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Viral Hemorrhagic Fever

Surveillance and Investigation Protocol

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I. ABOUT THE DISEASE

Viral hemorrhagic fevers (VHFs) are a group of diseases that cause illness associated with various symptoms depending on the type of VHF. Mortality, severity, and mode of transmission also vary depending on the type. There are four distinct families of VHFs: Filoviridae, Arenaviridae, Bunyaviridae, and Flaviviridae. Although each type is different, they share some common characteristics. The term "Viral Hemorrhagic Fever" refers to a condition that affects multiple body organ systems, damages the cardiovascular system, and reduces the body's ability to function. The term also refers to the ability of these illnesses to cause bleeding or hemorrhaging.

A. Clinical Presentation

The clinical presentation and symptoms vary depending on the type of VHF. Some are more severe than others. Because of space and time limitations, clinical description is limited to the VHFs with known information as described by the Centers for Disease Control and Prevention (CDC).

Arenaviruses

Arenaviruses are divided into 2 groups: the New World complex and the Old World or lymphocytic choriomeningitis (LCMV) / Lassa complex. Diseases associated with the Arenavirus family can range from asymptomatic to severe illness. Other Arenaviruses include Argentine hemorrhagic fever (Junin), Bolivian hemorrhagic fever (Machupu), Sabia-associated hemorrhagic fever, and Venezuelan hemorrhagic fever.

Chapare hemorrhagic fever (CHHF)[1]

Due to the low number of documented cases, there is limited information about the progression of signs and symptoms of CHHF. As with other VHFs, symptoms often occur before the late-stage hemorrhagic signs (bleeding). Symptoms include but are not limited to fever, headache, joint and muscle pain, pain behind the eyes, stomach pain, vomiting, diarrhea, bleeding gums, rash, and irritability.

Lassa Fever[2]

The majority (approximately 80%) of Lassa fever infections are mild and undiagnosed. These symptoms include fever, malaise, weakness, and headache. This disease may progress and have serious symptoms such as hemorrhaging, respiratory distress, repeated vomiting, pain in the chest, abdomen, back and facial swelling, and shock. Neurological symptoms can also be present and can include tremors,

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hearing loss, and encephalitis. Approximately 15%-20% of hospitalized cases die from the illness and death may occur within two weeks due to multi-organ failure; however, only 1% of infections result in death. Deaths for women in the third trimester are known to be high and spontaneous abortion can be a complication of infection with a 95% mortality rate in fetuses with mothers who are infected.

Lujo Hemorrhagic Fever[3]

Although there is not much information available for Lujo hemorrhagic fever, its symptoms are like those of severe Lassa fever. In a previous outbreak, the clinical course started with a febrile illness followed by headache and muscle pain. The disease can increase in severity with symptoms that include a morbilliform rash of the face and trunk, face and neck swelling, pharyngitis (sore throat), and diarrhea. Bleeding was not a prominent symptom. In fatal cases, a short improvement was followed by rapid deterioration with respiratory distress, neurological signs, and circulatory collapse with death occurring 10 to 13 days after symptom onset. Low blood platelets and white blood cell count (at onset, rising later) and elevated liver function values were present in patients. Since arenaviruses may enter the fetus through infection of the mother, and anecdotal evidence suggests that infected pregnant women may suffer miscarriages, it is reasonable to assume that both infection of the fetus and miscarriage may be associated with Lujo virus infection in the mother.

Lymphocytic choriomeningitis (LCM)[4]

LCM is recognized as causing neurological disease, but some who become infected do not have symptoms or only have a mild febrile illness. For those who do become ill, there is a biphasic febrile phase that may last as long as a week and typically begins with fever, malaise, lack of appetite, muscle aches, headache, nausea, and vomiting. Other symptoms can include sore throat, cough, joint pain, chest pain, testicular pain, and parotid pain. After a few days of recovery, a second phase may occur that includes symptoms consistent of meningitis (fever, headache, stiff neck, etc.), encephalitis (drowsiness, confusion, sensory disturbances, motor abnormalities), or meningoencephalitis (inflammation of both the brain and meninges). LCM can also cause acute hydrocephalus, myelitis, and myocarditis.

