hard water and may also contain protease enzymes (see Enzymatic Cleaner) and whitening agents.

Disease of Public Health Significance: An infectious disease specified in *Ontario Regulations 135/18*: Designation of Diseases. Under the *Health Protection and Promotion Act*, these diseases or suspected occurrences of these diseases must be reported to the Health Units by health care providers, laboratories, administrators of hospitals, schools, and institutions.

Disinfectant: A product that is used on surfaces or medical equipment/devices which results in disinfection of the surface or equipment/device. Disinfectants are applied only to inanimate objects. Some products combine a cleaner with a disinfectant. See also, Disinfection.

Disinfection: The inactivation of disease-producing microorganisms. Disinfection does not destroy bacterial spores. Medical equipment/devices are to be cleaned thoroughly before effective disinfection can take place. See also, Disinfectant.

Doffing: The action of taking off personal protective equipment (PPE).

Donning: The action of putting on personal protective equipment (PPE).

Droplet Precautions: Used in addition to Routine Practices for clients/patients/residents known or suspected of having an infection that can be transmitted by large infectious droplets.

Drug Identification Number (DIN): In Canada, disinfectants are regulated as drugs under the Food and Drugs Act and Regulations. Disinfectant manufacturers are to obtain a drug identification number (DIN) from Health Canada prior to marketing, which ensures that labelling and supporting data have been provided and that it has undergone and passed a review of its formulation, labelling and instructions for use.

Environment of the Client/Patient/Resident: The immediate space around a client/patient/resident that may be touched by the client/patient/resident and may also be touched by the health care provider when providing care. In a single room, the client/patient/resident environment is the room. In a multi-bed room, the client/patient/resident environment is the area that may come into contact with the client/patient/resident within their cubicle. In a nursery/neonatal setting, the patient environment includes the inside of the bassinette or incubator, as well as the equipment outside the bassinette or incubator used for that infant (e.g., ventilator, monitor). See also, Health Care Environment.

Exposure: An exposed person (exposure) will be defined by infection prevention and control in consultation with occupational health and safety and the public health unit.

Fit-Test: A qualitative or quantitative method to evaluate the fit of a specific make, model and size of respirator on an individual. Fit-testing is to be done periodically, at least every two years and whenever there is a change in respirator care or the user's physical condition which could affect the respirator fit.[2]

Hand Hygiene: A general term referring to any action of hand cleaning. Hand hygiene relates to the removal of visible soil and removal or killing of transient microorganisms from the hands. Hand hygiene may be accomplished using soap and running water or an alcohol-based hand rub. Hand hygiene includes surgical hand antisepsis.

Hand Hygiene Moment: The point(s) in an activity at which hand hygiene is performed. There may be several hand hygiene moments in a single care sequence or activity.

Health Care Environment: The people and items which make up the care environment (e.g., objects, medical equipment, staff, clients/patients/residents) of a hospital, clinic or ambulatory setting, outside the immediate environment of the client/patient/resident. See also, Environment of the Client/Patient/Resident.

Health Care Facility: A set of physical infrastructure elements supporting the delivery of health-related services. A health care facility does not include a client/patient/resident's home or physician/dentist/other health offices where health care may be provided.

Health Care Provider (HCP): Any person delivering care to a client/patient/resident. This includes, but is not limited to, the following: emergency service workers, physicians, dentists, nurses, midwives, respiratory therapists and other health professionals, personal support workers, clinical instructors, students and home health care workers. In some non-acute settings, volunteers might provide care and would be included as health care providers. See also, Staff.

Health Care Setting: Any location where health care is provided, including settings where emergency care is provided, hospitals, complex continuing care, rehabilitation hospitals, long-term care homes, mental health facilities, outpatient clinics, community health centres and clinics, physician offices, dental offices, independent health facilities, out-of-hospital premises, offices of other health professionals, public health clinics and home health care.

Hospital-Grade Disinfectant: A low-level disinfectant that has a drug identification number (DIN) from Health Canada, indicating its approval for use in Canadian hospitals.

Infection Prevention and Control (IPAC): Evidence-based practices and procedures that, when applied consistently in health care settings, can prevent or reduce the risk of transmission of microorganisms to health care providers, other clients/patients/residents and visitors and development of health care-associated infections in clients/patients/residents from their own microorganisms.

Infection Prevention and Control Canada (IPAC Canada): A professional organization of persons engaged in infection prevention and control activities in health care settings. IPAC Canada members include infection prevention and control professionals from a number of related specialties including nurses, epidemiologists, physicians, microbiology technologists, public health and industry.

Infection Prevention and Control Professional(s) (ICPs): Trained individual(s) responsible for a health care setting's infection prevention and control activities. In Ontario, an ICP is to receive a minimum of 80 hours of instructions in an IPAC Canada-endorsed infection control program within six months of entering the role and is to acquire and maintain Certification in Infection Control (CIC®), when eligible. The ICP is to maintain a current knowledge base of infection prevention and control information.

Infectious Agent: A microorganism, i.e., a bacterium, fungus, parasite, virus or prion, which is capable of invading body tissues and multiplying.

Manufacturer: Any person, partnership or incorporated association that manufactures and sells medical equipment/devices under its own name or under a trade mark, design, trade name or other name or mark owned or controlled by it.

Mask (fluid-resistant surgical/procedure): A device that covers the nose and mouth, is secured in the back and is used by health care providers to protect the mucous membranes of the nose and mouth. A label claim by the manufacturer of demonstration of fluid resistance by use of an objective standardized testing methodology (e.g. ASTM F1862 or other similar international standard) is to be evaluated in relation to the organization's risk assessment.

Medical Equipment/Device: Any instrument, apparatus, appliance, material, or other article, whether used alone or in combination, intended by the manufacturer to be used for human beings for the purpose of diagnosis, prevention, monitoring, treatment or alleviation of disease, injury or handicap; investigation, replacement, or modification of the anatomy or of a physiological process; or control of conception.

Mode of Transmission: The method by which infectious agents spread from one person to another (e.g., contact, droplet or airborne routes).

N95 Respirator: A personal protective device that is worn on the face and covers the nose and mouth to reduce the wearer's risk of inhaling airborne particles. A NIOSH-certified N95 respirator has a filter efficiency of 95 per cent or more for particles that are 0.3 microns or larger in size and provides a tight facial seal with less than 10 per cent leak.

Occupational Health and Safety (OHS): Preventive and therapeutic health services in the workplace provided by trained occupational health professionals, e.g., nurses, hygienists, physicians.

Personal Protective Equipment (PPE): Clothing or equipment worn for protection against hazards.

Powered Air Purifying Respirator (PAPR): A respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element. A blower carried by the user passes ambient air through an air-purifying component and then supplies purified air to the face piece. Powered types are equipped with a face piece, loose-fitting face piece, helmet, or hood.[2]

Provincial Infectious Diseases Advisory Committee (PIDAC): For the purposes of this document, PIDAC refers to Provincial Infectious Diseases Advisory Committee on Infection Prevention and Control (PIDAC-IPC). PIDAC-IPC is a scientific advisory committee that advises Public Health Ontario on the prevention and control of health care-associated infections in Ontario.

Public Health Unit (PHU): An official health agency established by a group of urban and rural municipalities to provide a more efficient community health program, carried out by full-time, specially qualified staff. Public health units administer health promotion and disease prevention programs.

Respiratory Etiquette: Personal practices that help prevent the spread of bacteria and viruses that cause acute respiratory infections (e.g., covering the mouth when coughing, prompt and careful disposal of tissues).

Risk Assessment: An evaluation of the anticipated/proposed interaction between the health care provider, the patient, and the patient environment in order to assess and analyze the potential for exposure to infectious disease in the course of the interaction.

Routine Practices (RP): The system of IPAC practices to be used with all patients during all care to prevent and control transmission of microorganisms in all health care settings. For a full description of Routine Practices, refer to PIDAC's Routine Practices and Additional Precautions in all Health Care Settings.

Safety-Engineered Medical Device: A non-needle sharp or a needle device used for withdrawing body fluids, accessing a vein or artery, or administering medications or other fluids, with a built-in safety feature or mechanism that effectively reduces exposure incident risk. Safety-engineered devices are licensed by Health Canada.

Seal-Check: A procedure that the health care provider is to perform each time an N95 respirator is worn to ensure it fits the wearer's face correctly to provide adequate respiratory protection. The health care provider is to receive training on how to perform a seal-check correctly.

Sharps: Objects capable of causing punctures or cuts (e.g., needles, lancets, sutures, blades, clinical glass).

Staff: Anyone conducting activities in settings where health care is provided, including but not limited to, health care providers, housekeeping and environmental services workers. See also, Health Care Provider.

Sterilization: The level of reprocessing required when processing critical medical equipment/devices. Sterilization results in the destruction of all forms of microbial life including bacteria, viruses, spores and fungi. Equipment/devices are to be cleaned thoroughly before effective sterilization can take place.

