The Management of Viral Haemorrhagic Fevers in Ireland

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Report of the Scientific Advisory Committee
of the Health Protection Surveillance Centre

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Foreword

Viral haemorrhagic fevers (VHFs) are zoonotic diseases that can cause a haemorrhagic syndrome in humans. They are endemic in a number of parts of the world: Africa, South America, the Middle East and Eastern Europe. Environmental conditions in Ireland however do not support the natural reservoirs or vectors of any of the viruses that cause VHF. Occasionally, cases of VHF have been imported into Europe, and the VHFs of particular concern in this regard are those that have demonstrated the potential for person-to-person spread, namely Ebola, Marburg, Lassa fever and other Arenaviruses and Crimean-Congo haemorrhagic fever.

In 2002 guidelines were drawn up by the Scientific Advisory Committee of the Health Protection Surveillance Centre to ensure that the Irish healthcare system would be ready to deal with an imported VHF case. These guidelines have now been updated to reflect the role of the National Isolation Unit at the Mater Misericordiae University Hospital, as well as current requirements under the International Health Regulations to report any such case to the World Health Organization.

The key elements to the guidelines include the need for vigilance in considering the possibility of VHF in a person with a fever who has recently returned (within 21 days) from travel to an endemic area, the institution of appropriate infection control measures if a case is suspected, the rapid testing and diagnosis of the case, and the management of his/her contacts. Given appropriate infection control measures, onward transmission to others is extremely unlikely. It is national policy that any case of VHF should be treated at the National Isolation Unit, if medically fit for transfer, and the guidance includes protocols for the safe ambulance transfer of such a patient. It is anticipated that a case of VHF could generate significant concern among contacts, as well as media interest, and the guidance details how to manage this situation.

The guidance is accompanied by up-to-date information on the HPSC website, which highlights areas where recent VHF outbreaks have occurred and provides risk assessment and contact management forms, as well as this guidance in chapters separated for ease of use.

I would like to sincerely thank the members of the sub-committee for their hard work and enthusiasm in updating the guidance. I would particularly like to mention the work and commitment of Gillian Cullen, whose contribution to this report has been invaluable.

Dr. Derval Igoe
Chair, VHF Sub-committee

Recommendations

These guidelines are for the management of imported cases of VHF that have demonstrated the potential for person-to-person spread: Ebola, Marburg, Lassa fever and other Arenaviruses, and Crimean-Congo haemorrhagic fever, as well as VHF of unknown origin with similar potential for person-to-person spread.

Assessment

- The possibility of VHF should be considered in any sick traveller with fever, who has recently travelled (within the past 21 days) from an endemic country and who has no clear features of an alternative diagnosis.
- The assessment algorithm and clinical risk assessment form should be used to determine the risk of VHF (no risk, *"**At Risk**"* or *"**High Risk**"*).
- In all acute medical settings, there should be clear arrangements in place, which staff are familiar with, as to who will conduct the risk assessment (e.g. senior clinician on take)
- The risk category assigned following risk assessment and the presence of symptoms, e.g. bleeding or bruising, determine the subsequent clinical management, laboratory investigation, infection prevention and control actions and public health management of the case.
- The patient's risk category can change depending on the patient's symptoms and/or the results of diagnostic tests. A patient with VHF infection can deteriorate rapidly.
- Communication with staff regarding potential infection risks is very important. Staff must understand the risks associated with a VHF patient once the infection is being considered.

Initial management

- Patients designated as ***At Risk*** patients should be investigated urgently for malaria and have standard and droplet infection control precautions applied. If they have bruising, bleeding, diarrhoea or vomiting, they should be put into a single room and contact precautions should be implemented.
- For patients designated as ***High Risk*** the VHF Sub-Committee advises, on a precautionary basis, the use of standard and transmission-based precautions (contact, droplet and airborne) at all times.
- Effective public health management of VHF is dependent on the immediate notification by clinicians, as soon as a ***High Risk*** case is suspected, to the Director of Public Health /Medical Officer of Health (DPH/MOH).
- All confirmed cases of VHF should be transferred to the National Isolation Unit in the Mater Misericordiae University Hospital, Dublin, as long as it is medically safe to transfer the patient. In addition, a ***High Risk*** patient with bleeding, bruising, vomiting or diarrhoea should be considered for early transfer prior to obtaining the result of the VHF test.

Infection prevention and control

- For confirmed cases of VHF and for patients assigned as ***High Risk,*** the VHF Sub-Committee advises, on a precautionary basis, the use of standard and transmission-based precautions (contact, droplet and airborne) at all times.
- As soon as VHF is being considered, the hospital infection control team must be actively consulted and included in all decisions regarding patient isolation requirements, use of personal protective equipment and patient transport arrangements.
- Enhanced PPE (e.g. double gloving) will be required for exposures that pose an increased risk of blood exposure.
- In the event of death, post-mortem examination should not be carried out.

Healthcare waste management

- All waste from patients identified as at ***High Risk*** of VHF, or confirmed as having VHF, must be treated as Category A Infectious waste. All acute hospitals should have a supply of Category A UN2814 packaging (minimum 4). It may be more practicable to purchase these health care risk waste containers at a regional level.

Laboratory diagnosis

- Consultation with the laboratory is essential prior to sampling. Only specimens essential for diagnosis or monitoring should be obtained for investigation.
- The use of point-of-care bedside diagnostic tests is favoured where possible.
- Emergency testing for malaria can be carried out using a WHO-approved rapid diagnostic test at the bedside, but should be followed up as soon as possible with blood film analysis by experienced laboratory staff in a microbiological safety cabinet (MSC) at BSL2.
- VHF testing is carried out only with prior consultation with the NVRL and upon receipt of a completed VHF investigation request form.
- Each laboratory should have a contingency plan for dealing with potential VHF specimens that includes out-of-hours operational procedures and contact details for key personnel.
    - Within the hospital, specimens should be transported according to local arrangements for high risk samples;
    - Personnel involved in referral of samples should receive appropriate certified training.
- Laboratory investigations should be carried out at BSL-3. If specimens are inactivated, tests can be processed at BSL2.
- Laboratory staff dealing with specimens from patients with suspected VHF must take, as a minimum, the same personal protective precautions as patient-care staff.

- Preliminary VHF results will be reported within 24 hours. If results are negative,the possibility of the patient having a VHF infection should be maintained until an alternative diagnosis is confirmed.

Public Health Management

- Once a ***High Risk*** case is notified to the DPH/MOH, he/she is to prepare to set up a Local Outbreak Control Team, plan contact tracing activities, and inform the Assistant National Director (AND) for Health Protection and the Director of HPSC.
- Once the case is confirmed, the DPH/MOH is to convene the outbreak control team and commence contact tracing activities.
- DPH/MOH is to identify potential contacts and categorise them as no risk, low risk or high risk contacts, based on the type and degree of exposure to the index patient. Management of contacts depends on this risk categorisation.
- The National Public Health Outbreak Response Team Plan (NPHORT) for a Public Health Emergency of International Concern (PHEIC) may also be activated. NPHORT and the DPH/MOH Local Outbreak Control Team need to agree the communications strategy for the incident.
- HPSC as national IHR Focal Point is required to notify a confirmed case of VHF to the World Health Organization (WHO) under the International Health Regulations (2005) and to Member States of the European Union via the European Union Early Warning and Response System.

Background

Introduction

Viral haemorrhagic fever agents (VHFs) are zoonotic diseases that may cause a haemorrhagic syndrome in humans. Of particular concern are those that have demonstrated the potential for person-to-person spread and they are the focus of this document. These are: Ebola, Marburg, Lassa fever and other Arenaviruses, and Crimean-Congo haemorrhagic fever (CCHF).

Guidelines on the management of VHFs in Ireland were first published in 2002. This document provides updated guidance on the management of VHFs in Ireland, incorporating changes internationally and in Ireland that have affected the way in which VHFs will be managed in Ireland in the future.

Purpose and Scope

The purpose of this document is to:

- provide guidelines for the initial clinical assessment, investigation, treatment and follow-up of persons infected with VHF, and the public health management of their contacts;
- eliminate or minimise the risk of transmission to healthcare workers and others coming into contact with a possible or confirmed case;
- incorporate the requirement to notify the World Health Organization (WHO), and national procedures for investigating Public Health Emergencies of International Concern into the guidance, as required under the International Health Regulations, 2005;
- incorporate the role and function of the National Isolation Unit (NIU), Mater Misericordiae University Hospital, in the management of VHF.

The guidance is applicable to the following specialist groups:

- **healthcare staff** in emergency departments, medical assessment units, infectious disease departments, infection control, microbiology, acute medical units and occupational health;
- **ambulance staff**, who may be required to transport a possible or confirmed VHF patient;
- **those working in laboratories** dealing with specimens from patients possibly or confirmed to be infected with a VHF virus;
- **public health professionals** who may be required to carry out public health actions associated with a VHF case.

Parts of the guidance will also be relevant to other non-specialist groups such as mortuary staff and funeral personnel, who may have to deal with a VHF case.

Setting: Any medical setting where the patient presents with symptoms, for example a hospital emergency department, medical assessment unit, acute medical ward, or any point of entry into Ireland (port or airport).

Patient population: Persons who present with a history of fever and travel in the last 3 weeks to a VHF endemic area or outbreak area; contacts of cases of VHFs; persons who may have been infected with a VHF through a laboratory accident or an act of bioterrorism.

Which VHFs? Members of the Arenavirus, filovirus, bunyavirus and flavivirus families that have demonstrated the potential for person-to-person spread; any haemorrhagic fever syndrome due to viruses discovered in the future with similar potential for person-to-person spread.

Content

These guidelines cover the following aspects of the management of VHF in Ireland: case identification, risk categorisation and initial management; infection prevention and control; laboratory diagnosis of VHF; transport of patients to the NIU; public health management of imported VHF, including contact identification, contact risk categorisation and surveillance; national and international notification of cases; and VHF in the context of bioterrorism.

The content is arranged as follows:

1. Main body of text – protocol for case identification, laboratory diagnosis, infection prevention and control, and transport of patients to the NIU; protocol for identification, assessment and surveillance of contacts of patients with VHF.
2. Appendices – stand-alone algorithms; case risk assessment and contact surveillance forms; checklists; evidence base for mode of transmission; description of imported cases.

Methods

Sub-committee

The sub-committee that developed the guidelines includes professionals with relevant expertise and experience, and target users of the guidelines. The disciplines represented are emergency medicine, infection prevention and control nursing, clinical infectious diseases, medical microbiology, laboratory medicine, paediatric infectious diseases and public health medicine. The membership is listed on page 6.

The sub-committee also consulted two other sub-committees of the HPSC Scientific Advisory Committee; the sub-committee on the management of deceased Individuals harbouring an infectious disease, and the infection prevention and control (standard and transmission based precautions) guidelines sub-committee. Members of the sub-committee also met with the chair of the national HSE port health sub-group on the HSE response to an infectious disease incident of international concern at a port.

Search protocol

In developing the recommendations in these guidelines, various sources of guidance were reviewed. Initially, the operational plans for the NIU, as well as existing international guidelines, policies and contingency plans for the management of VHF were reviewed. These included policies and standard operating procedures from emergency departments and infectious diseases services in addition to

regional and national contingency plans. Irish and international guidelines on the health response to the deliberate release of VHFs were also reviewed.

Information that was deemed relevant for the purpose of developing these guidelines was extracted from these sources by various sub-committee members and then discussed at sub-committee meetings to ensure that the guidance selected was appropriate for use in various settings throughout Ireland.

In order to provide information on the risk of transmission and the required precautions, reviews of reliable published resources were conducted by sub-committee members. Available published resources were reviewed and their recommendations were appraised by the sub-committee in terms of the reliability of the source, as well as their applicability and operability within Irish healthcare settings.

The search strategy for these guidelines is outlined in Appendix A. We searched in MEDLINE and also reviewed the references cited in articles identified through the MEDLINE search. Articles not in English were excluded.

Consultation

The consultation process was carried out as follows:

- A consultation document was sent to the HPSC Scientific Advisory Committee for its consideration on 12th October 2011.
- This document was then sent to key stakeholder groups and individuals (Appendix B) for consultation, and also placed on the HSE and HPSC websites for general consultation on 4th November, 2011. A notice about this posting appeared in the HPSC monthly on-line bulletin, Epi-Insight.

Feedback received during the consultation process was reviewed and incorporated into the final document.

1.Introduction

1.1 What are viral haemorrhagic fevers?

Viral haemorrhagic fever agents (VHFs) are zoonotic diseases that may cause a haemorrhagic syndrome in humans. These illnesses are caused by four distinct families of viruses: the Arenaviruses, bunyaviruses, filoviruses, and flaviviruses (table 1). VHFs of particular concern however are those that have demonstrated the potential for person-to-person spread and they are the focus of this document. These are: Ebola, Marburg, Lassa fever and other Arenaviruses, and Crimean-Congo haemorrhagic fever.

The principles described in this document for the management and follow-up of persons infected with these viruses, can be applied to any hemorrhagic fever syndromes due to viruses discovered in the future with similar potential for person-to-person spread. Other VHFs, though they are not transmitted from person-to-person, have been shown to be a potential bioterrorism threat, and these are also included in Table 1, and detailed further in Chapter 7.

Table 1. Haemorrhagic fever (HF) viruses and the diseases they cause

Family	Virus	Disease
Arenaviruses	**Lassa virus**	**Lassa fever**
	Junin virus	Argentine haemorrhagic fever
	Chapare virus	Bolivian haemorrhagic fever
	Machupo virus	Bolivian haemorrhagic fever
	Sabia virus	Brazilian haemorrhagic fever
	Guanarito virus	Venezuelan haemorrhagic fever
	Lujo virus	**Lujo haemorrhagic fever**
Filoviruses	**Ebola virus**	**Ebola haemorrhagic fever**
	Marburg virus	**Marburg haemorrhagic fever**
Bunyaviruses	**Crimean-Congo haemorrhagic fever virus**	**Crimean-Congo haemorrhagic fever (CCHF)**
	Rift Valley virus	Rift Valley Fever
Flavivirus	Yellow fever virus	Yellow fever
	Kyasanur forest disease virus	Kyasanur forest disease
	Omsk haemorrhagic fever virus	Omsk haemorrhagic fever
	Alkhurma haemorrhagic fever virus	Alkhurma haemorrhagic fever

BOLD indicates potential for person-to-person spread.

1.2 The need for new guidance

Guidelines on the public health management of VHFs in Ireland were produced by the Health Protection Surveillance Centre (HPSC; known then as the National Disease Surveillance Centre) in 2002.[1] Since then a number of changes internationally and in Ireland have affected the way in which VHFs will be managed in Ireland in the future. These changes include:

1. The requirement to notify WHO of a case of VHF under the International Health Regulations, 2005. A case of VHF would be considered a potential Public Health Emergency of International Concern (PHEIC) in these revised regulations;

2. The establishment of new national procedures and protocols for investigating public health emergencies of international concern (PHEIC);

3. The opening of the National Isolation Unit (NIU) at the Mater Misericordiae University Hospital, Dublin;

4. The recognition of VHFs as potential bioterrorism agents.

1.3 Overview of VHFs

VHFs share a number of common features:

- they are all RNA viruses with a lipid envelope;
- their survival is dependent on an animal or insect host;
- the viruses are geographically restricted to the areas where their host species live;
- humans are not the natural reservoir for any of these viruses;
- human cases occur sporadically;
- they can cause severe life-threatening disease.