Mortality is usually less than 1% and those who develop aseptic meningitis and encephalitis survive. Chronic infection has not been described. Temporary and permanent neurological damage is possible in infections involving the central

nervous system. Infections during pregnancy often result in fetal death and pregnancy termination during the first trimester. In the second and third trimesters, birth defects can develop including vision problems, mental retardation, and hydrocephalus.

Bunyaviruses

Crimean-Congo Hemorrhagic Fever (CCHF)[5]

The onset of symptoms is sudden with initial signs including headache, high fever, back pain, joint pain, stomach pain, and vomiting. Red eyes, a flushed face, a red throat and red spots on the palate (petechiae) can be common. Other symptoms may include jaundice, mood and sensory perception changes. Large areas of bruising, nosebleeds, and uncontrolled bleeding can occur as the illness progresses. This usually begins on the fourth day of the illness and lasts for about two weeks. Fatality rates can range from 9% to 50% in hospitalized patients.

Hantavirus Pulmonary Syndrome (HPS)[6]

There are two stages of symptoms of HPS: early and late. Early symptoms include fatigue, fever, muscle aches, headaches, dizziness, chills, and abdominal problems such as nausea, vomiting, diarrhea, and abdominal pain. Late-stage symptoms include coughing and shortness of breath and may occur four to ten days after the early stage of illness. The mortality rate for HPS is approximately 38%.

Hemorrhagic Fever with Renal Syndrome (HFRS)[7]

Symptoms for HFRS begin suddenly and include headaches, back and abdominal pain, fever, chills, nausea, and blurred vision. Some may have flushing of the face, inflammation or redness of the eyes, or a rash. Later symptoms can include low blood pressure, acute shock, vascular leakage, and acute kidney failure which can cause fluid overload. The severity of the disease varies depending on the specific virus causing the symptoms. The mortality rate from HFRS ranges from 1% to 15%.

Rift Valley Fever (RVF)[8]

Most commonly, those with RVF experience no or mild symptoms. Symptoms may include fever, weakness, back pain, and dizziness. Typically, recovery takes two days to one week after illness onset. About 8% to 10% of individuals infected have more severe symptoms such as ocular disease, encephalitis (<1% of patients), and hemorrhaging (<1% of patients).

Filoviruses

Ebola Virus Disease (EVD)
Since EVD is the most common VHF, there is a specific protocol dedicated to EVD. Please see the EVD protocol for more information.

Marburg (MVD)[9]
Symptom onset is usually sudden and marked with fever, chills, headache, and myalgia. A maculopapular rash may appear around the fifth day of symptoms. This rash is most prominent on the trunk (chest, back, stomach). Nausea, vomiting, chest pain, sore throat, abdominal pain, and diarrhea may appear. Symptoms may become severe and can include jaundice, inflammation of the pancreas, severe weight loss, delirium, shock, liver failure, massive hemorrhaging, and multi-organ dysfunction. The mortality rate for MVD is between 23%-90%.

Flaviviruses
Mosquito-borne flaviviruses, such as yellow fever virus, dengue virus, Japanese encephalitis virus, West Nile virus, and Zika virus have their own separate protocols.

Kyasanur Forest Disease (KFD)[10]
Symptoms of KFD begin suddenly with chills, fever, and headache. Usually, 3-4 days after an initial onset, severe muscle pain with vomiting, gastrointestinal symptoms, and bleeding problems may occur. Patients may experience low blood pressure, low platelet, red blood cell, and white blood cell counts. Some patients recover after 1-2 weeks of symptoms; however, 10-20% of patients experience a second wave of symptoms beginning in the third week. These symptoms can include fever, severe headache, mental disturbances, tremors, and vision defects. Fatality rates are from 3 to 5%.

Alkhurma hemorrhagic fever (AHF)[11]
AHF initially presents with non-specific flu-like symptoms that include fever, anorexia, malaise, diarrhea, and vomiting. A second phase has appeared in some patients that include neurologic and hemorrhagic symptoms in severe form. Multi-organ failure can happen and precede fatal outcomes. There have not been reports of chronic symptoms. Thrombocytopenia, leukopenia, and elevated liver enzymes have been observed in hospitalized patients.