Terminal Cleaning: The thorough cleaning of a client/patient/resident room or bed space following discharge, death or transfer of the client/patient/resident, in order to remove contaminating microorganisms that might be acquired by subsequent occupants and/or staff. In some instances, terminal cleaning might be used once some types of Additional Precautions have been discontinued. Refer to PIDAC's Best Practices for Environmental Cleaning in All Health Care Settings for more information about terminal cleaning.

Viral haemorrhagic fevers (VHF): Viral haemorrhagic fevers (VHFs) refer to a group of illnesses that are caused by several distinct families of viruses. In general, the term "viral haemorrhagic fever" is used to describe a severe multisystem syndrome. Symptoms are often accompanied by haemorrhage. While some types of haemorrhagic fever viruses can cause relatively mild illness, many of these viruses cause severe, life- threatening disease. The risk of VHF in Canada is low.

Background

Viral haemorrhagic fevers (VHFs) are caused by a wide range of viruses from four distinct taxonomic families:

- Filoviridae (includes Ebola, Marburg)
- Arenaviridae (includes Lassa, Machupo)
- Bunyaviridae (includes hantaviruses, Crimean Congo haemorrhagic fever, Rift Valley fever)
- Flaviviridae (includes Yellow Fever, Dengue)

Each of these viral families share similar features:[3]

- They are all RNA viruses and are covered or enveloped in a lipid coating
- Their natural reservoirs are animals or insect hosts
- The viruses are geographically restricted to the area in which their host species lives
- Humans may become infected when they come into contact with infected hosts. Further person to person transmission may occur with some viruses (Ebola, Marburg, Lassa and Crimean-Congo are examples) through close contact with the body fluids of the infected person or indirectly, through contaminated objects such as syringes and needles
- Human cases or outbreaks occur sporadically and irregularly due to introduction of the virus from an animal host, followed by human-to-human transmission in home and health care settings

In general, these viruses are able to cause a severe multisystem syndrome in which the vascular system is damaged and the body is unable to regulate itself. Outbreaks with human to human transmission chains require concerted public health efforts to contain and control spread.

VHFs are diseases of public health significance due to:

- A low infectious dose is required for infection
- There is high morbidity and mortality in human cases for many of the agents
- Effective vaccines or treatments are unavailable for most of the agents

VHFs are diseases of public health significance under *Ontario Regulation 135/18: Designation of Diseases* under the *Health Protection and Promotion Act, R.S.O. 1990, c. H.7* in Ontario and the Local Medical Officer of Health shall be notified immediately of any person presenting for care where an infection with a VHF virus may be suspected.[4]

Employers also have reporting responsibilities under the *Occupational Health and Safety Act* (OHSA). If occupationally acquired infection occurs, employer is to ensure than an appropriate notice of occupational illness is provided, as per the OHSA. Reporting requirements under OHSA can be viewed at the following website: http://www.labour.gov.on.ca/english/hs/incident.php

In the event of importation, threat of importation, or transmission of a VHF agent in Ontario, the Ministry of Health may establish standards through policy or directives that go beyond the recommendations contained in this document.

Global Occurrence

Table 1: General Epidemiologic Features of Selected Viral Haemorrhagic Fever Agents[5]

Virus	Major Geographic Location for Animal or Human Disease	Natural Host	Human Transmission Risk
Crimean-Congo	Africa Middle East and Asian countries south of the 50th parallel north (WHO Map) Balkans	Ticks plus a wide range of wild and domestic animals	• tick bites • contact with blood or tissues of infected animals (majority of cases in persons involved in the livestock industry) • secondary human-to-human transmission
Ebola (Zaire, Sudan, Cote d'Ivoire and Bundibugyo strains)	Sub-Saharan Africa (CDC Map)	Infected animals such as fruit bats or nonhuman primate	• contact with animal reservoirs through hunting, trapping • handling and ingestion of "bushmeat" • secondary human-to-human transmission through direct contact with body fluids (preparation of bodies for burial or providing care for ill persons without use of PPE)
Ebola (Ebola-Reston strain)	Philippines	Macaques (monkey of the genus *Macaca*)	• contact with macaques • asymptomatic human infections only
Lassa	West Africa (endemic) (CDC Map)	Multimammate rat (common African rat)	• ingestion of food contaminated with rat urine or faeces • eating infected rats • inhalation of small aerosols created when sweeping areas contaminated with rat urine or faeces • secondary human-to-human transmission
Marburg	Sub-Saharan Africa (WHO Map) (CDC Map)	Fruit bats, monkeys	• unprotected contact with infected bat feces or aerosols • secondary human-to-human transmission

Virus	Major Geographic Location for Animal or Human Disease	Natural Host	Human Transmission Risk
Rift Valley fever	Eastern and Southern Africa, sub-Saharan Africa, including West Africa and Madagascar Saudi Arabia Yemen (CDC Map)	Mosquitoes, domesticated animals (sheep, cattle, goats, camels)	• mosquito bites • contact with the blood, body fluids, or tissues of infected animals • ingestion of unpasteurized milk from infected animal • aerosol transmission has occurred • no human-to-human transmission
Yellow fever	Sub-Saharan Africa Tropical regions of South America (endemic) (CDC Map)	Mosquitoes	• mosquito bites • no human-to-human transmission

Transmission Risks

Vector-to-Human Transmission

Viruses responsible for haemorrhagic fevers are introduced into the human population when the activities of infected reservoir hosts or vectors and humans intersect. Humans may acquire viruses carried in rodent reservoirs through contact with urine, faecal matter, saliva or blood/tissues of infected rodents. Vector mosquitoes or ticks may spread the virus directly to humans through their bites, or infect animals or livestock that then expose humans who care for them or slaughter them for food.[3]

Human-to-Human Transmission

Once a human is infected, further transmission to others is possible for some VHFs (e.g., Crimean-Congo, Ebola, Lassa and Marburg) and human transmission chains may be initiated that can result in outbreaks within geographic areas.

Direct transmission occurs through contact with the body fluids of the infected person with exposure of mucous membranes or non-intact skin when:

- Providing care for the person at home or in a health care setting without the use of PPE
- Preparing a body for burial or participating in burial rituals without the use of personal protective equipment (PPE)
- Accidental inoculation of a caregiver occurs through a needle-stick injury
- A sexual partner has unprotected sexual contact with a male survivor of VHF (e.g., Ebola, Lassa and Marburg) who has persistent virus in semen following his initial infection

Indirect transmission has been a factor in propagating outbreaks in patients of the local health care settings where:

- Single-use medical equipment such as syringes and needles has been reused
- Multi-use patient care equipment has been contaminated

Non-Transmissible Viral Haemorrhagic Fevers

Several VHF agents (e.g., dengue haemorrhagic fever, yellow fever, and rift valley fever) are not transmissible from an infected person to another person due to the nature of the virus (arthropod-borne agents).

Evidence of Human-to-Human Transmission of VHF

Some viruses that are known to cause VHF can spread from one person to another once someone has become infected. Ebola, Marburg, Lassa and Crimean-Congo viruses are examples of those that cause secondary human-to-human transmission. This type of secondary transmission of the virus can occur directly through close contact with infected people or their organs, blood, secretions, or other body fluids. It can also occur indirectly through contact with objects contaminated with the above-mentioned. An example of this is the transmission of Ebola and Lassa virus through the use of contaminated syringes and needles.

The 2014-2016 Ebola virus disease (EVD) outbreak in West Africa was the largest and most complex in history. There were more cases and deaths in this outbreak than all others combined, which has added to the understanding of EVD transmission. In 2018, the Ministry of Health of the Democratic Republic of the Congo declared a new outbreak of EVD in North Kivu Province. Numbers fluctuate on a daily basis due to many factors including ongoing monitoring, investigation, and reclassification of cases. Suspect cases continue to systematically be investigated to confirm or exclude EVD before inclusion in the case counts or discarded as non-cases.

The following added to the knowledge gained during prior EVD outbreak investigations:[6]

- Cases are not communicable before the onset of symptoms[7]
- Virus levels in a patient's blood at the time of fever and symptom onset are low (some patients may not have a positive blood test result during the first three days of illness)
- Ebola virus RNA levels increase throughout the course of infection and are highest late in the course of the disease when copious fluid loss is experienced due to diarrhea, vomiting or haemorrhage
- The bodies of deceased EVD-infected persons are highly infectious
- Direct contact with blood or other body fluids of infected persons without use of PPE increased the risk for transmission in households or health care settings
- Adult family members who touched a deceased EVD patient without use of PPE and who were exposed during the late phase of illness were at additional risk for infection
- Cases remain communicable as long as blood or other body fluids contain the virus

In addition, HCPs continue to be at risk of acquiring a VHF. Literature[8] has identified VHF-related health care associated infection (HAI) outbreaks with high mortality rate among HCPs. High risk activities leading to transmission include:

- needle-stick injury
- interventions for gastro-intestinal bleeding
- emergency procedures performed on unsuspected cases
- unprotected handling of infected material

Transmission through Aerosol (Droplets) or Airborne Routes[9]

Very few theoretical, case-based or research-based articles currently exist that claim human-to-human airborne transmission of filoviruses. However, aerosol transmission of filoviruses is supported by limited epidemiological evidence and some experimental studies.