VHFs are endemic in a number of parts of the world: Africa, South America, the Middle East and Eastern Europe. Many wild and domestic animals, ticks, and mosquitoes are known to carry some of the VHF agents, although the reservoirs have not been identified for all VHF agents. Environmental conditions in Ireland do not support the natural reservoirs or vectors of any of the viruses that cause haemorrhagic fevers.

While for most European countries, including Ireland, the risk of epidemic spread in the general population is negligible, cases of VHF are occasionally imported into Western Europe. Given the ever-increasing speed and volume of air travel in today's world, the risk that individuals incubating VHF may arrive in non-endemic regions is increasing. Lassa fever is the most commonly imported VHF, with 12 cases imported to the UK between 1971 and 2011. The most recent cases were imported to the UK in early 2009; the first case was imported from Nigeria in January, and the second was imported from Mali in February.[2;3] In January 2010 a case of Lassa fever was imported to the United States from Liberia, bringing the total number of imported cases in the US to six. Two cases of Marburg haemorrhagic fever were imported from Uganda in 2008, one to the Netherlands and the other to the United States.[4] Three cases of Crimean-Congo haemorrhagic fever (CCHF) have been imported into Western Europe. A summary of published reports on responses to imported cases of VHF is provided in Appendix C.

Only one VHF is endemic in Europe. CCHF has been endemic in Bulgaria since the 1950s when a large outbreak occurred from 1954 to 1955 during which 487 cases were notified. Cases have also been notified in neighbouring countries including Albania, Kosovo, Turkey and the Ukraine, as well as in south western regions of the Russian Federation. The first case of CCHF in Greece was notified in

2008. Changes in climate may contribute to the further spread of the *Ixodid* ticks, the vector for CCHF, and consequently to the geographic spread of CCHF in southern Europe.[5]

While many VHFs were initially considered to be highly transmissible between humans, this hypothesis has not been substantiated. Although nososcomial transmission has occurred in areas with endemic disease, accumulated evidence shows that transmission of these viruses does not commonly occur through casual or remote contact. [6-8] Several importations to non-endemic countries have occurred without subsequent disease outbreaks. While secondary cases of Marburg have been documented, only one secondary case of Lassa fever has been identified following an importation episode. This involved the physician who was treating the patient. He seroconverted but remained asymptomatic.[9]

Persons at highest risk of secondary infection are those who are in closest contact with an infected person or his/her body fluids. Such persons include those with prolonged or close contact with patients, those providing direct medical and nursing care, and laboratory workers handling blood, tissue or other specimens.[10]

The key characteristics of the VHFs of public health importance, either due their potential for person-to-person transmission or as potential bioterrorism agents, are outlined in Table 2, including their distribution, vectors and reservoir hosts, incubation period and case fatality rate. Further details of the disease and viruses are given in Sections 1.4 to 1.9.

1.4 Ebola haemorrhagic fever

Ebola was first recognised in 1976 in the Democratic Republic of Congo. It is a severe, often fatal disease in humans and other primates. Ebola typically appears in sporadic outbreaks, usually within a health-care setting. Outbreaks have been occurring with increasing frequency since the mid 1990s, with 11 outbreaks reported from 1990-1996 compared with 6 for the period 1976-1989.[11] Five varieties of Ebola virus are known to exist, four of which are known to cause VHF in humans: Ebola Zaire, Ebola Sudan, Ebola Ivory Coast and Bundibugyo Ebola. The fifth subtype, Ebola Reston, has caused VHF in non-human primates but not in humans. [12;13]

The exact location, origin and natural reservoir of Ebola remains unknown, but researchers believe that the virus is zoonotic, native to the African continent. Current evidence suggests the fruit bat, as a potential reservoir for Ebola virus. Ebola-specific antibodies have been detected in three species of fruit bat in Africa (*Hypsignathus monstrosus, Epomops franqueti* and *Myoncyteris torquata*) and in *R. amplexicaudatus,* a common species of fruit bat in the Philippines.[14-16] The exact mode of transmission to humans is unknown. Once infected, the virus is then transmitted to others via direct contact with blood, secretions, organs or other bodily fluids of infected persons. Traditional burial practices, including washing and dressing the body of the deceased, have been identified as a risk factor. These practices were identified as the sole significant risk factor associated with being a probable or confirmed case in an outbreak in Uganda from December 2007 to January 2008.[17]

Confirmed cases and outbreaks of Ebola have been reported in various African countries since 1995, including the Gabon, Democratic Republic of Congo, Uganda, Ivory Coast, Republic of Congo, South Africa and Sudan. The mortality rates have ranged from 50-89%.[12] In 1976 a laboratory worker in the UK became infected as a result of a needle stick injury while working on specimens from a case of Ebola HF but he recovered.[6] In 2004 there were two further cases due to laboratory accidents, one in the US and the other in Russia. Both were due to needle stick injury. One case recovered (US) but the other died as a result of the infection (Russia).[18]

Ebola Reston virus was first reported in 1989 from several quarantine facilities in Reston, Virginia, USA, where monkeys from the Philippines became ill and died. There were similar reports from other facilities in the USA and Italy which also housed monkeys from the same monkey facility in the Philippines.[11,19] No further cases of Ebola Reston were reported after the closure of the affected facility in the Philippines in 1997. However, in October 2008, Ebola Reston infection was confirmed in pigs in the Philippines for the first time. A threat assessment by ECDC in January 2009 stated that European swine and monkey handlers should be considered potentially at low risk for exposure when handling animals from the Philippines. It also stated that further assessment was needed to determine the risk of transmission to humans through the eating of uncooked contaminated meat.[20]

1.5 Lassa fever

Lassa fever, an Old-World Arenavirus, is an acute viral illness that occurs in West Africa. The illness was first reported in 1969 when two missionary nurses died in Nigeria. Lassa fever is endemic in parts of West Africa including Guinea, Liberia, Sierra Leone and Nigeria. The reservoir of Lassa virus is the multimammate rat (*Mastomys* genus).

Humans can be infected in several ways. Rats shed the virus in urine and droppings and therefore primary transmission is likely to be through direct contact with these materials. Infection can also occur following inhalation of particles containing virus. Secondary transmission can also occur through person-to-person contact. In Ireland, such secondary transmission is most likely to occur in a healthcare setting either by coming into contact with the virus in blood, tissue or secretions of a case, or by breathing in airborne particles which the patient can produce by coughing. In endemic areas the majority of cases (80%) are asymptomatic, but of those hospitalised approximately 15-20% of patients die. The overall case fatality rate is 1%. The death rates are particularly high for women in the third trimester of pregnancy and for foetuses, about 95% of which die in the uterus of infected expectant mothers. Following recovery, the most common complication across all groups is deafness, which occurs in approximately 33% of cases.[21]

Lassa fever is the most common of the VHFs. Some studies indicate that 300,000 to 500,000 cases of Lassa fever and 5,000 deaths occur annually across West Africa. With such a large number of cases, there is a greater possibility of Lassa fever being imported into Europe than any of the other VHFs.[21]

1.6 Marburg haemorrhagic fever

Marburg virus was first recognised in 1967 when outbreaks of haemorrhagic fever occurred simultaneously in Marburg and Frankfurt in Germany, and in Belgrade in the former Yugoslavia. A

total of 32 people were infected as a result of those first affected having been exposed to blood, organs and cell cultures from African green monkeys imported from Uganda.[22] Thirty one cases were hospitalised while the other case was ill but did not require hospitalisation. Marburg infection was retrospectively serologically diagnosed in this patient. There were 6 secondary cases which were a result of: needle stick injuries (n=3); sexual intercourse (n=1); knife cut at post mortem (n=1); as well as one case of nosocomial transmission. The wife of the Belgrade index case was a physician and had drawn blood at home for testing and so this was considered nosocomial transmission. There were 7 deaths among the reported cases (case fatality rate 22%).[23]

Marburg virus is indigenous to Africa and while the geographic areas in which it is endemic are unknown, they appear to include at least parts of Uganda, Western Kenya, Angola and perhaps Zimbabwe. Recent studies implicate the African fruit bat as the reservoir host of the Marburg virus but further study is required to determine if there are other host species. The fruit bat is widely distributed across Africa, extending the area at risk for outbreak for Marburg haemorrhagic fever beyond that previously suspected. [24]

When the 1967 outbreak occurred in Europe, the virus had arrived with imported monkeys from Uganda. The next imported case did not occur until 1975 in Johannesburg and the patient had most likely been exposed while travelling in Zimbabwe. A travelling companion and a nurse were subsequently infected. In 1982, a case was identified in an 18 year old from the same rural part of Zimbabwe in which the case from 1975 had stayed. This patient recovered and there were no secondary cases.[25] Three cases (two deaths) have been associated with western Kenya. In 1980, a French engineer who travelled in western Kenya was infected and died. A physician who tried to resuscitate the case in a Nairobi hospital was infected but recovered. In 1987 a boy who visited a park near to where the engineer was infected was also infected and died. There were no secondary cases.[26]

Outbreaks have been reported in the Democratic Republic of Congo (1998-200), Angola (2004) and Uganda (2007), mostly among mine workers.[27] In 2008, two cases (one death) were reported in tourists, one Dutch and the other American, returning from Uganda. Both travellers had visited a well-known cave inhabited by fruit bats in a national park. [4, 28] How the virus is transmitted from animals to humans is unknown.

While the case fatality rate was initially thought to be significantly lower than that of Ebola, analysis of recent outbreaks in the Democratic Republic of Congo has shown that this is also greater than 70%. A case fatality rate of 90% was documented in an outbreak in Angola in 2004-2005. [29] Recovery from Marburg can be slow and known sequelae include orchitis, recurrent hepatitis, transverse myelitis and uveitis.

1.7 Crimean-Congo haemorrhagic fever

Crimean-Congo haemorrhagic fever (CCHF) was first described in the Crimea in 1944. In 1969 it was recognised that the virus causing Crimean haemorrhagic fever was the same as that responsible for an illness identified in 1956 in the Congo, hence the linkage of the two names.

CCHF is a severe illness in humans with a high mortality, but fortunately human illness occurs infrequently. Animal infection is more common. Animals become infected with CCHF from the bite of infected *Ixodid* ticks (*Hyalomma* genus). Humans who become infected usually do so from direct contact with blood or other tissues from infected animals or directly from a tick bite. The majority of cases have occurred in those involved with the livestock industry such as agricultural workers, slaughterhouse workers and vets. However, CCHF has repeatedly caused nosocomial outbreaks with high mortality rates, which puts healthcare workers, including those working in laboratories, at serious risk of infection.[30] In Bulgaria from 1950 to 1974, 42 health care workers were infected with CCHF with a case fatality rate of 40%. The case fatality rate among 14 healthcare workers in Turkey from 2003 to 2009 was 28%. [30] Percutaneous exposure presents the highest risk of transmission. [30]

The geographical distribution of the virus is widespread. The disease is endemic in parts of Africa, Asia, the Middle East and Eastern Europe. In Africa, outbreaks have been reported from South Africa, Congo, Mauritania, Burkina Faso, Tanzania and Senegal. An outbreak in China in 1965 had a case fatality rate of 80%. A large number of cases have also been reported from Middle Eastern countries such as Iraq, United Arab Emirates, Saudi Arabia and Oman. Since 2000, outbreaks have been reported in Albania, Kosovo, Turkey, Pakistan, Iran, Mauritania and Kenya. [30] Most recent data from South Africa reported 3 cases in 2009 (case fatality rate 33%), compared with 11 cases in 2008 and just one case in 2007. [31]

In Europe, CCHF is currently endemic only in Bulgaria where a total of 1,568 CCHF cases were notified from 1953 to 2008, with an overall case fatality rate of 17%. However, there has been an increase in cases and outbreaks of CCHF recorded in other countries in the region such as Albania, Kosovo, Turkey and the Ukraine as well as south-western regions of the Russian Federation. This increase has been attributed to climate and anthropogenic factors such as changes in land use, agricultural practices and movement of livestock , all of which may influence tick-host dynamics. The first case of CCHF in Greece was recorded in June 2008 in an agricultural worker with a tick bite in an area just a few kilometres from a previously documented Bulgarian outbreak. [32]

An inactivated suckling mouse brain-derived CCHF vaccine is currently used in Bulgaria to protect military and medical personnel, farmers and people living or working in endemic areas. The initial doses are given at days 0 and 30, the third dose one year later. Booster doses are then given every five years. [33]

In September 2008 ECDC held a meeting to review the current epidemiological situation of CCHF in Europe and to identify gaps in prevention and control. It was concluded that integrated control measures are essential and should include vector control, vaccination programmes, improved therapy strategies, diagnostic tools, surveillance (human and animal) and public awareness. Given the high case fatality rate and outbreak potential, CCHF poses a serious risk in Europe, as demonstrated by the increased geographic spread of cases. [32, 34]

CCHF cases have only rarely been imported into Western Europe, including a case imported from Zimbabwe to the UK in 1998; a case imported from Bulgaria to Germany in 2001; and a case imported from Senegal to France in 2004.[34]

1.8 Other Old-World and New-World Arenaviruses

New-World Arenaviruses are a group of rodent-associated Arenaviruses in South America similar to the Lassa group in Africa (Old-World), but antigenically unrelated to the African viruses.

Junín virus, which causes Argentinean Haemorrhagic Fever, was the first of these to be recognized (isolated in 1958). It occurs in a limited agricultural area of the pampas in Argentina. Machupo virus, which causes Bolivian Haemorrhagic Fever, is also geographically restricted. Isolated in 1963, it is found in the remote savannas of the Beni province of Bolivia. In December 2003 a newly discovered Arenavirus, Chapare virus, was identified as the cause of haemorrhagic fever in rural Bolivia in an area outside the known Machupo endemic region.[35] The Guanarito (Venezuelan Haemorrhagic Fever) and Sabia (Brazilian Haemorrhagic Fever) viruses are the most recent additions to this family.[36, 37] The Junín and Machupo viruses are associated with serious disease and both have peak incidence during May and June.[37]

The rodent hosts of Arenaviruses are chronically infected and the viruses are shed into the environment in the urine or droppings. Human infection occurs by direct contact of broken skin with rodent excrement, or through the inhalation of particles contaminated with rodent urine or saliva.[37] Laboratory–acquired infection of Junín and Machupo viruses have been reported; 21 cases (1 death and 6 cases (1 death), respectively, up to 1980.[38, 39]

In September-October 2008 a novel Old-World Arenavirus, Lujo virus, was identified as the cause of a nosocomial outbreak in South Africa. There were five patients involved in the outbreak, four of whom died. Three of the cases were secondary infections and one tertiary infection occurred. The patient who recovered was treated with Ribavirin and the institution of barrier nursing procedures prevented further spread. Lujo virus was the first highly pathogenic Arenavirus to be identified in Africa in 40 years and highlights the possibility that pathogenic Arenaviruses could be more widespread in Africa than previously thought.[40]

1.9 Flaviviruses

The flaviviruses cause a range of illness from self-limiting febrile illness to severe hepatitis and haemorrhagic fever. Of these, the viruses that cause Kyasanur forest disease, Omsk and Alkhurma haemorrhagic fevers are of greatest public health concern due to their potential as bioterrorism agents rather than their potential for person-to-person transmission.