Omsk hemorrhagic fever (OHF)[12]
Symptoms associated with OHF begin suddenly with chills, fever, headache, and severe muscle pain with vomiting, gastrointestinal symptoms, and bleeding problems that may occur 3-4 days after initial onset. Patients may experience abnormally low blood pressure and low platelet, red blood cell, and white blood cell counts. Some patients recover within 1-2 weeks; however, some may experience a second wave of symptoms at the beginning of the third week. These symptoms can include fever and encephalitis. The fatality rate is low (0.5% to 3%).

B. Etiologic Agent

All VHF viruses are small ribonucleic acid (RNA) viruses with lipid envelopes. The lipid envelope makes the virus more easily inactivated by hospital disinfectants compared to viruses such as norovirus that do not have a lipid coating.

There are four main virus families that cause VHF: Arenaviruses, Bunyaviruses, Filoviruses, and Flaviviruses. Paramyxoviruses, a virus found mostly in Southeast Asia and Australia, and Hantaviruses have been known to cause VHF as well but aren't as well known or as common as the other viruses.

A. Reservoir

The reservoir for VHF varies based on the virus involved. Table 1 lists the reservoir (if known), location found, and incubation period of the viruses known to cause VHF.

Virus Family	Virus Name	Incubation Period	Where located	Reservoir
Filovirus	Ebola Virus	2-21 days	The Democratic Republic of the Congo, Gabon, Guinea	Unknown (likely bats)
Filovirus	Sudan Virus	2-21 days	South Sudan, Uganda	Unknown (likely bats)
Filovirus	Bundibungyo Virus	2-21 days	The Democratic Republic of	Unknown (likely bats)

			the Congo, Uganda	
Filovirus	Tai Forest Virus	2-21 days	Cote D'Ivoire	Unknown (likely bats)
Filovirus	Marburg Virus	2-21 days	Angola, The Democratic Republic of the Congo, Equatorial Guinea, Ghana, Guinea, Kenya, Tanzania, Uganda, Zimbabwe	Egyptian Fruit Bat (*Rousettus aegyptiacus*)
Filovirus	Ravn Virus	2-21 days	The Democratic Republic of the Congo, Kenya, Uganda	Egyptian Fruit Bat (*Rousettus aegyptiacus*)
Arenavirus (order Bunyavirales)	Lassa Fever Virus	2-21 days	Benin, Burkina Faso, Cote D'Ivoire, Ghana, Guinea, Liberia, Mali, Nigeria, Sierra Leone, Togo	Multimammate Rat (*Mastomys natalensis*)
Arenavirus (order Bunyavirales)	Lujo Virus	7-13 days	Zambia	Unknown (likely rodents)
Arenavirus (order Bunyavirales)	Junin Virus	6-14 days	Argentina	Drylands vesper mouse

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				(*Calomys musculinus*)
Arenavirus (order Bunyavirales)	Chapare Virus	4-21 days	Bolivia	Small-eared pygmy rice rats (*Oligoryzomys microtis*)
Arenavirus (order Bunyavirales)	Sabia Virus	6-21 days	Brazil	Unknown (likely rodents)
Arenavirus (order Bunyavirales)	Machupo Virus	3-16 days	Bolivia	Large vesper mouse (*Calomys callosus*)
Arenavirus (order Bunyavirales)	Guanarito Virus	3-19 days	Venezuela	Short-tailed Cane mouse (*Zygogontomys brevicauda*)
Hantavirus (Bunyavirales)	Hantaviruses	1-8 weeks	Old World: Europe and Asia; New World: North, Central and South America	Each hantavirus serotype has a specific rodent host species
Nairovirus (order Bunyavirales)	Crimean-Congo Hemorrhagic Fever Virus	1-14 days	Eastern and Southern Europe, Central Asia, all of Africa, Middle East	Ixodid ticks
Phenuvirus	Rift Valley Fever Virus	2-6 days	Eastern and Southern Africa	Mosquitoes
Flavivirus	Alkhurma Hemorrhagic Fever Virus	2-4 days	Saudi Arabia and Egypt	Soft ticks (*Ornithodoros savignyi*) and