VHF Persistence

The EVD outbreaks have resulted in a large number of survivors and have also contributed to further understanding around sequelae of EVD infections and persistence of virus and possible relapse of disease symptoms.[10,11] EVD is not transmitted through casual contact with an EVD survivor. However, the virus can remain in immunologically privileged sites for several months after recovery. These are sites "where viruses and pathogens, like the Ebola virus, are shielded from the survivor's immune system, even after being cleared elsewhere in the body. These privileged sites include the testes, interior of the eyes, and central nervous system, particularly the cerebrospinal fluid. Whether the virus is present in these body parts and for how long varies by survivor."[12]

Studies continue on the long-term effects of EVD and its persistence to better understand how to provide treatment and care to EVD survivors.

Very little information related to the persistence of the virus is available for other VHFs. For example, Marburg virus transmission has been identified in infected semen up to seven weeks after recovery. It has been noted that more research is necessary to further determine the risk of sexual transmission. Lassa fever has also been detected up to 64 days post recovery in semen.

The knowledge regarding the length of viral persistence continues to evolve as survivor studies continue.

VHF Treatment and Vaccines

Treatment and vaccination studies are under development and may vary from one VHF agent to another. Research on experimental vaccines is ongoing. For more information on current VHF treatment and vaccination studies and recommendations, refer to regional public health authorities and national and international guidance such as PHAC, CDC and WHO.

Symptoms of VHF are to be treated as they appear. When treatment is initiated early, basic interventions can significantly improve outcomes. Treatment can include fluid replacement, oxygen therapy, medication to support blood pressure, reduce vomiting and diarrhea and manage fever and pain. Other treatment may be needed if/when other infections occur.

Clinical Presentation

The specific signs and symptoms vary by the type of VHF agent although the clinical presentations have some overlap due to the pathophysiology of the viruses and their effects on the vascular system.

All of the VHF agents cause a febrile prodrome (preliminary symptoms) with fatigue, muscles aches, weakness, and dizziness.[3] Patients may exhibit other notable clinical features including the following:

- Bleeding manifestations vary by agent (e.g., in about 30 per cent of patients affected with Ebola or Marburg virus and in only about one per cent of patients with Rift Valley fever)
- A maculopapular rash may be observed early in the clinical course in some forms of VHF, notably in those affected with Ebola and Marburg virus
- Severe exudative pharyngitis is a characteristic early feature of Lassa fever
- Several agents cause meningoencephalitis in addition to VHF (e.g., Rift Valley fever, Kyasanur forest disease, Omsk haemorrhagic fever viruses)
- Jaundice may be a prominent feature in some infections (e.g., Yellow Fever).
- Renal failure may be associated with some infections

Major clinical features for selected VHF diseases are included in Table 2.

Table 2: Clinical Characteristics of Selected Viral Haemorrhagic Fevers[6]

VHF	Incubation	Prodrome	Clinical Signs/Symptoms	Laboratory Features	Complications	Case-Fatality Rate
Ebola	3-13 days, although some reports indicate a range of 2-21 days	• abrupt onset of fever, severe prostration, headache and myalgia is typical • other features may include abdominal pain, nausea/vomiting, diarrhea, chest pain, cough, pharyngitis, lymphadenopathy, photophobia and conjunctival injection	• maculopapular rash • jaundice and pancreatitis • Bleeding (e.g., mucous membrane haemorrhages, bloody diarrhea and petechiae) • coma, seizures and shock	• leukopenia • thrombocytopenia • elevated amylase and hepatic enzymes • laboratory features of disseminated intravascular coagulation (DIC) may occur as disease progresses, including prolonged bleeding time, prothrombin time and activated partial thromboplastin time; elevated fibrin degradation products; and decreased fibrinogen	• migratory arthralgias • ocular disease (unilateral vision loss, uveitis) • suppurative parotitis • orchitis • hearing loss • pericarditis • illness-induced abortion among pregnant women	Varies by virus subtype and by outbreak
Marburg	2-21 days (average 5-9 days)	• abrupt onset of fever, severe prostration, headache and myalgia is typical but the patient may present with an influenza-like illness • other features may include abdominal pain, nausea/vomiting, diarrhea, chest pain, cough, pharyngitis, lymphadenopathy,	• maculopapular rash • jaundice and pancreatitis • bleeding (e.g., mucous membrane haemorrhages, bloody diarrhea and petechiae) • restlessness, confusion, apathy, somnolence and meningismus • shock	• leukopenia • atypical lymphocytes may be present • thrombocytopenia Eelevated amylase and hepatic enzymes • laboratory features of DIC may occur as disease progresses, including prolonged bleeding time, prothrombin time, and activated partial	• orchitis • alopecia • uveitis • recurrent hepatitis	Varies by outbreak (23%-93%)

VHF	Incubation	Prodrome	Clinical Signs/Symptoms	Laboratory Features	Complications	Case-Fatality Rate
		photophobia and conjunctival injection		thromboplastin time; elevated fibrin degradation products; and decreased fibrinogen		
Lassa	5-16 days	• illness begins gradually with fever, weakness and generalized malaise • arthralgias, back pain, non- productive cough and retrosternal pain often appear by 3rd to 4th day	• most Lassa virus infections in Africa are mild or subclinical • severe exudative pharyngitis • maculopapular rash • Severe prostration may occur • bleeding (e.g., mucous membrane haemorrhages, bloody diarrhea and petechiae) • edema of head and neck • pleural, pericardal effusios • encephalopathy, coma, meningeal signs, cerebellar syndromes, tremors, seizures, eighth cranial nerve involvement	• leukocyte counts occasionally are decreased but most often are normal or moderately increased • hemoconcentration, proteinuria, and elevated hepatic enzymes may occur • thrombocytopenia is mild or does not occur	• 8th cranial nerve damage with hearing loss • pericarditis • transient alopecia • illness-induced abortion among pregnant women	Varies by outbreak (9%-25% in hospitalized patients)

Source: Center for Infectious Disease Research and Policy. VHF.
Accessible from: http://www.cidrap.umn.edu/infectious-disease-topics/vhf

When to Suspect VHF

VHFs are not endemic in Canada and no cases have occurred in Ontario.[13] International travel has the potential to expose persons to a number of travel-associated diseases including VHF. It is essential that a travel history is included as part of routine patient evaluations at triage and beyond to ensure that prompt infection prevention and control measures are implemented to protect staff members and other patients/visitors from potential exposure to an infectious agent.

Screening of Patients Presenting for Care

A travel history is to always remain part of routine patient evaluation for persons presenting for assessment at triage with symptoms that could be due to an infectious cause (e.g., fevers, respiratory symptoms, rashes, vomiting and diarrhea).[10] A history of recent travel to a VHF-affected area (within three weeks) along with symptoms of an infectious disease are to trigger suspicion of VHF. IPAC measures are to be initiated. These measures include patient placement (Additional Precautions) away from the other waiting patients and source control measures (e.g., masking patient) to reduce the potential for transmission. Refer to Appendix 2 – Triage Assessment Algorithm for VHF.

The initial signs and symptoms of an infection with a VHF virus are non-specific and similar to many other common causes of febrile illnesses in returning travelers. It is important that other more common travel-associated diseases (malaria, dengue, vaccine-preventable diseases) and other emerging pathogens (chikungunya, Zika virus, MERS-CoV) be carefully considered and investigated. The level of IPAC measures required will depend on the patient's presentation and travel history (see risk analysis section below).

The Chief Medical Officer of Health may institute enhanced and active screening for travelers or visitors returning from areas experiencing widespread transmission of VHF when a risk for importation into Ontario exists under section 77.7 of the *Health Protection and Promotion Act, R.S.O., 1990, c.H.7 (HPPA).*

Applying Further Risk Analysis to Decision Regarding Further Investigation for VHF

Circumstances under which the diagnosis of acute VHF is to be considered for individuals who, **within 3 weeks before the onset of fever** (and with other clinically compatible symptoms), have:[14]

- travelled in the specific local area of a country where VHF has recently occurred or is endemic (see maps in Table 1)
- had direct contact with blood, other body fluids, secretions, or excretions of a person (alive or deceased) or animal with VHF
- worked in a laboratory that handles haemorrhagic fever viruses or in animal facility that handles animals known to be natural hosts of VHF agents

Laboratory Investigation and Diagnosis

VHF testing, excluding yellow and dengue fevers, requires the concurrence of a PHO Laboratory microbiologist. Before collecting appropriate specimens for investigation of suspected VHF, the clinician is to:

- consult with a PHO Laboratory microbiologist available through the PHOL Customer Service Centre at 416-235-6556 or toll free at 1-877-604-4567
- contact the local public health unit (PHU)

For current testing and laboratory guidance on VHF, including EVD, see:

Viral Haemorrhagic Fever including Ebola Virus Disease Test Information Sheet

Laboratory Guidance - Viral Haemorrhagic Fevers including Ebola Virus Disease

Specimens are to be taken by staff experienced in the required techniques. The same protective clothing as described for other hospital staff is to be worn by those obtaining laboratory specimens, with the addition of double gloves to facilitate the cleaning of the exterior of the specimen container. Once the specimen is collected, the entire outside of each specimen container is to be wiped with a hospital-grade disinfectant and the outer layer of gloves can be removed.