Kyasanur forest disease, caused by Kyasanur forest disease virus, is a haemorrhagic disease transmitted to humans principally from the bite of infected ticks. While larger animals such as goats, cows or sheep may be infected with Kyasanur forest disease virus, there is no evidence that they

have a role in its transmission, including transmission via unpasteurised milk.[41] There is no evidence of direct person-to-person transmission. Up to 1979, 87 cases of laboratory-acquired infections were reported. [41, 42] The virus is limited to Karnataka State, India. The case fatality rate is 2% - 10%.[41, 42]

Omsk haemorrhagic fever is also geographically limited and is found in the western Siberian regions of Omsk, Novosibirsk, Kurgan and Tjumen, with seasonal occurrence in each area coinciding with vector activity. Transmission to humans is from the bite of an infective tick but data also suggests direct transmission to humans from muskrat and from water contaminated with the virus. There is no evidence of direct transmission from person-to-person, and no outbreaks within a hospital or family have been reported, with the exception of family outbreaks where multiple family members were involved in the hunting of muskrats and the removal and treatments of their skins. The disease is thought to be under-reported as mild cases are frequently misdiagnosed or not reported.[43] Between 1946 and 1958 there were 972 cases but the incidence decreased dramatically from 1960 and in 1988 only 3 cases were reported. In 1989 22 cases were reported and outbreaks followed in 1990 (29 cases) and in 1991 (38 cases). In 1998 7 cases were reported, with 3 classified as severe and 1 death. [43] Laboratory-acquired infections have been documented including two cases due to aerosols generated from a broken vial in a centrifuge.[44] A total of 23 laboratory-acquired cases were reported: 21 in Russia and 2 in Czechoslovakia.[43] The case fatality rate is 0.4% -2.5%.[43]

Alkhurma haemorrhagic fever virus is genetically very closely related to Kyasanur forest disease. It is found in the Makkah and Najran provinces on the west coast of Saudi Arabia. It is also tick-borne but the reservoir host has not been documented but probably includes sheep, camels and goats. Humans who become infected usually do so directly from a tick bite, by contact with infected blood on a skin wound, or from consumption of unpasturised milk of infected animals. In the first three months of 2009, 4 cases were reported in the Najran province. The case fatality rate is 25% - 30%.[45]

Table 2. Key Characteristics of Viral Haemorrhagic Fevers

Family Disease (Virus)	Distribution	First Described	Person-to-person Transmission	Vectors	Reservoir Hosts	Incubation Period Usual (range)	Case Fatality Rate
Arenaviridae							
Lassa fever	West Africa, incl. Liberia, Guinea, Sierra Leone, Nigeria	1969	Y		Rodents of genus *Mastomys* shed virus in urine & faeces	6 - 21 days	1% overall, up to 20% of hospitalised cases
Argentine HF (Junin)	Argentina	1958	N		Rodents	7 -16 days	5-30%
Bolivian HF (Machupo)	Benin province Bolivia	1963	N		Rodents	7 -16 days	5-30%
Bolivian HF (Chapre)	Cochabamba province, Bolivia	2003	N		Unknown	Unknown	Unknown
Brazilian HF (Sabia)	Brazil	1990	N		Rodents	7 -16 days	
Venezuelan HF (Guanarito)	Venezuela	1989	N		Rodents	7 -16 days	
Lujo	Southern Africa	2008	Y		Possibly rodents	9-18 days (2 cases)	80% (4/5 cases)
Bunyaviridae							
Crimean-Congo HF	Africa, Eastern Europe, Middle East, Asia	1944	Y	*Ixodid* ticks (*Hyalomma* genus)	Small mammals, livestock, wide range of domestic & wild animals	1 -3 days (1 - 13 days)	10-50%
Rift Valley Fever	Africa		N	Mosquitoes	Sheep and cattle	3 - 12 days (few days - few months)	1%
Filoviridae							
Ebola	Central & Eastern Africa, incl. DR Congo, Gabon, Sudan, Ivory Coast, Uganda, Rep. of the Congo	1976	Y	-	African fruit bat	2 - 21 days	50-90%
Marburg	Eastern & Southern Africa, incl. Angola, DR Congo, Kenya, Zimbabwe & Uganda	1967	Y	-	African fruit bat	3 - 10 days	up to 90%
Flavivirdiae							
Yellow Fever	West Africa & South America	1927	N	Mosquitoes	Humans (monkeys)	3 - 6 days	
Kyasanur Forest Fever	India	1957	N	Ticks	Goats, cows, sheep	3 - 8 days	2-10%
Omsk HF	Siberia	1946	N	Ticks	Rodents, muskrat	3 - 8 days	0.4 – 2.5%
Alkhurma HF	Saudi Arabia (Makkah & Najran provinces)	1957	N	Ticks	Probably sheep, camels, goats	Probably 3-8 days	25-30%

1.10 Requirement to notify VHF to the World Health Organization under the International Health Regulations, 2005

The aim of the International Health Regulations (IHR) is to help the international community prevent and respond to acute public health risks that pose a serious risk to health worldwide and have the potential to cross borders. The IHR require countries to notify WHO of events that may constitute a Public Health Emergency of International Concern (PHEIC). This is done by the WHO IHR National Focal Point at HPSC. An event of VHF (Ebola, Lassa, or Marburg) "*shall always lead to utilisation of the algorithm in Annex 2* (a decision instrument for the assessment and notification of events that may constitute a PHEIC)*, because this disease has demonstrated the ability to cause serious public health impact and to spread rapidly internationally*" and would be notified to WHO (Appendix D).

The IHR 2005 came into force in 2007. There is a nationally agreed mechanism for responding to Public Health Emergencies of International Concern (PHEIC) and this is the National Public Health Outbreak Response Plan and Team (NPHORT). This would be activated in the event of a case of VHF arising in Ireland.

1.11 Establishment and role of National Isolation Centres

The National Isolation Unit (NIU) for adult patients, located at the Mater Misericordiae University Hospital, Dublin (St. Bernard's Ward), is the national referral centre for ***High Risk*** suspected and confirmed cases of VHF.

Officially opened in December 2008, the self-contained unit has 12 beds including six lobbied, en-suite single rooms with negative pressure ventilation. Two of the isolation rooms are of high specification and are separate from the rest of the unit with different air-handling systems. It is designed to admit, isolate and treat patients suspected or diagnosed with highly infectious diseases who are referred from all over Ireland who have both hazardous and highly infectious diseases. The Unit will also provide essential care of infectious diseases stemming from any bioterrorism.

There is currently no designated national paediatric referral centre for VHF. Contingency arrangements in the event of a paediatric case arising are currently in development.

This updated document provides guidance on the role of the National Isolation Unit in the assessment and clinical management of patients with VHF. It also provides information on ambulance transfer protocols from hospitals to the NIU.

1.12 Web resources

The VHF section of the Health Protection Surveillance Centre website (http://www.hpsc.ie/hpsc/A-Z/Vectorborne/ViralHaemorrhagicFever/) has been updated to reflect these guidelines. Available resources include up-to-date information on endemic countries and outbreaks of VHF, fact sheets and useful links as well as the forms and algorithms contained in this document, which are available for download.

2. Clinical Assessment, Risk Categorisation and Initial Management

2.1 Introduction

In Europe and the USA, imported cases of viral haemorrhagic diseases have occurred, but very rarely. Features of these imported cases are described in Appendix C. An imported case of VHF has not yet been diagnosed in Ireland.

The notable features common to these imported cases have included:

- Lassa fever has been the most commonly imported VHF;
- late diagnosis has been a feature, as VHF hasn't been considered early in the differential diagnosis;
- there has been a very low risk of nosocomial or other secondary spread when appropriate infection control precautions have been used routinely;
- as the number of those travelling to more remote rural areas where VHF is endemic increases, the risks to travellers may be increasing;
- an imported case usually results in a large burden of communication and information exchange, for which all involved in the response need to be prepared.

Patients occasionally present with fever and travel history to a country where VHF is endemic. During the early stages of illness (first three to seven days), patients present with influenza-like symptoms. **The possibility of VHF should be considered in any sick traveller from an endemic country, who has no clear features of an alternative diagnosis.**

The questions in the Clinical Risk Assessment Form (Appendix E) are designed to thoroughly assess the risk of VHF infection. Following the completion of this form, patients will be categorised as either:

- no risk;
- possibility of VHF (***At Risk***);
- or high possibility of VHF (***High Risk***).

2.2 Clinical presentation

Initial signs and symptoms are usually systemic, non-specific, and consistent with an "influenza-like" illness with symptoms of marked fever, dizziness, myalgia, arthralgia, fatigue, anorexia, diarrhoea and exhaustion. This lasts up to seven days. Early signs typically include fever, hypotension, relative bradycardia, tachypnea, conjunctivitis, and pharyngitis. Most diseases are associated with cutaneous flushing or a skin rash. Later, patients may show signs of progressive hemorrhagic diathesis, such as petechiae, mucous membrane and conjunctival haemorrhage, haematuria, haematemesis, and melaena. Disseminated intravascular coagulation and circulatory shock may follow. Central nervous

system dysfunction may be present and manifested by delirium, convulsions, cerebellar signs, or coma; these indicate a poor prognosis. The incubation period ranges from 1-21 days. Clinical features of individual VHFs are summarised in Tables 3-6.

Table 3. Clinical presentation of Crimean-Congo haemorrhagic fever

Disease (virus)	**Crimean-Congo haemorrhagic fever** (Crimean-Congo haemorrhagic fever virus)
Vector/Host	*Ixodid* ticks of *Hyalomma* genus
Mode of transmission	Direct contact with blood or other infected tissues from livestock, or via tick bite, or nosocomial - direct contact with infected patients blood or body fluids, or through contaminated medical equipment or supplies
Incubation period	Following tick bite: 1-3 days (max 9). Following contact with livestock, blood, or tissues: 5-6 days (max 13)
Risk groups	Farmers, vets, abattoir workers. (CCHF doesn't survive cooking); healthcare workers without PPE, outdoor activities
Clinical features	Sudden onset. Fever, myalgia, dizziness, neck pain and stiffness, backache, headache, sore eyes and photophobia. Nausea, vomiting, sore throat early on, +/- diarrhoea and abdominal pain. Over next few days, may develop sharp mood swings, confusion and aggression. After 2-4 days changes to sleepiness, depression and lassitude, abdominal pain may localise to Right Upper Quadrant, with hepatomegaly. May have tachycardia, lymphadenopathy, petechial rash on mucosa, palate and on skin. Echymoses may develop, beginning on day 4 or 5 and melaena, haematuria, epistaxis etc. Hepatitis. If severely ill, may develop hepatorenal failure
Duration of infectivity	Infectious when symptomatic – duration of infectivity not well established
Mortality rate	10-50%
Treatment	Supportive and ribavirin (both oral and IV) - no Randomised Control Trials, so evidence for use not strong

Table 4. Clinical presentation of Lassa fever

Disease (virus)	**Lassa fever** (Lassa fever virus**)**
Vector/Host	Rodents of genus Mastomys ("multimammate rat") shed virus in urine and faeces
Mode of transmission	Direct exposure to excreta of infected mastomys - or direct contact with blood, urine, faeces or other bodily secretions of person with Lassa fever. Sexual transmission has been reported. No epidemiological evidence for airborne spread.
Incubation period	6-21 days - majority present within 7-14 days after exposure
Risk groups	Those who live or visit areas with large populations of infected mastomys rodents
Clinical features	Gradual onset. 80% are asymptomatic, the remaining have severe multi-system disease. Fever, general weakness, malaise. After few days, headache, sore throat, muscle pain, chest pain, nausea, vomiting, diarrhoea, cough and abdominal pain. Severe cases may have facial oedema, pleural effusions, bleeding from mouth, nose, vagina or GI tract, and low blood pressure. Shock, seizures, tremor, disorientation and coma may be seen in late stages. Deafness in 25-30% - of whom 50% recover in 1-3 months. Transient hair loss and gait disturbance during recovery.
Duration of infectivity	Urine up to 32 days; Semen up to 3 months
Mortality rate	1% of cases overall, 15-20% of hospitalised cases, usually within 14 days of onset symptoms. Very severe in late pregnancy, with 80-95%% foetal loss in 3rd trimester
Treatment	Ribavirin, if given early on

Table 5. Clinical presentation of Ebola haemorrhagic fever

Disease (virus)	**Ebola haemorrhagic fever** (Ebola virus, 4 distinct species: Zaire, Sudan, Cote d'Ivoire and Bundibugyo)
Vector/Host	African fruit bat
Mode of transmission	Close contact with blood or other body fluids, including semen of ill patient (infectiousness increases with severity of illness), burial ceremonies with direct contact with body, contaminated injection equipment, or needle stick injuries. Contact with infected animals e.g. African fruit bat and primates.
Incubation period	2-21 days (mean 4-10)
Risk groups	Mostly in adults. Lab workers working with primates
Clinical features	Sudden onset. Fever, intense weakness, muscle pain, headache and sore throat. Followed by vomiting, diarrhoea, rash, impaired renal and liver function, and in some cases, hiccups, internal and external bleeding.
Duration of infectivity	Liver & fluid of anterior eye chamber up to 2 months; Semen up to 12 wks
Mortality rate	50-90%
Treatment	Supportive only

Table 6. Clinical presentation of Marburg haemorrhagic fever

Disease (virus)	**Marburg haemorrhagic fever** (Marburg virus)
Vector/Host	African fruit bat
Mode of transmission	Close contact with blood or other body fluids, including semen of ill patient (infectiousness increases with severity of illness), burial ceremonies with direct contact with body, contaminated injection equipment, or needle stick injuries. Contact with infected animals e.g. African fruit bat and primates.
Incubation period	3-10 days
Risk groups	Mostly in adults. Lab workers working with primates
Clinical features	Sudden onset. Severe headache and severe malaise, muscle aches and pains. Fever on day 1, followed by progressive and rapid debilitation. Severe watery diarrhoea, abdominal pain and cramping, nausea and vomiting on day 3. A rash may occur. Diarrhoea persists for a week; patients look “ghost-like” with drawn features, deep-set eyes, and extreme lethargy. Haemorrhagic manifestations on day 5 – 7. CNS involvement can lead to confusion, irritability and aggression. Death occurs on day 8-9.
Duration of infectivity	Liver & fluid of anterior eye chamber up to 2 months; Semen up to 12 wks
Mortality rate	83 – 88% in 2 outbreaks. CDC report a Case Fatality Rate of 23-25%
Treatment	Supportive only

2.3 Assessment of sick travellers for potential Viral Haemorrhagic Fever

The clinical risk assessment form and algorithm (Appendices E, F), based on an algorithm that was originally developed in the UK, and adapted for use here in Ireland, can be used in all acute medical settings, such as Emergency Departments or Medical Assessment Units, to help in the assessment and initial management of a sick traveller in whom VHF is a possibility.