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				hard ticks (*Hyalomma dromedary*)
Flavivirus	Kyasanur Forest Disease Virus	3-8 days	Karnataka state, India	Hard ticks (*Haemaphysalis spinigera*)
Flavivirus	Omsk Hemorrhagic Fever Virus	3-8 days	Western Siberia regions of Omsk, Novosibirsk, Kurgan, and Tyumen	Ticks (*Dermacentor reticulatus*, *Dermacentor marginatus*, *Ixodes persulcatus*)
Flavivirus	Dengue Virus	5-7 days	Africa, the Americas, South and Southeast Asia, Western Pacific region	Mosquitoes (*Aedes aegypti* or *Aedes albopictus*)
Flavivirus	Yellow Fever Virus	3-6 days	Tropical and subtropical areas of Africa and South America	Mosquitoes (*Aedes aegypti*)
Paramyxoviruses	Hendra Virus	9-16 days	Australia	Flying fox bat (genus *Pteropus*)
Paramyxoviruses	Nipah Virus	5-14 days	Bangladesh, India	Flying fox bat (genus *Pteropus*)

Table 1: Reservoir and Incubation period of VHF viruses. [13]

C. Reservoir

The reservoir depends on the type of virus that causes the VHF. A list is included in the table above.[13]

D. Incubation Period

The incubation period depends on the type of virus involved. A list of incubation periods for each virus is included in table 1 above.[13]

E. Mode of Transmission

All initial cases begin as zoonotic, either through the bite of an arthropod (mosquitoes, ticks), or contact with contaminated material from a bat, rodent, or non-human primate depending on the virus involved. Once in human populations, arenaviruses, filoviruses, and some bunyaviruses (other than Rift Valley Fever) can be spread human to human. Flaviviruses have not been shown to be spread from human to human.

With Ebola[14] and Marburg[15] viruses specifically, there has been evidence of the virus in semen several months after a survivor has cleared the virus. As such, it is recommended that any male survivors use a condom or refrain from sexual intercourse for at least 3 months after clearing the virus.

F. Period of Communicability

Filoviruses and arenaviruses have never been shown to be spread before the patient is symptomatic. Flaviviruses, most bunyaviruses, and Rift Valley fever virus are only spread to humans by animals, and don't have human to human transmission.[13]

II. DISEASE CONTROL AND PREVENTION

A. Disease Control Objectives

1. To prevent illness and death through rapid identification of populations exposed to VHFs coupled with education to adhere to standard, contact, and droplet precautions.
2. To reduce mortality by educating physicians about ribavirin therapy for arenaviruses and bunyaviruses prior to agent confirmation.

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B. Disease Prevention Objectives

To prevent disease through education of health care workers and public health workers to:

1. Detect index cases and direct contacts rapidly.
2. Use strict adherence to standard precautions, droplet precautions, and contact precautions to minimize exposure to blood and body fluids of living and deceased cases

C. Disease Prevention and Control Intervention

See CDC's Viral Hemorrhagic Fever Infection Control Recommendations at: https://www.cdc.gov/viral-hemorrhagic-fevers/hcp/infection-control/index.html

D. Treatment

1. Arenaviruses- There are no United States Food and Drug Administration (FDA) approved treatments for VHFs caused by arenaviruses. Intravenous Ribavirin has been used in African settings, but actual patient results are not clear. Infusions of immune plasma has been used in treating Argentine hemorrhagic fever (Junin virus) and brings down mortality to 1-2% when used within 8 days. All other care is supportive.[16]
2. Bunyaviruses- There are no FDA approved treatments for VHFs caused by bunyaviruses. There have been some studies using Ribavirin for a few of these viruses but should be avoided for Rift Valley Fever. All other care for patients is supportive.[16]
3. Filoviruses- With the exception of Ebola Zaire, there are not currently accepted treatments for VHFs caused by filoviruses. There is a vaccine and monoclonal antibody treatment for Ebola Zaire, but neither work on the other strains of Ebola virus.[16]
4. Flaviviruses- There is a vaccine for yellow fever, but all other care for VHFs caused by flaviviruses is supportive.[16]

III. DISEASE INVESTIGATION

A. Criteria for Case Ascertainment

Clinical, laboratory/imaging, and epidemiologic linkage criteria for VHF reporting are respectively summarized under 'Clinical Criteria,' 'Laboratory/imaging Criteria,' and 'Epidemiologic Linkage' in 'Case Definition and Case Classification.'