As per usual practices, laboratory specimens are to be transported in compliance with the *Transportation of Dangerous Goods Act, 1992*. Specimens are not to be transported in a pneumatic tube system.

Infection Prevention and Control (IPAC) Measures

While the risk of VHF introduction and transmission in Ontario is remote, continued awareness of emerging disease and outbreaks and continued commitment to strong IPAC programs and systems will ensure that HCPs and patients are protected from any risk of exposure should a case present for assessment and care. Guidance regarding IPAC practices for VHF is to be read in combination with current PIDAC Best Practice documents, and is based on the Hierarchy of Controls.

Routine Practices

The consistent and appropriate use of Routine Practices in providing health care remains the best defense against the transmission of VHF and all other infections in health care settings.[11] Incorporating the elements of Routine Practices into the culture of all health care settings and into the daily practice of each health care provider (HCP) must be a priority.[15]

Organizational and Individual Responsibilities

Health care organizations have the obligation and responsibility to evaluate all of the components in the hierarchy of controls to minimize the risk for transmission of infectious organisms within the setting.

An organizational risk assessment (ORA) is a central component of preparation and planning in the protection of all individuals who may be present in the facility (e.g., HCPs, patients, visitors, contractors).

This organizational risk assessment and planning may include:

- assessment of patient population accessing the setting and the level of care provided by the organization
- triage design and procedures for identification of symptomatic patients and initiation of Additional Precautions or source control measures (e.g. masks available for patients with acute respiratory symptoms)
- availability of isolation areas or airborne infection isolation rooms (AIIRs)
- availability of PPE in locations accessible to staff requiring it
- training of designated staff on the selection, application, use, removal and disposal of PPE. Fit-testing of respirators completed when required
- training of staff who could potentially care for a patient requiring assessment or treatment of a VHF
- organizational policies and procedures that support the safe delivery of care and services
- internal and external communication processes

Point-of-care Risk Assessment

A point-of-care risk assessment (PCRA) is performed by HCPs to determine the appropriate IPAC measures to protect the HCP from exposure to infectious organisms (e.g., from sprays of blood or other body fluids, respiratory tract or other secretions or excretions and contaminated needles and other sharps).

> **All staff have the responsibility to work safely and in alignment with organizational policies and procedures in order to protect themselves, their coworkers, patients and visitors, or others present within the setting.**

When are Routine Practices Used?

Routine Practices are to be used with all patients during all care, to prevent and control transmission of microorganisms in all health care settings.[15] These constitute the minimum IPAC practices used to ensure that HCPs do not contract infections from patients and that HCPs do not spread infections to other staff and patients during medical care.

Entry Points and Triage

- All staff (including volunteers) are to be trained on the application of Routine Practices within the scope of their role and have access to PPE.

Care of Patients with confirmed non-transmissible VHF infections

- Patients who have a diagnosis of VHF due to an identified agent that is known not to cause secondary human-to-human infection such as Dengue, Rift Valley fever and Yellow fever, are cared for using Routine Practices.[15]

Additional Precautions for Patients with Suspected or Confirmed VHF Where Human-to-Human Transmission is Possible

Additional Precautions are based on the mode of transmission of an infectious agent (e.g., direct or indirect contact, droplet or airborne). These Additional Precautions include the use of engineering controls such as isolation rooms and physical barriers, the selection and use of appropriate PPE and control of the environment (e.g. extra cleaning measures) that are put in place for interaction(s) with the patient or their immediate environment.

The elements of Additional Precautions include:

Routine Practices
+
Specialized Accommodation and Signage
+
Personal Protective Equipment
+
Dedicated Equipment and Additional Cleaning Measures
+
Limited Transport
+
Communication

Additional Precautions can be applied individually or in combination as determined by the route(s) of transmission of the infection. They are described by the following categories:

- Contact Precautions
- Droplet Precautions
- Airborne Precautions

When are Additional Precautions Used?

Additional Precautions are used in addition to Routine Practices for patients known or suspected to be infected or colonized with certain microorganisms to interrupt transmission.[15] Refer to Routine Practices and Additional Precautions In All Health Care Settings, 3rd edition Clinical Syndromes/Conditions with Required Level of Precautions (also known as "Appendix N") for a list of microorganisms/diseases that require Additional Precautions.

Triage and Patient Assessment/Care

- Additional Precautions are to be implemented as soon as symptoms suggest a transmissible infection. Refer to Appendix 2 – Triage Assessment Algorithm for VHF.
- Policies are to be in place in each health care setting to authorize any regulated HCP to initiate the appropriate Additional Precautions at the time symptoms are identified and to maintain Additional Precautions until laboratory results are available to confirm or rule out the diagnosis
- Additional Precautions are to remain in place until discontinued under the direction of the infection prevention and control professional or consultation with a physician with expertise in infectious diseases
- Additional Precautions in place for the patient are to be communicated to all other HCPs who may be interacting with the patient in the course of the clinical assessment and to the designated IPAC department contact
- Contact and Droplet Precautions are to be initiated if laboratory testing and further investigation for a VHF is indicated (i.e., a strong epidemiological exposure risk with the presence of compatible clinical symptoms)
- Airborne Precautions are added if the clinical assessment indicates the presence of pneumonia, if any airborne disease (e.g., Tuberculosis) is suspected, or for aerosol-generating medical procedures (AGMPs)

Consideration for Decision-Making Regarding IPAC Management of Patients with Suspected or Confirmed VHF

Patients who have a suspect or confirmed VHF due to an agent of the Filoviridae (e.g. Ebola, Marburg) or Arenaviridae (e.g. Lassa, Machupo, Junin) families or due to Crimean-Congo hemorrhagic fever virus, will require care using a combination of Additional Precautions due to the highly infectious nature of these agents and potential for transmission.

The clinical presentation of the patient with a suspect or confirmed VHF will evolve over time and risk of exposure to the infectious agent will also change depending on the patient`s clinical status and the nature of the care or procedure being provided.

Table 3 summarizes key aspects of the elements of Additional Precautions that can be applied based on whether or not the patient is experiencing fluid loss through uncontrolled vomiting, diarrhea, or bleeding. The presence of large amounts of fluid loss puts the HCP at a higher risk for body fluid exposure or the environment at higher risk for contamination[7]. Decision making will also need to take into account the anticipated care procedures.

Patients who are clinically stable (i.e., do not have vomiting, diarrhea, or bleeding) can be managed using the guidance outlined in **Table 3**. A lower risk of exposure of the HCP exists when caring for these patients when:

- patient is in early stage of illness (e.g., fever with fatigue and myalgia)
- patient is in convalescent stage of illness with diarrhea and vomiting resolved
- patient's body fluids are contained (e.g., formed stool, no emesis, no bleeding)
- patient is continent
- patient is capable of self-care and hygiene

Patients who are clinically unstable (i.e., experiencing high volume or uncontrolled fluid loss due to vomiting, diarrhea, or bleeding) will require more enhanced measures as included in **Table 3**.

These patients may also require invasive or AGMP. A higher risk of exposure of the HCP exists when caring for these patients when:

- patient's body fluids are soiling the environment (e.g., diarrhea, emesis, bleeding)
- patient is incontinent
- patient is unable to perform self-care and hygiene
- patient requires invasive or AGMP (e.g. intubation, suctioning, active resuscitation).

> **Each organization will need to incorporate protocols, policies and procedures specific to its organizational risk assessment and designated role, if indicated, in assessing, testing, and treating patients who may have a suspect or confirmed VHF.**

When Should Additional Barriers be Considered for Management of VHF?