They allow for rapid assessment as to whether the patient's clinical and travel history is suggestive of VHF, and outline the assessments, laboratory testing and infection control measures that need to be taken. There is also the remote, but theoretical possibility of bioterrorism related VHF, and this algorithm also caters for this.

Patient Risk Assessment Key Points

- Know who is the lead in your acute medical setting for conducting the risk assessment and be familiar with local risk assessment arrangements.
- Use the Clinical Risk Assessment Form (Appendix E) to determine the risk of VHF infection in anyone meeting both the clinical and travel history criteria for VHF at patient triage.
- The patient's risk category and symptoms determine the infection control precautions and the management of the patient.
- The patient's risk category can change depending on the patient's symptoms and/or the results of diagnostic tests. A patient with VHF infection can deteriorate rapidly.

Epidemiological and clinical assessment

The time between the last possible exposure and the onset of symptoms is a key question. If this time period is greater than the incubation period for VHF, (21 days for Lassa, Ebola, Marburg; and 13 days for CCHF), then VHF can be excluded.

Detailed questions need to be asked about exposure to an endemic area. Of relevance is exposure to rural locations, or rats, entering bat caves, exposure to dead or sick animals, or a history of tick bites. The questions to ask are detailed in the Clinical Risk Assessment Form, at Appendix E. Other warning signs include:

- failure to improve on antimalarials and/or antibiotic treatment for a preliminary diagnosis, failure of dengue fever to improve after seven days or more;
- rapid escalation of aspartate aminotransferase (AST) or lactate dehydrogenase (LDH) levels, a rapid fall in platelet count;
- the onset of epistaxis or bloody diarrhoea.[46]

Who should be assessed and when?

In Ireland anyone meeting both the clinical and travel history criteria for VHF at patient triage should be assessed urgently i.e. a patient with a fever (>38^{o}C) or history of fever in the previous 24 hours and who is recently returned (within the last 21 days) from, or is currently residing in, a VHF endemic area. Information on VHF endemic areas and outbreaks is available on the HPSC website,

http://www.hpsc.ie/hpsc/A-Z/Vectorborne/ViralHaemorrhagicFever/, and via daily global disease updates on ProMed.

Who should perform the risk assessment?

In Ireland as soon as a patient meeting the clinical and travel history criteria has been identified, the patient's risk should be assessed urgently using the Clinical Risk Assessment Form (Appendix E). The risk assessment should be led by a senior member of the medical team responsible for the acute care of patients, for example, the Emergency Medicine Consultant or admitting team consultant. The Infectious Disease Consultant on call at the Mater Misericordiae University Hospital, Dublin, is also available to assist in conducting the risk assessment.

The following questions should be asked to assess exposure:
Has the patient:

1. lived or worked in basic rural conditions where Lassa fever or CCHF is endemic?
2. travelled to any area where a VHF outbreak has recently occurred (in the last 6 months?
3. received a tick bite and or/crushed a tick with their bare hands and/or travelled to rural environments where contact with livestock or ticks is possible, in a CCHF endemic area?
4. travelled to a rural environment where contact with livestock or ticks is possible in a CCHF endemic area?
5. visited mines or caves in a VHF endemic area?
6. have been in an area contaminated by bats?
7. eaten food which could have been contaminated by rats in a Lassa fever endemic area?
8. swept/cleaned dust which could have been contaminated by rats in a Lassa fever endemic area?
9. handled or butchered dead primates or been involved in drying, smoking their meat or consuming their meat in a VHF endemic area?
10. come into contact with the body fluids of an individual or animal (live or dead) known or strongly suspected of having VHF e.g. during routine patient care, transport of patient, resuscitation, autopsy?
11. handled clinical/laboratory specimens (blood, urine, faeces, tissues, laboratory cultures) from a live or dead individual or animal known or strongly suspected of having VHF?
12. received IM or IV injections while in an endemic country?
13. had close contact with a live or dead individual known or strongly suspected of having VHF e.g. kissed, been breastfed by?
14. had sex in the last 3 months with an individual known or strongly suspected to have VHF?
15. been involved in the funeral preparations of an individual known or strongly suspected to have VHF?

16. come into contact with body fluids of a live or dead individual known or strongly suspected of having VHF either directly, e.g. handled blood, urine, faeces, or indirectly, e.g. soiled clothes or bedding?

Based on the completed Clinical Risk Assessment Form (signs & symptoms and exposure), either the diagnosis will be definitively excluded, or the patient will be categorised into one of two categories (Appendix G), as follows:

a) ***High Risk*** **Category**

If the answer is Yes to any of the above questions, in conjunction with fever or a history of fever, and travel, there is a high possibility of VHF, and the person is categorised as *High Risk*.

b) ***At Risk*** **Category**

If the answer is No to all of questions above, and the patient meets the clinical and travel history criteria, then VHF is still a possibility, but the patient is labelled ***At Risk*** and initially a malaria screen is done, as this is more likely.

The categorisation of the patient into *At Risk* or *High Risk* is a key step which determines the infection control precautions required, further investigations to be carried out, whether the patient will be considered for immediate transfer to the National Isolation Unit at the Mater Misericordiae University Hospital, and whether the Director of Public Health/Medical Officer of Health (DPH/MOH) needs to be informed.

Note: The patient's risk category can change depending on the patient's symptoms and/or the results of diagnostic tests. A patient with VHF infection can deteriorate rapidly.

2.4 Initial management of patient categorised as ***High Risk***

- Patient care needs to be managed by senior medical staff.
- **Infection control precautions:**
  - Put the patient in a single room. Use standard precautions, contact, droplet precautions, and airborne precautions. If the patient has bruising or bleeding or diarrhoea or vomiting or cough, contact the National Isolation Unit immediately and consider early transfer (prior to test results being available), if the patient is medically stable. See Chapter 3.
  - Inform occupational health of the situation. Education and communication with staff about potential risks is paramount. Staff must be informed about and understand the risks associated with a patient at ***High Risk*** of VHF, for example,
    - the severity of a VHF infection if confirmed;
    - that virus may be present:
      - in blood and body fluids, such as urine;

        - on contaminated instruments, equipment and surfaces;
        - in waste;
        - on contaminated clothing.
    - that exposure to the virus may occur, either:
        - directly, through exposure (broken skin or mucous membranes) to blood and/or body fluids during invasive, aerosol-generating or splash procedures;
        - indirectly, through exposure (broken skin or mucous membranes) to environments, surfaces , equipment or clothing contaminated with splashes or droplets of blood and/or body fluids.

- **Notify Director of Public Health/Medical Officer of Health**
    - Notify the Director of Public Health/Medical Officer of Health (DPH/MOH) immediately, so that the public health response to the situation (preparing to set up an outbreak control team, contact tracing, communications, national and international reporting) can be initiated.

- **Urgent investigations**
    - Contact the National Virus Reference Laboratory to arrange for testing for VHF (see Chapter 4). Ensure that request forms are completed in full and that appropriate packaging and agreed mode of transport are used (see Section 5.3). Vacuum-tube systems **must not be used** for transportation of specimens within hospitals or laboratories.
    - In addition arrange for the following investigations to be carried out urgently. **It is essential to inform the laboratory of the likelihood of VHF in advance.**

        - Full blood count
        - Renal profile (urea & electrolytes; U&E)
        - Liver profile (Liver function tests)
        - Prothrombin time (PT)
        - Activated partial thromboplastin time (APTT)
        - Glucose
        - Urgent malaria test (film and/or antigen)
        - Blood cultures
        - Chest X-ray (CXR)

- **Contact the NIU**
    - If the patient has bruising or bleeding, diarrhoea or vomiting, or cough, then contact the National Isolation Unit immediately to discuss patient transfer. If none of these are present, consultation and transfer to the NIU can await results of an urgent VHF test. See Appendix F for contact details.

If the VHF test is **positive**:

- arrange transfer to NIU. NIU will arrange appropriate ambulance for transfer with ambulance control;
- **contact DPH/MOH again immediately. DPH/MOH will launch Public Health actions as soon as a positive result is identified**

If the VHF test is **negative**:

- the possibility of the patient having a VHF infection should be maintained until an alternative diagnosis is confirmed;
- review in light of other results and re-evaluate the patient daily, particularly if the patient fails to improve e.g. fever (>38^{o}C) persisting after 72 hours of antimalarials or antimicrobials, nosebleed, bloody diarrhoea, sudden rise in ASK or CK, sudden fall in platelets, fall in BP, rapidly increasing O_2 requirements in absence of other diagnosis;
- contact the DPH/MOH who will then step down the arrangements for contact tracing and other public health actions;
- microbiologist/Consultant in Infectious Disease (Micro/ID) to advise on which infection control precautions need to remain in place.

2.5 Initial management of patient categorised as ***At Risk***

- Patient care needs to be managed by senior medical staff.
- **Infection control precautions:**
    - Put the patient in a single room. Use standard precautions. If the patient has bruising or bleeding, vomiting or cough, then use Standard plus Droplet plus Contact precautions. See Chapter 3.
    - Inform Occupational Health of the situation. Education and communication with staff about potential risks is paramount. Staff must be informed about and understand the risks associated with a patient at risk of VHF, for example:
        - the severity of a VHF infection if confirmed;
        - that virus may be present:
            - in blood and body fluids, such as urine;
            - on contaminated instruments, equipment and surfaces;
            - in waste;
            - on contaminated clothing.
        - that exposure to the virus may occur, either:
            - directly, through exposure (broken skin or mucous membranes) to blood and/or body fluids during invasive, aerosol-generating or splash procedures;

- indirectly, through exposure (broken skin or mucous membranes) to environments, surfaces , equipment or clothing contaminated with splashes or droplets of blood and/or body fluids

- **Urgent investigations:**
  - Contact the laboratory to arrange urgent testing for malaria, **and inform them that the patient is categorised as A*t Risk* for VHF**. Ensure that appropriate labelling of samples is used.
  - In addition the following investigations should be carried out:
    - Full blood count
    - Renal profile (urea & electrolytes; U&E)
    - Liver profile (Liver function tests)
    - Prothrombin time (PT)
    - Activated partial thromboplastin time (APTT)
    - Glucose
    - Blood cultures
    - Chest X-ray (CXR)

- **Notification to DPH/MOH**
  - There is no need to notify the DPH/MPH prior to obtaining the malaria screen result. Notification is needed when and if the malaria test is negative and a VHF test is being undertaken.

- **National Isolation Unit**
  - There is no need to contact the NIU until when and if the VHF test is positive.

If the malaria test is **positive**:

- VHF is unlikely but the patient should be reassessed daily, particularly if the patient fails to improve e.g. fever (>38^{o}C) persisting after 72 hours of antimalarials, nosebleed, bloody diarrhoea, sudden rise in ASK or CK, sudden fall in platelets, fall in BP, rapidly increasing O_2 requirements in absence of other diagnosis;
- consider dual infection if the patient deteriorates significantly despite antimalarial treatment.

If the malaria test is **negative**:

- review in light of other test results, consider VHF test;
- contact the DPH/MOH and Infectious Disease clinician/microbiologist and infection control team urgently in this situation.

If the VHF test is **positive**:

- arrange transfer to NIU (NIU will arrange appropriate ambulance for transfer with ambulance control);
- contact DPH/MOH again who will now launch Public Health actions;

If the VHF test is **negative**:

- the possibility of the patient having a VHF infection should be maintained until an alternative diagnosis is confirmed;
- review in light of other results and re-evaluate the patient daily, particularly if the patient fails to improve e.g. fever (>38^{o}C) persisting after 72 hours of antimalarials or antimicrobials, nosebleed, bloody diarrhoea, sudden rise in ASK or CK, sudden fall in platelets, fall in BP, rapidly increasing O_2 requirements in absence of other diagnosis;
- microbiologist/Consultant in Infectious Disease (Micro/ID) to advise on which infection control precautions need to remain in place.

2.6 Patient transfer

As a general rule, patients at ***High Risk***, with bruising or bleeding, diarrhoea, vomiting, or cough, and those with a positive VHF laboratory test result (regardless of initial categorisation), should be transferred to the NIU for management. This should always be done following consultation between the attending clinician and the ID consultant at the NIU. There may be circumstances where transfer is not appropriate e.g. patient too unstable medically. See Chapter 6 for further details on transport of infected patients.

2.7 Differential diagnosis

The differential diagnosis includes a wide array of both infectious and non-infectious aetiologies. In most circumstances the diagnosis will be one of the more common infectious diseases summarised in Table 7 below. Of these, malaria, followed by typhoid are the most likely.

Table 7. Differential diagnosis of viral haemorrhagic fever

Bacterial	**Typhoid**; Pyelonephritis; Pneumonia; Sepsis; Meningococcal disease; Leptospirosis; Shigellosis; Systemic plague; Systemic tularaemia; Rheumatic fever; Non typhoidal salmonellosis; Toxic shock syndrome
Helminthic	Schistosomiasis; Katayama syndrome
Viral	Yellow fever; Rift Valley Fever; Infectious mononucleosis; Dengue; Dengue shock syndrome; Dengue haemorrhagic fever; Hepatitis A; HIV infection; Fulminant Hepatitis ; Systemic herpes infection ; Systemic CMV, EB; Varicella zoster infection; Hantavirus pulmonary syndrome; Haemorrhagic smallpox
Rickettsial	Typhus; Q fever; Tick borne rickettsiosis
Protozoal	**Malaria**; Amoebic liver abscess; Trypanosomiasis

Diagnosis in **bold** are the most likely alternate diagnosis.

Non-infectious disease causes should also be considered, as disseminated intravascular coagulation could be mistaken for acute leukaemia, lupus erythematosis, idiopathic or thrombotic thrombocytopaenic purpura, and Haemolytic Uraemic Syndrome.

2.8 Clinical case management

It is intended that cases will be managed in the NIU. However, if the patient is not medically stable for transfer they will be managed by clinicians in the hospital to which they were first admitted, in consultation with the Infectious Disease Consultants at the NIU.

If the diagnosis is Lassa fever, Ribavirin is likely to be used according to the following dosing schedule:

Ribavirin
30mg/kg loading dose
Then
15mg/kg every 6 hours for 4 days
Then
7.5mg/kg every 8 hours for 6 days.

Medisource, Kilcoole, Co. Wicklow (www.medisource.ie) are suppliers of Virazole (RibavIrin) in Ireland. Please note that this medicine does not have a current Irish marketing authorisation and will be supplied as an exempt medicine. The product details are:

- Virazole 0.1G/ml Injection
- Active ingredient: Ribavirin
- Pack size: 5 vials of 12ml Solution for Injection

Ribavirin is not of benefit for Ebola and Marburg HF. Information on the use of Ribavirin in patients with clinically evident VHF of unknown aetiology or secondary to Arenaviruses or bunyaviruses is provided in Section 7.5.