B. Case Definition and Case Classification

This case definition for case classification is intended solely for public health surveillance purposes and does not recommend criteria for clinical diagnosis purposes. Once a public health agency has ascertained data on potential cases of a disease or condition from reporting entities, the public health agency assigns case statuses based on the case classifications.

Clinical Criteria

Acute onset of one or more of the following clinical findings*:

- o Subjective OR measured fever ≥38°C/100.4°F
- o Headache
- o Muscle and/or joint pain
- o Weakness and fatigue
- o Cough/difficulty breathing
- o Pharyngitis
- o Loss of appetite
- o Chest pain
- o Skin rash
- o Red eyes
- o Abdominal pain
- o Vomiting
- o Diarrhea
- o Intractable hiccups
- o Encephalitis or other neurological manifestations
- o Unexplained bleeding or bruising not related to injury or menstruation
- o Acute hearing loss**

* This list of signs and symptoms are not exhaustive and may be nonspecific; no sign or symptom is pathognomonic for VHFs.

** Relevant for Lassa fever

Laboratory/Imaging Criteria

Confirmatory Laboratory Evidence:

- Detection of VHF-specific^ nucleic acid in blood or other body fluids, blood products, or tissues using a diagnostic molecular test (e.g., nucleic acid amplification test (NAAT), genome sequencing);

  OR

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• Detection of VHF-specific^ IgM by enzyme-linked immunosorbent assay (ELISA);
OR
• Detection of a four-fold rise in VHF-specific^ IgG titer from an acute sample to a convalescent sample;
OR
• VHF^ viral isolation in cell culture for blood, blood products (e.g., serum), or tissues

Presumptive Laboratory Evidence:
N/A
Supportive Laboratory Evidence:
N/A
*** Note: The categorical labels used here to stratify laboratory evidence are intended to support the standardization of case classifications for public health surveillance. The categorical labels should not be used to interpret the utility or validity of any laboratory test methodology.
^ VHF refers to viral hemorrhagic fever caused by filoviruses (Orthoebolaviruses and Orthomarburgviruses), Old World arenaviruses (Lassa and Lujo viruses), New World arenaviruses (Guanarito, Machupo, Junin, Sabia, and Chapare viruses), or viruses in the Bunyaviridae family (Rift Valley fever virus, Crimean-Congo hemorrhagic fever virus).

Epidemiologic Linkage

Within the incubation period of the VHF any of the following:

• Contact with a person who had known or suspected^^^ VHF or any object contaminated by their body fluids without use of or confidence in proper adherence to, or experiences a breach in, recommended infection prevention and control (IPC) precautions, including personal protective equipment (PPE) use,

OR

• Handles specimens that contain or might contain replication competent VHF viruses without use of or confidence in proper adherence to, or experiences a breach in, recommended infection prevention control (IPC) precautions, including personal protective equipment (PPE) use,

OR

• Handles bats, rodents, or primates that are or may be infected with a VHF without use of or confidence in proper adherence to, or experiences a breach in, recommended IPC precautions, including PPE use,

OR

• Exposure to body fluids (i.e., urine, saliva, sweat, vomit, breast milk, amniotic fluid, semen, aqueous humor, or cerebral spinal fluid) from a person who clinically recovered from a VHF without use of or confidence in proper adherence to, or experiences a breach in, recommended IPC precautions, including PPE use,

OR

• Residence in or travel to a VHF endemic area or area with active transmission† AND an experience with any of the following scenarios for potentially unrecognized VHF exposures:

- o Contact with someone who was sick or died;
- o Visiting or working in a healthcare facility;
- o Breach in PPE and/or IPC precautions;
- o Visiting a traditional healer;
- o Attend or participate in funerals or burials;
- o Contact with animals;
- o Consumption of or handling raw meat;
- o Tick or mosquito bite;
- o Spent time in a mine or cave;
- o Any other scenario for previously unrecognized VHF exposure as determined in consultation with subject matter experts at CDC

^^ Epidemiologic linkage criteria may require public health/CDC consultation to address any uncertainties and determine VHF risk. Please contact the CDC Emergency Operations Center (EOC) by phone at (770) 488-7100.
^^^ Exposure may have occurred outside the U.S.
† As defined by public health authorities

Vital Records Criteria

A person whose death certificate lists VHF or infection with a VHF-causing virus (Ebola, Lassa, Marburg, Lujo, Guanarito, Machupo, Junin, Sabia, Chapare, Rift Valley Fever, or Crimean-Congo hemorrhagic fever viruses) as an underlying cause of death or a significant condition contributing to death.