Additional barriers for Droplet and Contact Precautions may be considered when providing care to a person with a suspected or confirmed VHF infection that is caused by a highly infectious agent. Additional PPE that provides coverage of all skin and mucous membranes of the HCP and that is more resistant or impermeable to fluid penetration may be considered to reduce the potential for exposure to the infectious agent. The additional barriers can include:

- full face shield that covers all mucous membranes of the face
- fluid resistant mask
- fluid resistant or impermeable long sleeved, cuffed gown/coveralls to protect clothing and the HCP from the larger amounts of body fluids that can be present as the clinical course of the disease evolves
- fluid impermeable apron for additional protection to the front of the body
- additional head/neck and foot coverings (if not part of a coverall suit)
- use of N95 fit–tested, seal-checked respirator or powered air purifying respirator (PAPR) for AGMPs

> **Each organization will need to develop comprehensive policies, procedures, and training for the sequence of putting on (donning) and removing (doffing) PPE that has been made available for staff providing care to a patient with a suspect or confirmed VHF infection.**

Table 3: IPAC Recommendations for Clinically Stable (Lower Risk) and Clinically Unstable (Higher Risk) Suspect or Confirmed VHF* Patients[7,17,18,20,21]

Component	Recommendation	Comments
Additional Precautions	• Contact and Droplet Precautions in addition to Routine Practices • notify IPAC team immediately • notify local PHU/Medical Officer of Health	• Airborne Precautions may also be needed if the patient is exhibiting signs of VHF pneumonia, has a differential diagnosis of tuberculosis or measles or is receiving AGMPs
Patient placement	• single room with a dedicated washroom • door to remain closed • location allows for separate spaces that are clearly delineated "clean" and "contaminated" areas • storage for clean PPE in clean area • alcohol-based hand rub (ABHR) and waste containers available in "contaminated" or doffing area	• it may be practical to use an airborne isolation room (AIIR) due to attached washroom and anteroom • consideration to placement in a room/unit that can accommodate changes (i.e., require AGMP) in the clinical presentation of the patient • if a dedicated washroom is unavailable, a dedicated commode with appropriate disposable absorbent pads or disposable bedpans may be used as an alternative
Staffing	• only staff members who have been trained and demonstrate competency in donning/doffing of recommended PPE are to be assigned to provide care for the patient • for **clinically stable** VHF patient(s), assess the need for secondary personnel to monitor donning and removal of PPE • for **clinically unstable** VHF patient(s), institute observed PPE donning and doffing; maintain a log of all people entering the room	• if unfamiliar PPE is being worn, refresher training is to be provided prior to use • maintain a log of all people entering the room
Hand hygiene	• access to hand washing sink and ABHR for staff • separate patient sink	• clean hands is the most important measure in preventing self-inoculation of eyes or mucous membranes during and after removal of PPE
Personal protective equipment	All staff members entering the room are to wear at a minimum: • disposable full face shield • gloves with extended cuffs to pull over gown cuffs	• follow organizational risk assessment for PPE use – point-of-care (POC) risk assessment before patient contact is to be done to evaluate the care tasks

Component	Recommendation	Comments
	In addition, for **clinically stable** VHF patient(s): • disposable fluid-resistant** cuffed gown that covers to mid-calf • fluid resistant*** mask (surgical or procedure) • fit-tested, seal-checked N95 respirator during AGMPs or when additional precautions indicate airborne precautions are needed For **clinically unstable** VHF patient(s): • impermeable**** long-sleeved, cuffed gown that covers to mid-calf or impermeable coverall • fit-tested, seal-checked N95 respirator or powered-air purifying respirator (PAPR) for the potential of unexpected aerosolization of secretions • shoe covers • hair/head/neck covering	planned, the patient's current condition, the patient's possible response to the procedures, and the potential for exposure to blood and/or body fluids • If an AGMP is to be performed and/or the patient becomes clinically unstable, assess the need for additional PPE
Patient care equipment	• dedicate patient care equipment to the room • use disposable equipment where possible	• continue to ensure all dedicated, non-disposable equipment is cleaned with an approved hospital-grade disinfectant after each use to reduce bio burden within the patient environment
Environmental cleaning	• communicate with the environmental services department • experienced environmental services staff members trained in IPAC practices and use of recommended PPE are to be assigned • environmental services cleaning equipment is to be disposable or remain in the room for duration of patient admission • frequency of cleaning is to be based on the level of contamination with blood and/or body fluids—but, at a minimum, cleaning is to be done daily • use appropriate hospital-grade disinfectant with a Drug Identification Number (DIN) and claim sufficient to inactivate enveloped viruses	• cleaning of the patient room and PPE doffing area is important in reducing the environmental contamination which in turn decreases the risk of transmission to HCPs • VHF viruses have lipid envelopes which make them relatively easy to inactivate with most approved hospital-grade disinfectants

Component	Recommendation	Comments
Waste management	• general patient care waste from patients undergoing investigation for possible VHF is to be stored in a labelled leak-proof container if possible until such time as a VHF diagnosis is confirmed or eliminated • liquids/body fluids from patient or patient care activities can be disposed of through the normal sanitary sewer system	• most VHF agents are classified under Transport Canada regulations as Class A agents and require special handling and packaging[19] • do not use hand hygiene sinks or patient sinks for disposal of body fluids/liquids
Linen management	• staff members handling soiled linen are to wear the required PPE based on POC risk assessment • linen that is not soiled with body fluids can be held for laundering or disposal until such time as a VHF diagnosis is confirmed or eliminated • linen soiled with body fluids is to be placed into a leak-proof bag at the point-of-use. The external surface of the bag/container is to be disinfected prior to removal from the area for disposal	
Duration of precautions	• duration of precautions is to be determined on case-by-case basis based on laboratory findings and patient symptoms • decisions to revise or discontinue Additional Precautions for confirmed cases are to be made in conjunction with the IPAC department and local Medical Officer of Health	• other co-conditions may require specific additional precautions be continued for the patient (tuberculosis, ARO colonization, etc.)

*Applies to infections due to agents of the Filoviridae, Arenaviridae families and Crimean-Congo virus. Infections due to Yellow Fever, Dengue and Rift Valley Fever are managed using Routine Practices.

** Fluid resistant gowns meet CSA or AAMI level 2 or 3 standards (see Appendix 1)

*** Fluid resistant mask (see Glossary and also Appendix M: Advantages and Disadvantages of PPE in PIDAC Routine Practices and Additional Precautions, November 2012)

****Impermeable gowns meet CSA or AAMI Level 4 standard (see Appendix 1)

Additional Infection Prevention and Control Considerations

Aerosol-Generating Medical Procedures (AGMPs)

Aerosol-generating medical procedures (AGMP) are to be performed only if medically necessary on a patient with suspected or confirmed VHF. In this case, an AGMP is to be performed in an AIIR, if feasible, with the use of Airborne Precautions. If emergency intubation is necessary and the patient is not in an AIIR, intubation is to proceed with HCP wearing appropriate PPE.

Limit the number of staff to the minimum required to safely perform the procedure. Visitors are not to be present. Whenever possible, the procedure is to be performed by the most highly experienced staff member available.

All staff members entering the AIIR or participating in the emergency intubation are to wear at a minimum:

- impermeable, long-sleeved cuffed gown or coverall
- gloves with extended cuffs to pull over gown cuffs so that there is no exposed skin or clothing
- fit-tested, seal-checked N95 respirator or PAPR, where available
- full face shield
- shoe covers
- hair/head/neck covering

Following the procedure, the room is to be cleaned and disinfected.

Transportation of Suspect or Confirmed Patients with VHF

Internal Transportation

Internal transportation for patients with a suspected or confirmed VHF due to a **non-transmissible** agent (e.g., Dengue) does not need to be restricted.

Patients being cared for with Droplet/Contact Precautions due to a suspected or confirmed infection with a transmissible VHF are not to leave the room or be transferred internally except for essential medical procedures or diagnostic tests that cannot be performed in the patient's room. Transport staff members are to be aware of the patient's status and the required PPE. Patients with respiratory symptoms are to wear a mask to contain respiratory droplets during transport.[15]

If an internal transfer cannot be avoided ensure new room is ready before transfer to minimize time outside of the patient room. HCPs providing transport are to discard PPE as they leave the room, and put on new PPE.[11] Prior to transporting the patient for diagnostic testing, the receiving unit is to be fully

aware of the patient's impending arrival and be prepared to perform testing immediately. Patients are to be transported using the most direct route to their destination. Staff transporting the patient is to wear full PPE (e.g. gown, gloves, full face shield) as patients are potentially clinically unstable and may require care during transportation. If the patient is coughing, a surgical mask is to be placed over their mouth and nose. Following the procedure, the room is to be cleaned as per the organizational policies and procedures that are specific to VHF or other emerging pathogens.

External Transportation

Transport companies and Emergency Medical Services staff members are to be notified of the patient's status to determine the requirements for the most appropriate PPE based on the risk assessment.

Visitor Restriction

Visitors do not need to be restricted for patients with suspected or confirmed VHF due to a **non-transmissible** agent (e.g., Dengue, Rift Valley fever, Yellow fever).

For patients in Additional Precautions for suspected or confirmed VHF due to a transmissible agent, procedures are to be established for monitoring, managing and training visitors.