3. Infection Prevention and Control Guidance

3.1 Introduction

Four VHFs have caused significant outbreaks of disease due to person-to-person transmission (Lassa fever, CCHF, Ebola HF and Marburg HF). They present a risk to public health and have the potential for nosocomial transmission. Given the lack of effective therapy or preventive vaccines against most VHF agents, efforts to prevent transmission rely on careful and vigilant implementation of appropriate infection control measures.

This chapter provides the infection prevention and control advice for management of patients ***At Risk*** or at ***High Risk*** of VHF, and for those with confirmed VHF; advice on environmental decontamination and management of healthcare risk waste, as well as advice on post-mortem management. It is important to note that **strict adherence to Standard and Transmission-based Precautions, including the correct use of Personal Protective Equipment (PPE), at all times during the care of *At Risk* or *High Risk* patients and those confirmed as having VHF is of paramount importance**.[47-51] All staff should be familiar with the correct sequence for the donning and removal of PPE in order to prevent contamination of the face, mucous membranes and clothing.

The infection control and prevention principles outlined in this chapter apply to all healthcare settings irrespective of patient location and apply to acute Emergency Departments, Medical Assessment Units and paediatric settings.

3.2 Mode of transmission

Most of the evidence for the mode of transmission of VHF comes from endemic areas where large outbreaks have occurred, in settings with limited medical and public health infrastructure. The transmission risks associated with various body fluids have not been well defined because most caregivers who have acquired infection had contacts with multiple fluids.

Epidemiological investigations of outbreaks have demonstrated that the four main VHF viruses appear to be predominantly transmitted from person-to-person in the same way: through direct contact with virus-infected body fluids, such as blood, saliva, vomitus, stools and possibly sweat. Cross-infection with multiple-use sharp instruments such as lancets and needles is associated with a high infection risk and a high fatality rate.

Marburg, Ebola and Lassa virus have been shown to be present in the genital secretions of convalescent patients several weeks after illness. At least one incident of transmission from a convalescent patient to their sexual contact has occurred with Marburg HF.[22] Evidence of Ebola virus has been detected in semen up to 91 days after disease onset.[52]

These viruses may be transmitted over a short distance of a metre or so by droplets of body fluids from infected patients, if the droplets come into contact with mucous membranes. There is also a

potential risk to laboratory workers as small clouds of aerosolised viruses can be released in laboratory accidents such as breakage of containers within centrifuges.

Because for some cases, no plausible alternative explanations for transmission have been considered possible, airborne transmission remains a theoretical possibility. Appendix H summarises available evidence in relation to the mode of transmission.

Key Points

- **The VHF sub-committee advises, on a precautionary basis, the use of Standard and Contact, Droplet and Airborne Precautions at all times when managing patients who are *High Risk* cases, or confirmed cases.**
- **Standard Precautions should be used at all times when caring for patients who are classified as *At Risk* of VHF.**

3.3 Incubation period and infectivity

Haemorrhagic fever viruses are relatively simple RNA virus with lipid envelopes. Their lipid envelope makes them relatively susceptible to detergents, low-pH environments, and household bleach. However when protein is present, they are stable at neutral pH. As a result, these viruses are stable in blood for long periods and can be isolated from a patient's blood specimen after weeks of storage in a refrigerator or at ambient temperature.[53]

Percutaneous transmission is associated with the shortest incubation period and highest mortality. A very low inoculum appears to result in infection. Incubation period and duration of infectiousness for the four main VHFs are set out in Table 8.

The risk for person-to-person transmission of haemorrhagic fevers is greatest during the latter stages of illness when the viral loads are highest.

There is no evidence that close personal contact with a non-febrile non-symptomatic infected individual during the incubation period or convalescence results in transmission, except for sexual contact.

Feverish patients, who are well enough to care for themselves, have never been shown to transmit infection to contacts on airplanes, or to contacts on public transport, or to other casual contacts.

Table 8. Incubation period, duration of infectivity and case fatality rate by VHF

Disease	Incubation Period Usual (range)	Duration of Infectivity**	Case Fatality Rate
Lassa fever	6 - 21 days	Urine up to 32 days; Semen up to 3 mths	1% overall; up to 20% of hospitalised cases
Crimean-Congo HF	1 -3 days (1 - 13 days)		10-50%
Ebola HF	2 - 21 days	Semen up to 91 days after onset	50-90%
Marburg HF	3 - 10 days	Liver & fluid of anterior eye chamber up to 2 mths; Semen up to 12 wks	up to 90%

** Viruses are shed in secretions from the onset of symptoms and for long periods after recovery from infection for all VHFs

3.4 Initial assessment

As soon as VHF is being considered, the hospital Infection Control Team in conjunction with the senior member of the medical team must be actively consulted and included in all decisions regarding patient isolation requirements, use of personal protective equipment and patient transport requirements.

Prior to a definitive laboratory diagnosis being available, the risk of infection, and infection control precautions needed, depend on:

1. the risk assessment based on travel and exposure history, with categorisation of the patient into one of 2 categories: ***At Risk*** or ***High Risk***;

AND

2. the nature of the patient's symptoms.

This risk assessment is carried out by either the Infectious Disease clinician or the senior member of the medical team in charge of the patient (See Chapter 2 for details of this process).

Details of the infection prevention and control precautions for managing patients categorised as ***At Risk*** or ***High Risk*** of VHF as well as confirmed cases are provided below.

3.5 Infection prevention and control precautions for managing a patient categorised as ***At Risk*** of VHF

In addition to this chapter on infection prevention and control, please also refer to:

- VHF risk assessment algorithm for use in all acute medical settings (Appendix F);
- Standard Precautions, Health Protection Surveillance Centre, 2009 (http://www.hpsc.ie/hpsc/A-Z/Respiratory/Influenza/SeasonalInfluenza/Infectioncontroladvice.

Standard Precautions

When caring for patients ***At Risk*** of VHF, infection prevention and control practices and measures should be applied as per Standard Precautions, including environmental decontamination, management of healthcare waste etc. Additional transmission-based precautions may be required depending on the patient's symptoms and the type of procedures being undertaken, as highlighted below for patient placement and PPE for HCWs.

1. Patient placement

If the patient is bruised or is bleeding or has diarrhoea, vomiting or a cough, the patient should be placed in a single room to limit contact. Where possible the side room should have en-suite facilities or at least a dedicated commode.

2. PPE for healthcare workers (HCWs)

The level of protection required depends on the patient's symptoms as listed below and the type of procedures undertaken.

Table 9. List of patient symptoms and recommended PPE for staff

Patients symptoms	Staff protection
None of the symptoms below	Standard precautions • Hand hygiene • Gloves / apron
Bruised OR Bleeding OR Diarrhoea OR Vomiting OR Cough	Standard plus Droplet plus Contact Precautions • Hand hygiene • Gloves • Apron • Fluid repellent facemask Goggles/visor for potential aerosol or splash procedure

The following additional precautions are required when carrying out **Aerosol – or splash generating procedures (e.g. intubation, bronchoscopy, CPR, suction or centrifugation in the laboratory):**

- only staff needed to perform the procedure should be present in the room;
- don additional PPE: long sleeved gown, FFP3 mask, eye protection (goggles), gloves;
- the above PPE should be worn during the procedure and by those remaining in or entering the room within one hour of cessation of the procedure.

Communication with staff regarding potential infection risks is very important. Occupational Health should be informed of the situation. Education is crucial and staff must understand the risks associated with a VHF patient once the infection is being considered.

Staff should be aware that:

- the virus may be present:
  - in blood and body fluids, such as urine;
  - on contaminated equipment and instruments;
  - on contaminated clothing / surfaces;
  - in waste.
- exposure may occur:
  - directly through exposure to blood or bodily fluids during invasive, aerosolising or splash inducing procedures;
  - indirectly through exposure to the environment, surfaces, equipment or clothing contaminated with droplets of blood or bodily fluids.

Test results

If malaria test is **positive**:

- VHF is unlikely but dual infection should be considered if the patient deteriorates significantly despite anti-malarial treatment. The Infection Control Team should provide advice regarding ongoing infection control precautions.

If malaria test is **negative**:

- the possibility of the patient having a VHF infection, and therefore the infection control precautions outlined above, should be maintained until an alternative diagnosis is confirmed. The patient will be reviewed by the ID clinician, microbiologist and Infection Control Teams. An urgent VHF test may be requested.

If the VHF test is **positive**:

- see Section 3.7 on infection control and prevention precautions for managing a confirmed case of VHF.

If the VHF test is **negative**:

- the possibility of the patient having a VHF infection, and therefore the infection control precautions outlined above, should be maintained until an alternative diagnosis is confirmed.

3.6 Infection prevention and control precautions for managing a patient categorised as ***High Risk*** of VHF

In addition to this chapter on infection prevention and control, please also refer to:

- VHF risk assessment algorithm for use in all acute medical settings (Appendix F);
- checklist of supplies for acute hospitals in preparation for ***High Risk*** or **confirmed** cases of VHF (Appendix I);
- Standard Precautions, Health Protection Surveillance Centre, 2009 (http://www.hpsc.ie/hpsc/A-Z/Respiratory/Influenza/SeasonalInfluenza/Infectioncontroladvice.

Initial actions

- An urgent VHF screen needs to be carried out, plus diagnostic investigations which should include a malaria screen (See below "Internal transport of specimens to laboratory");
- If the patient has symptoms of bruising or bleeding, diarrhoea, vomiting or cough, discuss the situation urgently with the NIU at the Mater Misericordiae University Hospital and consider referral prior to laboratory confirmation;
- Public Health should also be contacted immediately;
- If the patient VHF screen is positive, transfer to the NIU at the Mater Misericordiae University Hospital should be arranged as soon as possible.

Standard plus Droplet plus Contact plus Airborne Precautions

1. Patient placement

The patient should be placed in a negative pressure room or, if not available, a single room (keep the door closed) in the setting where they present (Emergency Department, Medical Assessment Unit etc) immediately to limit contact, preferably with a dedicated commode. Place a restricted entry sign on the door.

2. Hand hygiene

Cover cuts and perform hand hygiene as per the WHO "5 Moments for Hand Hygiene"

1. before patient contact;
2. before an aseptic task;
3. after body fluid exposure;
4. after patient contact;
5. sfter contact with patient surroundings.

Neglecting to perform hand hygiene after removal of PPE will reduce or negate any benefits of the protective equipment. This applies to all staff entering and leaving the room. Alcohol hand gels should be at all points of care, i.e. end of bed, all trolleys and at entrances and exits of all areas of the isolation room.

3. PPE for HCWs

Standard plus droplet plus contact plus airborne precautions are required for staff protection as follows:

- gloves;
- fluid repellent long sleeved disposable gown;
- FFP3 facemask;
- goggles / visor (disposable).

Aerosol generating procedures (intubation, bronchoscopy, CPR, suction or centrifugation in the laboratory):

- no additional PPE is required;
- only staff needed to perform the procedure should be present in the room;
- the above PPE should be worn during the procedure and by those remaining in or entering the room within one hour of cessation of the procedure.

4. Patient care equipment/instruments/devices

- Use as much single use equipment as possible.
- Dedicate non-disposable equipment for patient use only i.e. stethoscopes, BP cuff, blood glucose monitoring.
- All non-disposable equipment needs to be thoroughly cleaned daily according to manufacturer's instructions.

5. Environmental decontamination

- All environmental surfaces and non disposable equipment need to be thoroughly cleaned daily
- All surfaces need to be washed with water and detergent followed by a solution of 1000ppm available chlorine (NaDCC solution) in order to achieve disinfection.
- Gloves, gowns and closed shoes (e.g. boots) to be worn when carrying out cleaning.
- Only trained cleaning staff should carry out the daily and post-discharge cleaning.
- Following discharge, the room will be thoroughly decontaminated and all disposable equipment and consumables discarded into the UN2814 healthcare risk waste container.

6. Dishes and eating utensils

- Disposable crockery and cutlery should be used where possible.
- If non-disposable items have been used they should be transported to the dishwasher in a secure disposable container. If dishwashers are used, temperatures must be recorded twice a day and records kept, and they must reach over 75 degrees centigrade.
- Once the utensils have been placed in the machine, the container is discarded into the UN2814 healthcare risk waste container.

7. Management of blood spills

- In the event of a blood spill, apply full PPE, cover the spill with absorbent paper towels and discard towels into the UN2814 healthcare risk waste container. The contaminated area should again be liberally covered with 10,000ppm available chlorine and left for contact time recommended in manufacturers' instructions; then wipe up with paper towels.
- The surface should then be washed with warm water.
- Discard all paper towels and PPE into the UN2814 healthcare risk waste container.
- For larger spills, cover the area with hypochlorite granules. If possible ensure windows are open. Allow 2-3 minutes for granules to gel, then using scoop from Spill Kit remove the gel, place in yellow bag provided and discard into the UN2814 healthcare risk waste container.
- Wash the area with warm water following disinfection with 10,000ppm available chlorine.

8. Management of needle stick injuries and blood and body fluid exposure

- Limit the number of exposures to blood and body fluids by:
    - limiting the patients pathology tests to those listed in Appendix F;
    - **using needleless devices.**
- If an exposure incident occurs, follow local hospital policy in relation to needle stick injury or blood or body fluid exposure occurring, including sprays / splashes occurring to mucous membranes
- **Should the patient test positive for VHF, any unprotected exposure to blood or body fluids will categorise the healthcare worker as a high risk contact,** who will require surveillance for a period of 21 days, and consideration for post exposure prophylaxis with Ribavirin (in the case of Lassa fever and CCHF). See Chapter 5 for further details.

9. Management of healthcare waste, including sharps

Type of packaging

- All waste from patients identified as at ***High Risk*** of VHF must be treated as Category A infectious waste. All treatment, disposal and transport of waste should therefore be carried out as defined in the Department of Health Healthcare Waste Packaging Guidelines, 2010.[55]
- The existing packaging used generally in hospitals for Healthcare Risk Waste is not approved for the segregation and packaging of Category A waste. All healthcare risk waste and contaminated non-healthcare risk waste from a patient at ***High Risk*** or with confirmed VHF must be disposed of in the specialist Category A (UN2814) packaging.
- All acute hospitals should have a supply of Category A UN2814 packaging (minimum 4). It may be more practicable to purchase these healthcare risk waste containers at a regional level.

In the patient room

- The external cardboard component of the Category A UN2814 packaging should not be placed in the patient room but remain outside.

- The inner packaging consisting of a 30 litre drum with lid and double plastic bag with absorbing material is placed in the patient area.
- All waste, other than sharps, should be discarded directly into the drum.
- Sharps should be discarded into a small sharps box (<10 litres).
- When full, sharps boxes should sealed and placed into the drum.
- External surfaces of the drum should be decontaminated with a solution of 10,000ppm available chlorine before it is removed from the room.
- The drum can then be placed in the cardboard box in the anteroom.

Transport within the hospital

- The waste must be accompanied by the appropriate Waste Transfer Forms which are available on line as normal. (https://wrms.dublincity.ie/wrms/frontoffice/)
- This waste must be segregated separately from all other healthcare and non-healthcare risk waste. It is imperative that this waste **is not placed in "wheelie bins".**
- It should be clearly identified by placing 'quarantine' labels on the outer container.
- It is important that the portering staff handling this waste are fully informed and trained in the use of the appropriate PPE and hand hygiene.