Other Classification Criteria

None.

Case Classifications

Confirmed:

- Meets confirmatory laboratory evidence.

Suspect:

- Meets clinical criteria AND meets epidemiologic linkage evidence.

OR

- Meets vital records evidence.

C. Reporting Timeframe to Public Health

VHF is a Category I disease, so all suspected or confirmed cases of VHF should be reported **IMMEDIATELY** to the local health department.

D. Outbreak Recognition

There has never been a case of VHF in WV; therefore, one case of VHF constitutes an outbreak.

E. Healthcare Provider Responsibilities

1. Remain alert for imported cases of viral hemorrhagic fever (VHF). However, the epidemiology of VHF can change rapidly. Consult www.cdc.gov or https://www.afro.who.int/health-topics/viral-haemorrhagic-fever for information on current outbreaks worldwide. Consider the diagnosis of VHF in returned travelers with illness including:
   a. Fever,
   b. Myalgia,
   c. Severe headache,
   d. Abdominal pain,
   e. Vomiting,
   f. Diarrhea, or
   g. Unexplained bleeding or bruising
   AND
   h. recent travel to a country with a current VHF outbreak
2. Other risk groups include direct contact with a confirmed or highly suspected VHF case. If there are no risk factors (i.e., no travel history AND no direct contact), then alternative diagnoses should be pursued.

3. For any suspected case of VHF:
   a. Immediately place the suspected case in isolation: At a minimum, private room, standard, droplet and contact precautions (gown, two sets of gloves, N95 mask or PAPR, goggles, boot covers, and hand hygiene before donning and after doffing personal protective equipment (PPE)) should be used.
      i. CDC guidelines for infection control: https://www.cdc.gov/viral-hemorrhagic-fevers/hcp/infection-control/index.html
      ii. WHO guidelines for infection control: http://apps.who.int/iris/bitstream/10665/130596/1/WHO_HIS_SDS_2014.4_eng.pdf?ua=1&ua=1
   b. Immediately inform the infection preventionist that a case of suspected VHF is in the health care facility. Immediately inform receiving personnel (infection preventionist and emergency department personnel and emergency medical service workers) if a suspected VHF patient is being transported from one facility to another.
   c. Immediately inform the local health department (LHD). Anticipate the need to collaborate with the local health department on:
      i. Obtaining laboratory confirmation of the diagnosis,
      ii. Obtaining clinical information to confirm the diagnosis, and
      iii. Identifying contacts of the case so that their health can be monitored
   d. Call the Epidemiologist On-Call to coordinate with the Department of Health.

F. Laboratory Responsibilities

1. Office of Laboratory Services (OLS) will facilitate specimen shipping to CDC or other Laboratory Response Network (LRN) sites for confirmatory testing of potential VHF positive patients.
2. Immediately report confirmatory testing results back to the OEPS as well as the healthcare provider.
3. Ship the specimen in accordance with current Suspected Category A shipping guidelines.

G. Local Health Responsibilities

1. Monitor the condition of return travelers from VHF endemic areas, new or established, or suspect VHF patients forwarded by the Zoonotic Disease program from CDC over the 21 day quarantine period either by talking directly with the

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patient, or the healthcare provider if the patient is incapacitated. A monitoring form and guidance will be provided.
2. If a returned traveler, patient, or household contact starts to become symptomatic, immediately contact the Epidemiologist On-Call to facilitate transportation to a healthcare facility.
3. Report information on monitored returned travelers back to the Zoonotic Disease program at Division of Communicable Disease Epidemiology (DCDE).
4. Contact the return travelers, patient, or household contacts when they have passed the quarantine period to let them know they are cleared.
5. If a case is identified, obtain a line list of contacts for monitoring purposes.
6. Complete Viral Hemorrhagic Case Report Form to report suspect/confirmed VHF cases to the State Department of Health.