Visitors are to be restricted to only those absolutely necessary (i.e., to help with patient history if patient unable to communicate). Case-by-case exceptions may be made when it is essential for the well-being of the patient and in consultation with local Public Health and Infection Prevention and Control teams.

Visits are to be controlled and scheduled to allow for:

- screening for symptoms of VHF before entering or on arrival to hospital for those persons who may have been exposed to the patient (or index case) prior to or following admission
- evaluation of the current risk to the visitor and ability of the visitor to comply with precautions

A log is to be maintained of all visitors entering and leaving the patient room (with times documented).

Follow-up of contacts, including those who may have accompanied a patient with suspected or confirmed VHF due to a transmissible agent to the emergency department, will be done by the local PHU/Medical Officer of Health.

Communications

Internal Communications

For cases of suspected or confirmed VHF, the hospital IPAC department is to be notified immediately. Consult with a PHO Laboratory microbiologist prior to the collection of any specimens. Refer to Section **Laboratory Investigation and Diagnosis**.

In addition, it is prudent to notify administrative leadership and public relations, as VHF can generate significant media interest. A strategy for internal communications within the organization to reach all

staff is important. Easy access to updated policies, procedures, fact sheets and Q and A's geared to various educational and language levels are examples. Maintaining patient confidentiality in the face of media interest is a challenge. HCPs are to be reminded of their legal responsibilities under the *Personal Health Information Protection Act, 2004, S.O. 2004, c. 3, Sched. A.*[22]

External Communications

All cases of suspect or confirmed VHF are to be reported to the local PHU immediately. The health unit business and after-hours contact information is available online at this link. Health care facilities caring for patients with suspect or confirmed VHF are to have a communications plan in place to deal with media interest while ensuring patient confidentiality.

Note that the Ministry of Health may activate the Ministry Emergency Operations Centre (MEOC) to coordinate and direct the health system's response in the event of a confirmed case of VHF in Ontario. As part of this coordination, the MEOC will support health system partners to implement a coordinated communications strategy.

Education of Staff and Visitors

Education for Staff

Basic IPAC education is essential and is to be provided to all staff, especially those providing direct patient care. In addition to scheduled ongoing continuing education related to potentially serious imported diseases such as VHF, all HCPs are to refresh their knowledge and skills on the following IPAC practices:

- Point-of-care risk assessment is the first step in the effective use of RP done before each interaction with a client/patient or their environment. For more information, please refer to: Provincial Infectious Diseases Advisory Committee's (PIDAC) Routine Practices and Additional Precautions in All Health Care Settings[15]
- Hand hygiene is considered the most important and effective IPAC measure to prevent the spread of health care-associated infections. For more information, please refer to: PIDAC's Best Practices for Hand Hygiene in All Health Care Settings[16]
- Routine Practices and Additional Precautions are IPAC practices to be used with all clients/patients during all care to prevent and control the transmission of microorganisms in all health care settings. For more information, please refer to: PIDAC's Routine Practices and Additional Precautions in All Health Care Settings[15]
- Infection Prevention and Control (IPAC) core competencies are basic knowledge and skills all health care workers in Ontario need to possess about IPAC, regardless of their role or position, education, experience or culture

Training for VHF (and other emerging infectious diseases) preparedness:

Staff members require training on the protocols, policies and procedures that are developed by the organization in support of the designated role of the organization in the testing or treatment of patients with suspect or confirmed infections due to an agent of VHF.

The training is to include the proper selection, use, and limitations of all PPE that would be used in the care of a patient with suspected or confirmed VHF.

- Each organization is to have specific guidance and training on the donning and doffing of PPE that has been selected by the organization, where additional barriers are needed based on identified VHF. Ongoing training/refreshers are to be scheduled to ensure retention of practice
- Guidance and training are to also address the measures to take should the PPE be breached. This includes careful removal of the damaged PPE and removal of any leaked blood and body fluids on intact skin with soap and water
- Clear protocols and response roles are to be in place for any blood or body fluid exposure including puncture, splash, or spray to mucous membranes

Education for Visitors

For patients with suspected or confirmed VHF, visitors are to be restricted, unless the agent that is suspected or confirmed is non-transmissible. For visitors deemed essential, teaching is to include:[18]

- hand hygiene
- hygiene practices that prevent the spread of microorganisms
- appropriate selection and use of PPE based on recommendations
- self-screening for fever or symptoms of VHF

Infection prevention and control professionals (ICPs) may assist staff in education of visitors through developing and/or reviewing informational materials pertaining to Routine Practices.

For visitors deemed essential for patient care, teaching is to include:

- correct hand hygiene
- hygiene practices that prevent the spread of microorganisms
- appropriate use of PPE
- self-screening for fever or symptoms
- infection prevention and control professionals (ICPs) may assist staff in education of visitors through developing and/or reviewing informational materials pertaining to RP and AP
- establish procedures for monitoring, managing and training visitors

Handling of Deceased VHF Patients in the Acute Care Setting

Death Due to a Transmissible Agent of VHF

Due to the presence of high viral loads throughout the body at the time of death, only persons who have been trained in the proper use of PPE and the process for handling the body of a patient infected with a transmissible VHF agent are to handle, prepare and move the body within the patient room. Handling of the body is to be kept to a minimum. Autopsies are not recommended and embalming is not to be done.[6] Notification of all other areas where the body may be stored or transported is required prior to arrival of the body.

The preparation of the body is to be done within the patient room as follows:

- clamp and leave all intravenous lines, endotracheal tubes or other invasive devices in place to avoid additional splashes or leakage, cover any leaking tubes with absorbent material
- do not wash, spray or clean the body
- use the bed linens to wrap the body
- immediately place the wrapped body into a leak-proof plastic body bag (ideally 150 µm thick) and close the zipper
- clean the outside of the bag to remove any visible soil or leakage with an approved hospital-grade disinfectant and discard the wipes or cloths and gloves
- clean hands, apply new gloves and use a fresh wipe or cloth and reapply the disinfectant to the entire bag surface
- allow appropriate contact time and drying according to the manufacturer's recommendations
- place the bagged body into a second leak-proof body bag and close the zipper
- disinfect the outside of the second bag along with the stretcher surfaces, again allowing for appropriate contact and drying time according to the manufacturer's recommendations prior to removing the body from the room
- as the body exits the room, have other staff outside the room assist in moving the stretcher through the anteroom or the doorway of the isolation room to allow space for the staff who have prepared the body to safely remove and discard their PPE within the allocated doffing space

Once the body has been double bagged and the outer surfaces have been disinfected with an approved hospital-grade disinfectant, the personnel providing the transportation of the body to the morgue do not need to wear PPE. Affix identification of the body and confirmation of surface disinfection to the bag and ensure that the body is kept in a secured area that cannot be accidently accessed if there will be any delay in retrieval of the body by the designated funeral home staff.

Cremation is the preferred option. Embalming is not to be done. A hermetically sealed casket may be used as an alternative to cremation if burial is preferred or required by the family.

Death Due to a Non-Transmissible Agent of VHF (e.g., Dengue)

Routine facility protocols for the preparation and management of bodies would be followed.

Recommendations for Recovering Patients Presenting for Care or Readmission

Recovering Patients Presenting for Care that is Not Related to a VHF Relapse

- **Body fluids that are NOT from immunologically privileged sites:** As per usual, Routine Practices and Additional Precautions (and not VHF-specific precautions) are used for potential exposure to blood, and body fluids

- **Body fluids from immunologically privileged sites:** VHF-specific precautions are used if contact is expected with fluids from immunologically privileged sites (e.g., intraocular fluid, cerebral spinal fluid, semen, breast milk or synovial fluid), depending on VHF agent. VHF-specific precautions would no longer be required for fluids that have been tested (e.g., Ebola virus RNA by RT-PCR) and have been found to be negative on two consecutive tests

- **Delivery and handling of newborns:** VHF-specific precautions are used for the delivery and handling of the newborn baby from a woman who had a transmissible VHF while pregnant. Routine Practices and Additional Precautions are used for the delivery and handling of a baby if the woman became pregnant after recovering from a transmissible VHF. For example, in both women who had EVD during pregnancy or became pregnant after recovering from EVD, VHF-specific precautions would be required if handling breast milk or if the woman is receiving an epidural or spinal anesthetic, because of the potential exposure to CSF

- **Elective surgery:** If surgery on immunologically privileged sites (eyes, brain, spinal cord, breasts, male genitourinary tract including testes, prostate and seminal vesicles and joints), depending on VHF agent, is elective and can be postponed, it is recommended that it be delayed for one year post resolution of acute infection with transmissible VHF. For example, if surgery on any of the immunologically privileged sites is to be performed on a recovered EVD patient, VHF-specific IPAC precautions will be required, even if beyond a year from EVD symptom onset. During surgery, testing for EVD is to be taken from the implicated site to assist with IPAC management post-operatively.[11]

Recovering Patients Presenting for Care that is or May be Related to a VHF Relapse

Patient experiencing a relapse may present with VHF agent-specific symptoms (e.g., fever, eye symptoms, or neurologic symptoms such as headache, neck stiffness, photophobia, altered mental status, and/or seizures). When examining a patient who is or may be having a relapse, VHF-specific IPAC precautions are used until VHF is ruled out by testing of blood and specific body sites as indicated based on symptoms.