Waste collection

- This waste will also be collected separately from other healthcare risk waste by the national licensed contractor.

Waste generated before patient is identified as at ***High Risk*** of VHF

- Where a case is identified as ***High Risk*** and had been admitted to a multiple occupancy room, then the UN3291 Health Care Risk Waste bags and sharps boxes from that room should be placed in Zulu bins.
- These bins should be sealed and wiped down with 10,000ppm available chlorine before being removed from the room.
- These bins should be dated and labelled 'Query Category A Waste'.
- This waste must be segregated separately from all other healthcare and non-healthcare risk waste. It is imperative that this waste **is not placed in "wheelie bins".**
- It is important that the portering staff handling this waste are fully informed and trained in the use of the appropriate PPE and hand hygiene.
- If it is confirmed that the patient has VHF, then the hospital should liaise with the national licensed waste contractor on the packaging and removal of this waste.

10. Management of laundry and linen

- Where possible, disposable linen should be used and discarded directly into the UN2814 healthcare risk waste container.
- If non-disposable linen has been used, it must be treated as Health Care Risk Waste and discarded into the UN2814 healthcare risk waste container.

- When handling linen from ***High Risk*** patients, use gloves, gowns, closed shoes and goggles.

11. Respiratory hygiene and cough etiquette

- Patients with respiratory symptoms should wear a surgical mask, if tolerated.

12. Safe injection practice

- Limit the use of needles and other sharp objects as much as possible. **Needle-free systems** should be used to reduce the risk of needle stick injuries.
- Limit the use of phlebotomy and laboratory testing to the minimum necessary for essential diagnostic evaluation and patient care (Appendix F).

Communication with staff regarding potential infection risks is very important. Occupational health should be informed of the situation. Education is crucial and staff must understand the risks associated with a VHF patient once the infection is being considered.

Staff should be aware that:

- the virus may be present:
  - in blood and body fluids, such as urine;
  - on contaminated equipment and instruments;
  - on contaminated clothing / surfaces;
  - in waste.
- exposure may occur:
  - directly through exposure to blood or bodily fluids during invasive, aerosolising or splash inducing procedures;
  - indirectly through exposure to the environment, surfaces, equipment or clothing contaminated with droplets of blood or bodily fluids.

Internal transport of specimens to laboratory

Within the hospital, specimens should be transported according to local arrangements for high-risk samples. See Chapter 4 for precautions in the packaging and transport of biological specimens.

Test results

If the VHF test is **positive**:

- see Section 3.7 on infection control and prevention precautions for managing a confirmed case of VHF.

If the VHF test is **negative**:

- the possibility of the patient having a VHF infection, and therefore the infection control precautions outlined above, should be maintained until an alternative diagnosis is confirmed.

3.7 Infection prevention and control precautions for managing a patient with **confirmed** VHF pending transfer to the NIU, Mater Misericordiae University Hospital

In addition to this chapter on infection prevention and control, please also refer to:

- VHF risk assessment algorithm for use in all acute medical settings (Appendix F);
- checklist of supplies for acute hospitals in preparation for ***High Risk*** or **confirmed** cases of VHF (Appendix I);
- Standard Precautions, Health Protection Surveillance Centre, 2009. (http://www.hpsc.ie/hpsc/A-Z/Respiratory/Influenza/SeasonalInfluenza/Infectioncontroladvice

Standard plus Droplet plus Contact plus Airborne Precautions

1. Patient placement

It is national policy to manage all confirmed cases of VHF in the NIU at the Mater Misericordiae University Hospital, as long as it is medically safe to transfer the patient. If it is not possible to transfer the patient due to other medical reasons please adhere where possible to the principles laid out in this document:

- The patient should remain in a negative pressure room, or if not available, a single room (keep the door closed), with dedicated commode. Restricted entry sign to remain on the door;
- Pending transfer, once VHF has been confirmed, ensure that the clinical and non-clinical staff assigned to care for the patient (staff now restricted to caring for this patient only) do not move freely between the isolation area and other clinical areas during the patient's stay;
- Restrict all non-essential staff from the isolation area;
- Maintain a log of all personnel entering the isolation area, both visitors and staff;
- Visitors (family members only and this should be restricted also) should be strictly limited to only those considered essential;
- Ensure all visitors use personal protective equipment and are provided with instructions in its use and in hand hygiene practices prior to entry into the isolation area.

2. Hand hygiene

Cover cuts and perform hand hygiene as per the WHO "5 Moments for Hand Hygiene"

1. before patient contact;
2. before an aseptic task;
3. after body fluid exposure;
4. after patient contact;
5. after contact with patient surroundings.

Neglecting to perform hand hygiene after removal of PPE will reduce or negate any benefits of the protective equipment. This applies to all staff entering and leaving the room. Alcohol hand gels should be at all points of care, i.e. end of bed, all trolleys and at entrances and exits of all areas of the isolation unit.

3. PPE for HCWs

- Standard plus droplet plus contact plus airborne precautions must be used at all times.
- Use the "buddy system" to ensure that the donning and removal of PPE is carried out correctly. A second person is always present to guide the individual who is donning / removing PPE. The PPE required for the buddy is minimal: scrubs, apron and gloves.
- Keep hands in front of body once PPE is on.
- Medical and nursing staff caring for the patient should wear scrubs beneath PPE.
- **Gloves** should be worn on entering the room. Single gloves should be worn when handling any body substance, mucous membrane and non-intact skin of all VHF patients and when handling any equipment or surfaces that have been contaminated with body secretions.
- **Double gloving** is advised during invasive procedures that pose an increased risk of blood exposure or in the final stages of the illness when haemorrhage may occur. Ensure gloves are long enough to cover over the cuff of the gown; inner glove should be size usually worn and outer glove should be a size larger then usual. [56] If wearing double gloves, carry out hand decontamination on the outer gloves then remove. Hand decontamination should be carried out immediately after removal of gloves.
- **Face and respiratory protection:** FFP3 mask and goggles, or FFP3 mask with face shields should be worn on entry to the room. Patients with respiratory symptoms should also wear a surgical mask to contain respiratory droplets prior to leaving their room and during transport if tolerated.
- **Gowns:** Disposable fluid resistant long sleeve gowns should be worn for all patient contact.
- **Aerosol generating procedures (intubation, bronchoscopy, CPR, suction or centrifugation in the laboratory)**
    - No additional PPE is required
    - Only staff needed to perform the procedure should be present in the room
    - The above PPE should be worn during the procedure and by those remaining in or entering the room within one hour of cessation of the procedure
- **Shoes:** All individuals involved in the patient care area should wear closed fluid resistant shoes to avoid accidents with misplaced contaminated sharp objects.

- The largest viral load is in the final stages of the illness when haemorrhage may occur. Additional PPE including cap, double gloves and boots may be used during patient contact.
- All PPE must be carefully ***removed prior to leaving the patient area*** with the exception of the mask, which is removed in the lobby area or corridor (single room) ensuring the door to the patient's room is closed, and disposed of into the UN2814 healthcare risk waste container.
- When removing PPE be careful to avoid any contact between the soiled items (gloves, gowns) and any area of the face (eyes, nose, and mouth).

4. Patient care equipment/instruments/devices

- Use as much single-use equipment as possible. Non-disposable equipment should be dedicated to that patient only e.g. stethoscopes, glucometer, commode pans, bedpans, urinals. Where possible use disposable bedpans and commode pans.
- If non-disposable bedpans and commode pans are used, they can be decontaminated in a bedpan washer disinfector that has been validated for certification against HTM2030 in the last 6 months. PPE needs to be worn when emptying contents of a bedpan, commode, urinal or measuring jug into a bedpan washer disinfector.
- All suction tubing and suction canisters should be placed directly into the UN2814 healthcare risk waste container. Ensure suction canisters are correctly closed before disposal.
- Ensure urinary catheters are emptied before the catheter is removed. Both catheter and drainage bag should be discarded into the UN2814 healthcare risk waste container.
- All non-disposable equipment needs to be thoroughly cleaned daily according to manufacturers' instructions.

5. Environmental decontamination

- All environmental surfaces and non-disposable equipment need to be thoroughly cleaned daily.
- All surfaces should be thoroughly washed with a general purpose detergent (GPD) and warm water followed by disinfection using a chlorine releasing agent diluted to 1000ppm available chlorine.
- Gloves, gowns and closed shoes (e.g. boots) to be worn when carrying out cleaning.
- Only cleaning staff who have been trained should carry out the daily and post-discharge cleaning.
- Following discharge, the room will be thoroughly decontaminated and all disposable equipment and consumables discarded into UN2814 healthcare risk waste container.

6. Dishes and eating utensils

- Disposable crockery and cutlery should be used.

7. Management of blood spills

- In the event of a blood spill, apply full PPE, cover the spill with absorbent paper towels, discard towels into the UN2814 healthcare risk waste container. The contaminated area should again be liberally covered with 10,000ppm available chlorine solution and left for 2 minutes before wiping up with paper towels.
- The surface should then be washed with warm water.
- Discard all paper towels and PPE into the UN2814 healthcare risk waste container.
- For larger spills, cover the area with hypochlorite granules. Allow 2-3 minutes for granules to gel, then using scoop from Spill Kit remove the gel, place in yellow bag provided and discard into the UN2814 healthcare risk waste container.
- Wash the area with warm water and detergent following disinfection.

8. Management of needle stick injuries and blood and body fluid exposure

- Limit the number of exposures to blood and body fluids by:
    - limiting the patient's pathology tests to those listed in Appendix F;
    - using needleless devices.
- If an exposure incident occurs, follow local hospital policy in relation to needle stick injury or blood or body fluid exposure occurring, including sprays / splashes occurring to mucous membranes
- **Any unprotected exposure to blood or body fluids will categorise the healthcare worker as a high risk contact,** who will require surveillance for a period of 21 days, and consideration for post exposure prophylaxis with Ribavirin (in the case of Lassa fever and CCHF). See Chapter 5 for further details.

9. Management of healthcare waste, including sharps

Type of packaging

- All waste from patients identified as confirmed cases of VHF must be treated as Category A infectious waste. All treatment, disposal and transport of waste should therefore be carried out as defined in the Department of Health Healthcare Waste Packaging Guidelines, 2010.[55]
- The existing packaging used generally in hospitals for Healthcare Risk Waste is not approved for the segregation and packaging of Category A waste. All healthcare risk waste and contaminated non-healthcare risk waste from a patient with confirmed VHF must be disposed of in the specialist Category A (UN2814) packaging.
- All acute hospitals should have a supply of Category A UN2814 packaging (minimum 4). It may be more practicable to purchase these healthcare risk waste containers at a regional level.

In the patient room

- The external cardboard component of the Category A UN2814 packaging should not be placed in the patient room but remain outside.

- The inner packaging consisting of a 30 litre drum with lid and double plastic bag with absorbing material is placed in the patient area.
- All waste, other than sharps, should be discarded directly into the drum.
- Sharps should be discarded into a small sharps box (<10 litres).
- When full, sharps boxes should sealed and placed into the drum.
- External surfaces of the drum should be decontaminated with a solution of 10,000ppm available chlorine before it is removed from the room.
- The drum can then be placed in the cardboard box in the anteroom.

Transport within the hospital

- The waste must be accompanied by the appropriate Waste Transfer Forms which are available on line as normal. (https://wrms.dublincity.ie/wrms/frontoffice/)
- This waste must be segregated separately from all other healthcare and non healthcare risk waste. It is imperative that this waste **is not placed in "wheelie bins".**
- It should be clearly identified by placing 'quarantine' labels on the outer container.
- It is important that the portering staff handling this waste are fully informed and trained in the use of the appropriate PPE and hand hygiene.

Waste collection

- This waste will also be collected separately from other healthcare risk waste by the national licensed contractor.

10. Management of laundry and linen

- Where possible, disposable linen should be used and discarded directly into the UN2814 healthcare risk waste container.
- If non-disposable linen has been used, it must be treated as Health Care Risk Waste and discarded the UN2814 healthcare risk waste container.
- When handling linen from patients with confirmed VHF, use gloves, gowns, closed shoes and goggles.

11. Respiratory hygiene and cough etiquette

- Patients with respiratory symptoms should wear a surgical mask, if tolerated.

12. Safe injection practice

- Limit the use of needles and other sharp objects as much as possible. **Needle-free systems** should be used to reduce the risk of needle stick injuries. Parenteral exposure has been associated with a high risk of transmission, a short incubation period and severe disease.
- Limit the use of phlebotomy and laboratory testing to the minimum necessary for essential diagnostic evaluation and patient care (Appendix F).

Communication with staff and visitors (family members) regarding potential infection risks is very important. Occupational health should be informed of the situation. Education is crucial; staff and visitors must understand the risks associated with a VHF patient once the infection is being considered.

Staff should be aware that:

- the virus may be present:
  - in blood and body fluids, such as urine;
  - on contaminated equipment and instruments;
  - on contaminated clothing / surfaces;
  - in waste.
- exposure may occur:
  - directly through exposure to blood or bodily fluids during invasive, aerosolising or splash inducing procedures;
  - indirectly through exposure to the environment, surfaces, equipment or clothing contaminated with droplets of blood or bodily fluids.

Internal transport of specimens to laboratory

Viruses causing hemorrhagic fevers are classified as **Category A** infectious pathogens. Within the hospital, specimens should be transported according to local arrangements for high-risk samples. See Chapter 4 for precautions in the packaging and transport of biological specimens.

Infection prevention and control precautions on discharge

The patient should be informed of the risk of sexual transmission for up to 3 months following discharge and advised to use condoms during sexual intercourse during this period.

3.8 Handling human remains

The general principles outlined in the *Management of Deceased Individuals with Infectious Disease (MODI) Guidance* (personnel communication) should be applied. In addition to following the advice on the use of standard precautions as outlined in the document, the following is required for VHF:

- as with all other infectious disease threats, confidentiality must be maintained after death;
- the risk of infection must be communicated clearly verbally or in writing as appropriate, by the attending hospital clinician to those who will be handling the body. These include ward staff, porters, mortuary staff, bereaved relatives, funeral directors, pathologists;
- for VHF, this risk is categorised as High;
- as there is an increased risk of leakage of body fluids in those who are deceased, standard precautions and appropriate additional PPE where necessary, e.g. gloves and gown (and goggles if deemed necessary) should be used when handling human remains;
- the deceased must be placed in a body bag immediately after death;
- it is imperative that a funeral director is informed that the body poses a significant health risk;
- no hygienic preparation of the body should be undertaken. This applies not withstanding any cultural or religious requirements. This needs careful and sensitive discussion with relatives;
- plugging of orifices is not permitted;
- drains, catheters, intravenous lines etc. should not be removed;
- implanted medical devices e.g. pacemakers or defibrillators should not be removed. In cases where such devices are present, the body should not be cremated as these pose an explosion risk;
- funeral directors must use standard precautions at all times;
- the body should be placed in a robust coffin, which should then be sealed prior to removal from the unit;
- embalming should not be carried out;
- waking of the body at home should not take place;
- viewing of the body should be forbidden in order to protect the health of relatives and staff.