H. State Health Responsibilities

1. Train local health and/or providers on how to monitor suspect/confirmed cases and how to fill out reporting forms.
2. Disseminate information from CDC, hospitals, and labs about suspected cases of patients returning from outbreak areas and pass that information down to local health authorities.
3. Zoonotic Disease Program will keep a total line list of suspected/confirmed cases and their symptoms and send aggregate information back to CDC in a timely manner.
4. If a patient becomes symptomatic, the Zoonotic Disease program will coordinate with Center for Threat Preparedness to get transportation for the patient to a designated healthcare facility capable of handling this type of patient.
5. If a patient becomes symptomatic, the Zoonotic Disease program will coordinate with OLS and the CDC Emergency Operations Center (EOC) to facilitate whether testing is appropriate.
6. Answer questions from the public, media, and other partners about the disease/outbreak and number of cases when appropriate.

I. Occupational Health

1. Healthcare workers caring for patients with VHF must have received comprehensive training and demonstrated competency in performing VHF-related infection control practices and procedures.

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2. Personal protective equipment (PPE) that covers the clothing and skin and completely protects the mucus membranes is required when caring for VHF patients.
3. Ensure workspace safety programs are in place and have been followed, in particular, the Occupational Health and Safety Administration's (OSHA) Bloodborne Pathogens, PPE, and Respiratory Protection standards.
4. An onsite manager must supervise personnel providing care to VHF patients at all times. A trained observer must also supervise each step of every PPE donning/doffing procedure to ensure established PPE protocols are completed correctly.

See CDC's guidelines for PPE for confirmed patients and clinically unstable patients suspected to have VHF at: https://www.cdc.gov/viral-hemorrhagic-fevers/hcp/guidance/ppe-clinically-unstable.html

See CDC's guidelines for PPE for clinically stable patients suspected to have VHF at: https://www.cdc.gov/viral-hemorrhagic-fevers/hcp/guidance/ppe-clinically-stable-puis.html

IV. DISEASE SURVEILLANCE

A. Public Health Significance

VHF viruses are maintained in nature in naturally occurring reservoirs including mosquitoes (Yellow Fever, Rift Valley Fever, and Dengue); ticks (Crimean-Congo Hemorrhagic Fever); bats (Marburg and potentially Ebola); rodents (Lassa fever); domestic ruminants (Rift Valley fever); and nonhuman primates (Marburg). VHF diseases are ordinarily restricted to specific geographic areas and are often named for the geographic location where they were first identified. However, cases can be introduced into non-endemic areas by an infected human host or reservoir species. Outbreaks can result from the introduction of the virus into a new environment or changes in ecology (rainfall, density of vector and reservoir species, land management, etc.). Some diseases have high fatality rates and person-to-person transmission such as Ebola and Marburg. Person-to-person transmission due to poor infection control in healthcare settings in the developing world contributes to large outbreaks of Marburg, Ebola, Lassa fever, and Crimean-Congo Hemorrhagic

fever. For other viruses (dengue and yellow fever) asymptomatic infections and mosquito transmission are common.

The risk of a bioterrorism attack with VHFs is low, but possible, and would have a substantial impact on public health because of the high mortality rate of most VHFs. Large quantities of Marburg, Ebola, Lassa, and New World arenaviruses were weaponized by the former Soviet Union and Russia until 1992, and there has been a case of Marburg in a Russian lab as recently as 1995[17].

B. Disease Surveillance Objectives

1. To provide information on the temporal, geographic, and demographic occurrence of VHF and describe risk factors for infection and facilitate the prevention and control.
2. To ensure rapid detection of pathogens on the Tier I Select Agent and CDC Category A bioterrorism agent list.
3. To ensure rapid intervention and an informed public health response early in the course of illness to minimize morbidity and to prevent human-to-human spread of infection.

C. Surveillance Indicators

1. Proportion of cases with complete demographic information.
2. Proportion of cases with complete clinical information.
3. Proportion of cases with exposure history and contact information.

V. REFERENCES

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