Occupational Health and Safety Considerations

Monitoring and Management of Potentially-Exposed Staff

Implementation of Routine Practices and Additional Precautions including hand hygiene, and appropriate training of workers are key to preventing the occupational transmission of VHF.

Organizations are to develop policies for monitoring and management of potentially-exposed staff. The follow-up of staff potentially exposed to a transmissible VHF agent is the role of occupational health and safety (OHS).

Persons with percutaneous or mucocutaneous exposures to blood, body fluids, secretions, or excretions from a patient with suspected or confirmed VHF are to:

- Stop working and immediately wash the affected skin surfaces with soap and water. For mucous membrane splashes (e.g., conjunctiva) irrigate with copious amounts of water or eyewash solution
- Immediately contact a supervisor and OHS for assessment and post-exposure management for blood borne pathogens (e.g., hepatitis B virus, hepatitis C virus, and HIV) as per usual organizational policy
- Comply with any medical surveillance or work exclusion as per the OHS/local PHU until further confirmation of the VHF diagnosis

Assessment of the risk presented by exposure to a patient with suspected or confirmed VHF requires careful review of the activities undertaken by the staff member along with review of the use of appropriate Routine Practices and Additional Precautions. This may need to be done in consultation with the local PHU and other infectious disease or IPAC experts.

Workers who are identified as being low risk contacts are to self-monitor for fever and other symptoms compatible with VHF for 21 days from their last exposure to the confirmed case. The workplace (e.g., OHS) is to discuss return to work policies with the PHU. Workers are to consult with OHS prior to returning to work. Criteria for low risk exposure includes:[23]

- direct contact with a symptomatic transmissible VHF case, their body fluids, and their corpse, while adhering to recommended IPAC practices and with no known breach in IPAC practices or
- lived or worked in areas/settings where active transmission of transmissible VHF was occurring (e.g., a humanitarian aid worker who was not working in a healthcare facility but was in a location with active transmission) or
- had only casual interactions, and no direct contact, with a transmissible VHF case or their body fluids. (i.e., casual interactions include sharing a seating area on public transportation or sitting in the same waiting room

Workers classified as high risk contacts are to avoid direct patient contact for the 21-day monitoring period. Criteria for high risk exposure includes:[23]

- percutaneous (e.g., needle stick) or mucous membrane exposure to blood or other body fluids of a confirmed case or
- unprotected sexual contact with a person infected or recovering from a transmissible (i.e., VHF can persist for months in the semen of infected males and possibly the vaginal secretions of infected females) or
- direct or close contact with a symptomatic confirmed transmissible VHF case (i.e., touched the person or their body fluids or was within one metre of them, not including just walking by the person) without the recommended PPE at all times) or
- the provision of health care to a confirmed transmissible VHF case or, while in hospital, entered their room or care area without recommended PPE at all times or
- a laboratory worker handling specimens of a confirmed transmissible VHF case without recommended biosafety measures at all times or
- direct contact with a dead body of a confirmed case (does not include a body in a body bag or coffin) without recommended PPE at all times or
- a household contact or a person seated next to the confirmed transmissible VHF case on an airplane

If the index patient has a non-transmissible VHF (e.g., Rift Valley fever or a flavivirus infection), then medical surveillance needs to be continued until 21 days after the last exposure only for those who processed laboratory specimens from the infected patient prior to initiation of recommended IPAC practices (since these conditions are transmitted in the laboratory setting but not via person-to-person).[5]

Public Health Considerations

Reporting to Public Health Unit

VHFs are diseases of public health significance[4] as per *Ontario Regulation 135/18: Designation of Diseases* under the *Health Protection and Promotion Act, R.S.O. 1990, c. H.7*. Physicians, other health care practitioners and hospitals administrators are required by law to report to the medical officer of health of the PHU in which professional services are being provided, any patient who has or may have a reportable disease such as VHF. Therefore, individuals who have symptoms consistent with VHF and travel history to a VHF affected area or endemic country in the 21 days prior to symptom onset are to be reported to the local PHU to ensure appropriate follow-up.

This reporting is to occur regardless of whether VHF testing has been ordered and regardless of the results. A list of Ontario PHUs can be found at: http://www.health.gov.on.ca/en/common/system/services/phu/locations.aspx.

Contact Management

The need to initiate contact investigation and management will vary with each different VHF agent and the ability of that agent to be transmitted to others who may have been exposed.[5] Some VHFs may not be transmissible while others may only cause subclinical or asymptomatic illness. Other VHFs such as Marburg and Ebola are extremely infectious during the later stages of illness and contact identification and management is a key component to stopping human transmission chains.

For further information regarding public health guidance for returning travellers, case and contact management and risk assessment criteria, please visit https://www.ontario.ca/ebola.

Appendix 1

Decision Guide on Selection of Personal Protective Equipment: Isolation Gowns or Coveralls for VHF

Selection of the range of PPE supplied by an organization for the assessment and care of a patient with suspected or confirmed Viral Haemorrhagic Disease (VHF) needs to be based on a site-specific risk assessment that includes a review of the care level and tasks anticipated, work and environmental conditions, and all of the environmental and administrative controls in place. This assessment will determine the correct PPE required for protection of the staff members who provide direct care or support services throughout the continuum of care, from out- patient assessment to critical care to recovery or mortuary care. Organizations will need to customize their inventory to ensure that the PPE selected offers effective protection for the users. Several different designs or options may be required to be able to fit different staff.

PPE provides physical coverage for the user that prevents the exposure of non-intact skin or the mucous membranes of the eyes, nose and mouth to blood, other body fluids, secretions or excretions. Hand hygiene at key moments and sequencing of PPE removal (doffing) is critically important to prevent accidental self-contamination. Staff training on the care, use, benefits and limitations of all of the PPE selected by the organization for care of a patient with suspected or confirmed VHF is required as part of a comprehensive planning and preparation process.

The type of gown or protective clothing selected is to be based on the nature of the interaction with the client or patient, including:

- anticipated degree of contact with infectious material
- risk posed by VHF
- potential for blood and body fluid penetration of the gown
- duration of potential exposure

> The use of protective clothing for VHF may evolve, and the type and level of protection may need to increase as the condition of the patient changes.

Comfort and usability of the PPE (wearability) is important in the selection of PPE for VHF and each setting is to consider the following factors:

- available in a wide range of sizes to fit different body types (PPE that is too small may tear)
- design allows for proper range of motion involved in the completion of expected tasks and does not impede movement (e.g., potential for injury, trip hazard)
- ease of donning and doffing without self-contamination in the process
- assessment of comfort when wearing for extended periods of time
- supply chain availability and ability to source and replenish stock and sizes easily if needed

Isolation Gown Standards

There is currently no established guidance that specifies performance criteria for PPE that is specific to VHF. The performance criteria included in the Canadian Standards Association Z314-18 Canadian medical device reprocessing[24] is to be used in selecting isolation gowns. See **Table 4**. These CSA standards also mirror the Association for the Advancement of Medical Instrumentation (AAMI) standards.

It is important to note that in the CSA standard the "critical zones" for isolation gowns encompasses the entire gown including the front and back. For surgical gowns the critical zones are the front panel and sleeves only. Using a surgical gown in an isolation setting would not necessarily provide full protection.