Post-mortem examination

Post-mortem examination should not be done, in accordance with UK Royal College of Pathologists' guidelines.[57]

In the situation where a death has occurred but the diagnosis hasn't been confirmed antemortem, yet VHF is considered highly likely, then blood should first be taken and tested for VHF. If the test is negative then post mortem can be carried out safely. If positive, post mortem should not be done.

4. Laboratory Diagnosis of Viral Haemorrhagic Fever Viruses

4.1 Introduction

Early infection with VHF is characterised by a short non-specific viral prodrome with an extensive differential diagnosis. The putative diagnosis of VHF is based on clinical assessment with laboratory testing used to confirm or exclude the diagnosis.[13, 46]

Molecular and serological protocols are used for safe identification of Arenaviruses, filoviruses and bunyaviruses in biosafety level 3 (BSL-3) facilities. In Ireland this service is offered by University College Dublin National Virus Reference Laboratory (UCD NVRL). Supplementary molecular and serological investigations are performed at the Rare and Imported Pathogens Laboratory (RIPL) located at the HPA Porton, Sailsbury, U.K.

This chapter provides a description of the diagnostic tests recommended for ***At Risk*** and ***High Risk*** patients and details the specimen collection requirements for VHF-specific tests. Packaging and transport instructions for referral to the laboratory are also included. Clinical specimens derived from patients with VHF are classified as Category A infectious substances. The clinical laboratory processing these tests should be informed of the suspicion of VHF so that specimens can be segregated and processed separately using dedicated equipment where appropriate . Each laboratory should have a contingency plan for dealing with potential VHF specimens which includes out-of-hours operational procedures and contact details for key personnel.

The information in the chapter is based on guidance from European Network for Diagnostics of Imported Viral Diseases (ENIVD), from the Advisory Committee on Dangerous Pathogens (ACDP) and from the Health Protection Agency (HPA).[56, 58-60]

Specimen collection, packaging and transport – Key Points

- Consultation with the laboratory is essential prior to sampling. Only specimens essential for diagnosis or monitoring should be obtained for investigation.
- Each laboratory should have a contingency plan for dealing with potential VHF specimens which includes out-of-hours operational procedures and contact details for key personnel.
- Within the hospital, specimens should be transported according to local arrangements for high-risk samples.
- Personnel involved in referral of samples should receive appropriate certified training.

4.2 Collection of clinical specimens

Only specimens essential for diagnosis or monitoring should be obtained for investigation. Appropriate PPE must be worn during specimen collection. Standard Precautions should be applied when sampling from a patient categorised as ***At Risk***. If the patient is symptomatic then Standard plus Contact plus Droplet Precautions should be applied. This should be increased to Standard plus Contact plus Droplet plus Airborne Precautions when sampling from ***High Risk*** patients (see Chapter 3).

The preferred specimen for diagnosis of VHF is blood. Ideally, 5ml blood is required to complete the VHF analysis although 1ml volume is sufficient to perform essential tests where sufficient sample volume is difficult to obtain (i.e. infants and young children). Urine and post-mortem tissue samples are also suitable for testing.

Rapid methods for the diagnosis of VHF include antigen detection, IgM detection and detection of viral nucleic acid (RNA) in blood. Diagnosis by detection of viral antigens is suitable for patients in the early stage of illness, while serological diagnosis by the detection of specific IgM and IgG antibodies is suitable for patients in a relatively late stage of illness. Acute-phase specimens should be collected within 7 days of illness onset. Collect convalescent-phase specimens 7-20 days later, and at least 14 days after illness onset.

4.3 Packaging and transport of biological specimens

Viruses causing hemorrhagic fevers are classified as **Category A** infectious pathogens.

Within the hospital, specimens should be transported according to local arrangements for high-risk samples. Precautions should include:

- primary containers must be leak-proof and a waterproof, leak-proof seal must be used;
- secondary containers should be placed in a good quality box, which is well taped up and clearly labelled "Pathological Specimen - Open only in Laboratory";
- specimens should be transported by hand by a responsible person using the above packaging. Vacuum-tube systems **must not be used** for transportation of specimens within hospitals or laboratories;
- specimens should not be processed in the routine specimen reception area.

For transport from the pathology laboratory to reference laboratory specimens should be packaged in UN2814 certified packaging and transported according to UN602 guidance. Regulations regarding packaging and transport of Category A infectious substances are governed the ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road) and International Air Transport Association (IATA) both of which use the United Nations Model Regulations system.[61-63]

Personnel involved in packaging and sending samples are responsible for adhering to current regulations and interpreting applicable regulations for their facility. Appropriate certified training is recommended.

Each local laboratory should have appropriate packaging on site. Category A transfers should be individually requested through an approved courier. The courier must be licensed to carry dangerous goods and have appropriate training. The service should be available 24/7 and must involve tracked door-to-door delivery, which must be signed for on collection and receipt.

Specimens must be transported in triple packaging system according to the following instructions:

- primary containers must be leak-proof and a waterproof, leak-proof seal must be used;
- the secondary packaging must also be leak-proof and contain sufficient absorbent material to absorb the entire contents of the primary container. If multiple primary containers are packaged together they must be individually wrapped to prevent contact;
- the outer shipping packaging should be UN2814 certified (Packaging Instruction 602);
- specimen data forms, letters etc should be taped to the secondary container. Request forms are available at http://www.ucd.ie/nvrl/pdfs/BL3_Investigation_Request_Form_LF_UM_d-2.0.pdf.

Serological and confirmatory testing on all samples is carried out at the RIPL. Transport of samples to the RIPL will be coordinated by the NVRL according to UN602 guidance.

4.4 Laboratory testing for ***At Risk*** patients

Laboratory testing for ***At Risk*** patients - Key points

- The use of point of care bedside diagnostic tests is favoured where possible.
- Emergency testing for malaria can be carried out using a WHO-approved rapid diagnostic test at the bedside but should be followed up as soon as possible with blood film analysis by experienced laboratory staff in a microbiological safety cabinet (MSC) at BSL2.
- VHF testing is only carried out with prior consultation with the NVRL and upon receipt of a completed VHF investigation request form.
- Preliminary VHF results will be reported within 24 hours. If the VHF screen is negative then the possibility of the patient having a VHF infection should be maintained until an alternative diagnosis is confirmed.

For all patient specimens with a risk of VHF, specific risk assessments must be developed alongside local codes of practice, which should be agreed between clinical and laboratory staff. This information can be used to ensure that the risks are effectively controlled and relevant facilities are

in place and are managed properly. The risk assessment should include evaluation of the risks associated with each analytical technique and the application of appropriate control measures.

Although any cause of fever must be considered in a febrile patient suspected of VHF infection, the major infectious microbial causes include malaria, shigellosis, typhus or typhoid fever. Evidence suggests that most suspected VHF cases will subsequently be diagnosed as malaria. Therefore, upon presentation of a possible case of VHF in the ***At Risk*** category, malaria tests should be performed immediately (Appendix F). If the malaria test result is negative a VHF test should be considered.

Request forms for investigation of VHFs can downloaded from the NVRL website (http://www.ucd.ie/nvrl/pdfs/BL3_Investigation_Request_Form_LF_UM_d-2.0.pdf) and must be completed in full before testing can proceed. Testing is carried out only with prior consultation with the NVRL. Consultation is available 24/7 by calling +353 87 9806448. During normal business hours, the NVRL telephone number for queries is +353 1 7164413/4414.

*Table 10. Laboratory tests required for **At Risk** patients*

Recommended Laboratory Tests

• A thin blood smear (EDTA blood specimen) to look for malaria parasites on at least two occasions
  - Thick films should not be prepared
• Two sets of blood cultures, using routine blood culture bottles, from separate vein punctures taken at least 30 minutes apart
  - 20 to 30ml per set (5-10ml volumes are appropriate for children)
• White blood cell and differential count and either haemoglobin or haematocrit
• Renal profile (Urea & electrolytes)
• Urine culture, if urinalysis results suggest an infection
• Glucose measurements
• Liver functions tests
• Prothrombin time (PT) and Activated Partial Thromboplastin Time (APTT)

The use of point-of-care bedside diagnostic tests is favoured where possible. Emergency testing for malaria can be carried out using a WHO-approved rapid diagnostic test at the bedside but should be followed up with blood film analysis as soon as possible. Routine laboratory tests should be carried out where possible in closed system analysers at BioSafety Level 2 conditions (BSL2). Blood film analysis using thin preparations should be carried out by experienced laboratory staff in a microbiological safety cabinet (MSC) at BSL2.

Laboratory staff dealing with specimens from patients categorised as ***At Risk*** must take, as a minimum, the same personal protective precautions as patient-care staff. The level of protection required, including PPE, depends on the patient's symptoms and the procedures being preformed. Details are provided in Chapter 3.

If the VHF screen is negative then the possibility of the patient having a VHF infection should be maintained until an alternative diagnosis is confirmed.

4.5 Laboratory testing for ***High Risk*** patients

Laboratory testing for ***High Risk*** patients - Key points

- Liaison with the local microbiologist/virologist or infectious disease physician is essential prior to test requesting.
- VHF specific diagnostic tests should be carried out urgently and a malaria screen and all other analyses listed in Table 10 should also be conducted concurrently.
- VHF testing is carried out only with prior consultation with the NVRL and upon receipt of a completed VHF investigation request form.
- Laboratory investigations should be carried out at BSL-3. If specimens are inactivated tests can be processed at BSL2.
- Laboratory staff dealing with specimens from patients with suspected VHF must take, as a minimum, the same personal protective precautions as patient-care staff
- Preliminary VHF results will be reported within 24 hours. If results are negative then the possibility of the patient having a VHF infection should be maintained until an alternative diagnosis is confirmed.

Following clinical assessment if the patient is classified as ***High Risk*** then VHF-specific diagnostic tests should be carried out urgently. These tests should be carried out concurrently with a malaria screen and all other analyses listed in Table 10 (see also Appendix F). Liaison with the local microbiologist/virologist or infectious disease physician is essential.

Laboratory tests on specimens from these patients should be carried out at BSL-3 using dedicated machines. Where possible, specimens should be inactivated before they are tested. Once inactivated, samples can be processed at BSL2. Specimen handling and storage should be kept to a minimum. Test protocols likely to result in the production of aerosols must be assessed and, where appropriate, carried out in a microbiological safety cabinet (MSC). If specimens are not inactivated, for centrifugation procedures a sealed centrifuge bucket or rotor must be used.

Laboratory staff dealing with specimens from patients categorised as ***High Risk*** must take, as a minimum, the same personal protective precautions as patient-care staff (see Chapter 3).

If the VHF screen is negative then the possibility of the patient having a VHF infection should be maintained until an alternative diagnosis is confirmed. Infection control precautions should also be maintained.

4.6 Reporting of results

- Preliminary VHF specific test results will be available to the requesting clinician within 24 hours of receipt of specimen at the NVRL.
- Test results on ***High Risk*** patients will also be reported to the Director of Public Health/MOH.
- Final printed reports are issued when all laboratory tests have been completed, typically within 3-6 days.

4.7 Disposal of residual blood samples

All laboratory waste generated during investigation of an ***At Risk*** VHF case should be treated as Category B infectious waste. Waste in this category must be packaged in accordance with P621 or LP621 or IBC620 of ADR regulations. All laboratory waste generated during investigation of suspected ***High Risk*** VHF case should be treated as Category A waste and autoclaved and/or incinerated. Waste in this category must be packaged in accordance with P620 of ADR regulations. The transport, storage and arrangements for disposal of waste need to be carried out by named persons. All personnel involved in this process should be competent, specifically trained and wear appropriate protective clothing.

4.8 Contact information

Table 11. Contact Information for National Virus Reference Laboratory and the Rare and Imported Laboratory, U.K.

	Address	**24/7 Emergency Telephone number**	**Request Form**
National Virus Reference Laboratory	University College Dublin Belfield Dublin 4, Ireland	00 353 1 7164413/4414 (Office hours) 00 353 87 9806448 (24/7 emergency number)	www.ucd.ie/nvrl/pdfs/BL3_investigation_Request_form.pdf
Rare and Imported Pathogens Laboratory	HPA Porton, Salisbury, Wiltshire, SP4 OJG, U.K.	00 44 1980 612100 (24/7 emergency number) 00 44 844 7788990 (24/7 medical advice only)	www.hpa.org.uk/cepr/specialpathogens

5. Public Health Management of Imported VHF

5.1 Irish guidelines

Although VHF is not endemic in Western Europe, imported cases have occasionally arisen and countries need to be prepared to deal with this situation. Most countries have national guidelines on the management of imported cases.[48, 56] European guidelines have also been prepared.[58]

The Irish guidelines on the public health management of VHF below draw on international guidelines and also on the issues reported in the case reports summarised in Appendix C.

Effective public health management of VHF is dependent on the immediate notification by clinicians of potential cases to the Director of Public Health /Medical Officer of Health (DPH/MOH), as soon as a *High Risk* case is suspected.

5.2 Notification of a potential case

Medical practitioner notification to the DPH/MOH

Prompt notification of suspected viral haemorrhagic fever to the local DPH/MOH is essential, as the DPH/MOH is statutorily responsible for the investigation and control of all suspected cases of VHF. Notification is a legal requirement.

"A medical practitioner, as soon as he or she becomes aware or suspects that a person on whom he or she is in professional attendance is suffering from or is the carrier of an infectious disease… shall forthwith transmit a written or electronic notification to a medical officer of health, and further in the case of … viral haemorrhagic fevers (Lassa, Marburg, Ebola, Crimean-Congo),… give immediate preliminary notification thereof to a medical officer of health" (SI 707 of 2003)

The most likely site of presentation of a suspected case of VHF is in an acute hospital, either in the Emergency Department, or after admission. In this situation, the attending consultant should immediately notify the DPH/MOH, according to how the suspected case has been categorised, as per Algorithm (Appendix F).

Presentation at points of entry (ports and airports)

The MOH/DPH may be first notified of a potential case of VHF if a person becomes ill when on board a plane or ship. Under the Shipping Regulations (SI No. 4 of 2008)) and Aircraft Regulations (SI No. 411 of 2009) the captain/pilot of the plane or ship is required to notify the DPH/MOH when he/she suspects that a person with an infectious disease is on board.

DsPH/MOH with Points of Entry in their geographic area should have protocols and procedures in place for the clinical and public health assessment of patients with potential infectious diseases of public health concern. These protocols should incorporate the need to consider if there is a risk of VHF, and the subsequent patient management, patient transport, infection control and contact

management implications of this. An algorithm has been developed for the assessment of possible VHF cases presenting at airports (Appendix J), and may be further adapted as appropriate and used.

Threshold for notification to the DPH/MOH

Medical practitioners should immediately notify all suspected cases that have been categorised as ***High Risk*** to the DPH/MOH, and should not wait until the diagnosis has been confirmed (Appendix F).