Table 4: Summary of Liquid Barrier Classification and Tests (Adapted from CSA Z314-18[24] and AAMI PB70: 2012[25])

Reference	Material	Resistance to Fluid Penetration	Testing Measure	Isolation
CSA Level 1 AAMI Level 1 (Fluid resistant)	Spunbond nonwoven fabric	Minimal water resistance	AATCC 42 Test for resistance to spray)	This would be the minimum standard for isolation gowns where minimal amounts of spray or droplets are anticipated
CSA Level 2 AAMI Level 2 (Fluid resistant)	Single layer microfibers or is a topically treated textile material	Resistant to water spray and some resistance to water absorption on contact	AATCC 127 (Test for resistance to water on contact; hydrostatic pressure) AATCC 42 (Test for resistance to water spray)	Commonly used as an isolation gown; suitable for situations involving low amounts of fluid or low risk of sprays

Reference	Material	Resistance to Fluid Penetration	Testing Measure	Isolation
CSA Level 3 AAMI Level 3 (Fluid resistant)	Laminated or coated material e.g., polypropylene coated polypropylene gowns	Resistant at a higher standard to water spray and resistance to water absorption on contact	Meets a higher test standard (compared to Level 2) for fluid resistance based on ATCC 127 (Test for resistance to water on contact; hydrostatic pressure) AATCC 42 (Test for resistance to water spray)	Used where more moderate amounts of fluid exposure or sprays may be anticipated in the course of providing patient care or handling of body fluids
CSA Level 4 AAMI Level 4 (Fluid impermeable)	Laminated or coated materials (e.g. impervious polyethylene)	Resistant to penetration of viruses based on penetration of a surrogate microbe for Hepatitis (B and C) and the Human Immunodeficiency Viruses	All critical components meets requirements of the bacteriophage penetration test ASTM F1671	Used where large amounts of fluids or sprays may be anticipated or encountered

Manufacturers may cite other references to testing criteria used for gowns or protective clothing. For instance a manufacturer may cite an ISO standard for fluid resistance (for example ISO16603[26] or 16604[27]). Others may simply reference the test method used such as ASTM 1670 or ASTM 1671, without actually referencing the AAMI or CSA standard. For instance, with full body suits, there is no reference in CSA or AAMI because both of these standards are more specific to gowns (e.g., drapes)

Protective clothing that meets ASTM for fluid resistance has been tested for resistance to a synthetic blood challenge (see below). All materials that pass ASTM test 1671 have also passed ASTM 1670. A product that has passed ASTM 1671 (which includes any gown that is level 4 based on AAMI/CSA) is therefore one of the most desirable protective clothing for circumstances where there is high probability for blood and body fluid exposure where infectious agents are present.

> It is important to note that these tests utilize arbitrary values that may not always reflect the actual reality of end-use.

Isolation Gown Selection Criteria

Gowns used as PPE are to be cuffed and long-sleeved, and offer full coverage of the body front, from neck to mid-thigh or below and fully overlap in the back with adequate closures to keep the gown secured.

Screening/Triage Settings

A gown that meets the CSA/AAMI standard for isolation gown as a level-2 or 3 (fluid resistant) gown is sufficient for interactions at triage, initial screening, brief interactions and moving of a patient to an isolation room for further investigation or assessment.

Patient Care

In selection of gowns for use in providing direct care for patients with increasing symptoms of VHF, the gown is to meet the CSA/AAMI standard for isolation gown as a level-3 (fluid resistant) or level-4 (fluid impermeable). Choice of fluid resistant or fluid impermeable will be made based on the risk and amount of fluid exposure anticipated during the patient or patient environment encounter.

Protective Clothing/Coverall Selection Criteria

There are a wide range of full body coveralls available that provide coverage of the body and head, depending on their design. Integrated foot coverings, gloves and face protection or respiratory protection may be available. These suits have been designed for wide variety of applications from protection against dry particulates to chemical and liquid splash-resistance.

Coveralls are not part of the AAMI or CSA standards for gowns. However, in the selection of coveralls for use in caring for patients with VHF, the fabric is to meet at least the CSA/AAMI standard level 3 or 4 (fluid resistant or fluid impermeable), or reference ASTM 1670 or 1671 or other standard that is based on ASTM testing. The seams and closures may have less barrier performance than the material. Coveralls that are constructed with taped or sealed seams would require other coverings or measures that reduce the risk and volume of contact with body fluids (e.g., addition of fluid impervious aprons, absorbent materials to reduce volume of fluids, other barriers)

> Manufacturers are to be consulted to review the performance criteria of the selected coveralls and suitability of that suit for use in a medical setting.

End-users need to also determine if the coveralls provide enough range of sizes to be able to fit all staff. Coveralls that are too small may tear as the user bends or squats. Suits that are too large may catch or snag on equipment or objects. The coverall also needs to accommodate the use of any additional PPE required.

A final area of consideration is the ease of donning or doffing of the coverall and the amount of dedicated space and extra assistance required to do this safely.

Use of Gowns or Coveralls with Other PPE

When a protective gown or coverall is selected it is important that other PPE is compatible and fits to make a proper ensemble. For example gloves may leave a gap between the sleeve and the glove when the arm is outstretched. Longer gloves will be needed if there is a gap.

Where hoods are part of the PPE, it is important that masks or respirators and face-shield will not dislodge or become occluded as the hood is applied and the health care worker moves during the provision of care.

Selection of Other PPE

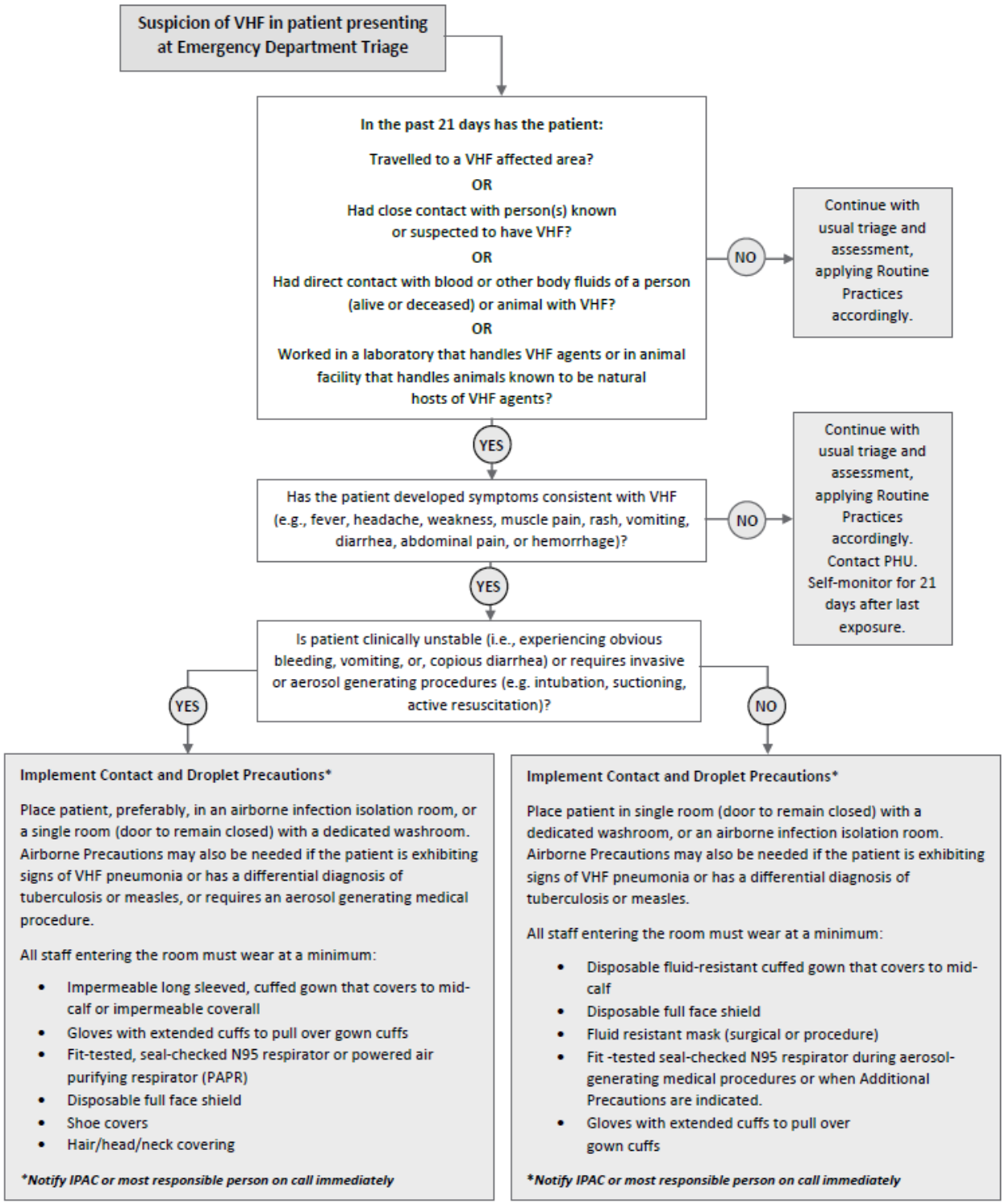
For further information on the selection PPE including medical gloves, masks and respirators and eye protection, please refer to Appendix M: Advantages and Disadvantages of PPE in PIDAC Routine Practices and Additional Precautions, November 2012[15] and to any applicable CSA Standards (e.g., CSA Z94.4 for respirators).

All PPE selected are to meet the performance criteria determined by the organization based on the organizational risk assessment.

> Occupational health and safety requirements are to be met. Health care facilities are required to comply with applicable provisions of the *Occupational Health and Safety Act (OHSA), R.S.O. 1990, c.O.1* and its Regulations.

Appendix 2

Triage Assessment Algorithm for VHF



This algorithm is based on the CDC's: Identify, Isolate, Inform: Emergency Department Evaluation and Management of Patients Under Investigation for Ebola Virus Disease[28]

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