For patients who have been categorised as ***At Risk***, i.e. febrile patients (fever >38^{o}C or history of fever in the previous 24 hours) who have within 3 weeks before the onset of fever travelled in the specific local area of a country where VHF is endemic but who have no additional risk factors that would place them in the high-risk category, then notification to the DPH/MOH is not needed until confirmation, **or** if a VHF test is deemed necessary.

Key actions for DPH/MOH on notification

The key actions for the DPH/MOH to coordinate in the management of a case of VHF include:

- convening and chairing the Local Outbreak Control Team (OCT);
- leading the epidemiological investigation;
- identifying, categorising and monitoring contacts;
- communicating with health professionals, contacts and the media;
- participating in the National Public Health Outbreak Response Team (NPHORT) for a Public Health Emergency of International Concern (PHEIC), if convened;
- notifying HPSC, the National International Health Regulations (IHR) Focal Point, and European Early Warning and Response System (EWRS) national contact point, so that international notification occurs promptly if appropriate.

5.3 Actions to be taken by the DPH/MOH once notified of a ***High Risk*** possible case

The time between notification of a ***High Risk*** case and laboratory confirmation (<24 hours) should be used:

1. to **prepare for** the key tasks of:
    a) setting up the outbreak control team which will coordinate the overall response to the incident;
    b) contact tracing.
2. **to inform** the Assistant National Director(AND) for Health Protection and the Director of HPSC, and in consultation with them, agreeing how the outbreak response will be organised, including the communications strategy.

The DPH/MOH should ensure that the hospital has been in contact with the National Isolation Unit at the Mater Misericordiae University Hospital to discuss transfer, and that appropriate laboratory investigations have been undertaken, in consultation with the National Virus Reference Laboratory.

1 a) Prepare to set up a Local Outbreak Control Team

The MOH/DPH is responsible for establishing the local OCT to coordinate the overall response to the incident. This is set out in the ID Regulations as follows:

"On becoming aware, whether from a notification or intimation under these regulations or otherwise, of a case or a suspected case of infectious disease or a probable source of infection with such disease, a medical officer of health, or a health officer on the advice of a medical officer of health shall make such enquiries and take such steps as are necessary or desirable for investigating the nature and source of such infection, for preventing the spread of such infection, and for removing conditions favourable to such infection."

Members should be contacted at this stage, and informed that a suspected ***High Risk*** case has been identified. The membership should include ID physician/admitting physician, occupational health, hospital infection team, microbiology, haematology, hospital management, communications representative, representative from HPSC, and the AND for Health Protection. At this stage the communications strategy for the media and the public should be discussed and agreed locally and nationally with the hospital, the AND for Health Protection, and the Director of HPSC.

The DPH/MOH should consider whether additional resources will be needed locally to manage the outbreak control and contact tracing activities if the case is confirmed. Consideration should be given to putting the HSE Regional Crisis Management Team on standby alert.

1 b) Prepare for contact tracing

Pre-existing plans, surveillance forms, contact leaflets, supplies of thermometers and arrangements for assessment of symptomatic contacts should be checked, reviewed, and amended or updated as needed.

In the case of suspected Lassa fever, check the arrangements in place and ensure availability of supplies of Ribavirin for chemoprophylaxis. Ensure availability of PPE, though it is unlikely to be needed for contact tracing.

2. Inform the Assistant National Director (AND) for Health Protection and the HPSC, and agree organisation of the national response

The DPH/MOH should immediately report ***High Risk*** suspected cases nationally to the AND for Health Protection and HPSC, Ireland's national IHR Focal Point for communicable diseases. The purpose of this is to:

- agree how the outbreak response will be organised, including if and when the National Public Health Outbreak Response Team (NPHORT) is to be convened, how this will liaise with the Local Outbreak Control Team, and prepare the communications strategy for the incident;
- inform the Department of Health, and allow prompt international reporting to WHO (Appendix D).

5.4 Actions by DPH/MOH once case is confirmed

5.4.1 Outbreak control

Local Outbreak Control Team

The local outbreak response team at the site of the incident should now meet. The DPH/MOH should convene and chair the Local Outbreak Control Team, in consultation with the hospital where the patient is being managed. This will be a major multidisciplinary collaborative effort. The role of the Local OCT is to:

- ensure appropriate management of the case, including arrangements for patient transfer to NIU, if medically safe;
- determine who is responsible for the assessment, categorisation and management of contacts, including those outside Ireland, the actions to be taken and the advice to be given;
- ensure appropriate infection control measures are in place and that staff are aware of potential infection risks;
- oversee the epidemiological and laboratory investigation;
- provide information to staff, the public and media ;
- designate media spokespersons as per agreed media strategy, and ensure that there is no release of information to, or discussions with, the media without the agreement of all parties;
- agree all media statements and messages in advance with all parties, including NPHORT and Department of Health;
- link with the National Public Health Outbreak Response Team (NPHORT) and the National IHR Focal Point (NFP) at HPSC;
- prepare regular briefing reports for the AND HP and NFP;
- debrief and review procedures following the event;
- write an incident report.

National Public Health Outbreak Response Team (for PHEIC)

One confirmed case of VHF is considered a Public Health Emergency. It is likely that The National Public Health Outbreak Response Team Plan will be activated. The DPH/MOH should discuss

activation with the named contact points at the National Focal Point at HPSC. NPHORT is activated by the named contact points following consultation with the Chief Medical Officer at the Department of Health. NPHORT will include the DPH/representative from the Local Outbreak Control Team, a representative from the National Virus Reference Laboratory, the National Isolation Unit, and other national experts as required.

Once a potential Public Health Emergency of International Concern (PHEIC) is detected, a rapid, skilled public health assessment and response is then needed. IHR requires State Parties to assess all reports within 48 hours and to notify WHO through the National Focal Point if the event is notifiable. NPHORT is activated to coordinate this public health assessment and response.

The role of NPHORT is:

- to carry out an initial rapid epidemiological assessment of the potential PHEIC;
- to co-ordinate the descriptive and analytical epidemiological investigation, and the collection, collation and dissemination of information from the different areas and bodies involved locally and nationally;
- to evaluate the potential wider importance of the incident locally, nationally and internationally and determine if it is a PHEIC;
- to report its findings to the NFP within 48 hours and then to produce regular update reports;
- to advise the NFP on any local, regional, national and international control measures needed in the light of the findings. This advice will be communicated by the NFP to the relevant parties, e.g. HSE, Department of Health, other Government Departments, WHO etc;
- to produce a final report, with lessons identified following closure of any potential PHEIC investigation. This report is for the NFP, and then for onward communication to WHO, and other interested parties.

5.4.2 Contact tracing

This is done by public health in conjunction with the hospital team (Infectious Disease consultant/admitting clinician, infection control, clinical microbiologist, and Occupational Health physician).

A contact *is defined as a person who has been exposed in the previous three weeks to a symptomatic infected person or to a symptomatic infected person's secretions, excretions or tissues.*

The following steps should be taken:

- identify the type of VHF. Consider the stage of the illness and the level of viraemia at the time of exposure – infectiousness increases with progression of clinical illness ;
- determine if the patient has/had acute respiratory symptoms with intense coughing or sneezing prior to diagnosis, and from this any possibility of potential airborne spread via blood tainted secretions;
- trace the movements of the index patient for up to 3 weeks prior to onset of illness with a view to establishing the source of infection;
- from the index patient or his/her proxy, prepare a list of all potential contacts who are at risk of developing the disease (Appendix K);

- identify and interview all potential contacts using a standardised form (Appendix L) and assign a risk category to these potential contacts (see Box 1 below);
- use the high-risk contact surveillance form (Appendix M) to log the surveillance of high-risk contacts. Duration of contact tracing and surveillance depends on the VHF identified (e.g. 21 days post last exposure for Lassa fever, Marburg and Ebola, 13 days for CCHF).

Note: If the patient had acute respiratory symptoms, this will then affect the type of surveillance needed – there may be a need to expand contact tracing to include those who shared the same airspace. This will be assessed on a case-by-case basis. Please see Section 3.2 on mode of transmission and Appendix H for further details on the evidence for transmission of VHFs.

The risk categorisation determines the nature and type of actions needed subsequently.

Box 1

Risk Categorisation

Casual/no-risk contacts
Casual/no risk contacts are those with no direct contact with the patient or body fluids, or who just had casual contact e.g. sharing a room with the patient, without direct contact with body fluids, or who shared the same airplane, same hotel, visited the patient's home etc. They should be informed of the absence of risk, and be given an advice leaflet (available from HPSC) and a contact number to phone if concerned.

Close /low-risk contacts
Close contacts are persons who had direct contact with the patient, and where proper precautions including PPE had been carried out e.g. contacts who provided routine medical/nursing care, or were involved in transport of the patient, or handled clinical/laboratory specimens while wearing PPE. Close contacts also includes those who were living with the patient, or who had skin to skin contact with the patient, including hugging, or shaking hands when ill.

High-risk contacts
High risk contacts are those who had unprotected exposure of their skin or mucous membrane (e.g. mucosal exposure to splashes, needlestick injury) to potentially infectious blood or body fluids (urine or secretions), including unprotected handling of clinical/laboratory specimens, or at autopsy, or resuscitation. It also includes those who kissed or had sexual intercourse with the patient.

Contact tracing of passengers on a flight

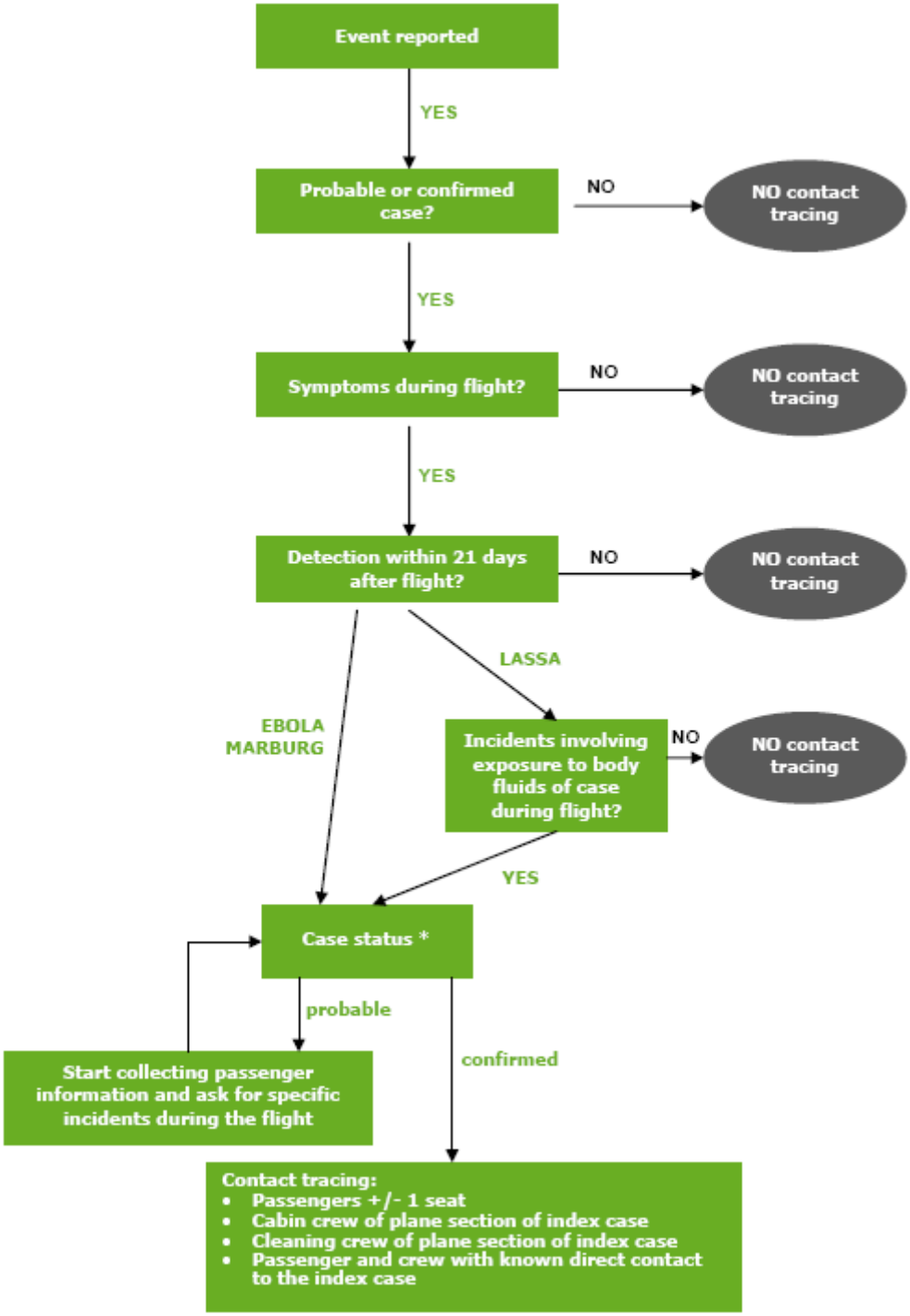
If the case was on a flight when symptomatic, a risk assessment should be undertaken as to whether other passengers are at risk, and contact tracing activities undertaken on the basis of this risk assessment. Recent guidelines from ECDC propose the following actions in relation to three of the VHFs as follows:[64]

Table 12. ECDC Contact tracing guidelines for Ebola, Marburg and Lassa

VHF	Timing of flight	Symptomatic during flight	Who to include in contact tracing
Ebola, Marburg and Lassa	Consider if flight within previous 21 days	Contact trace only if symptomatic on the flight	• Passengers and crew with direct contact with body fluids – obtain this via records of significant events during the flight from the airline • Passengers +/- 1 seat in each direction • Crew members of plane section of index case • Cleaning staff for plane section of index case

Figure 1 Relevant area for trace-backs, viral haemorrhagic fevers (Lassa, Marburg, Ebola) ECDC Risk assessment guidelines for diseases transmitted on aircraft 2nd ed. Stockholm: ECDC;2010

Figure 2 Risk assessment algorithm, viral haemorrhagic fevers (Lassa, Marburg, Ebola) from ECDC Risk assessment guidelines for diseases transmitted on aircraft 2nd ed. Stockholm: ECDC;2010



* If the diagnosis cannot be laboratory confirmed (e.g. if clinical samples are unavailable), contact tracing should be considered if the clinical and epidemiological picture is strongly suggestive of a VHF as the likely diagnosis
[Probable case is a clinically compatible case with an epidemiological link]

5.4.4 Management of contacts

This is summarised in Table 13.

Surveillance of low-risk/close contacts

Low-risk/close contacts should be asked to self monitor for fever once the diagnosis has been confirmed and report any temperature above 38^{o}C or any symptom of illness to the assigned person in the Department of Public Health/acute hospital responsible for contact surveillance (as agreed at OCT). Low-risk/close contacts should be provided with an information leaflet, a digital thermometer if needed, and a contact number for the person to contact in case symptoms develop. This should continue for 21 days* after the person's last contact with the index patient or fomite. There is no need for restriction on work or movement unless they suffer a rise in temperature above 38^{o}C at which time they should be immediately isolated in hospital and be assessed as a potential VHF patient. Those incubating the infection are in general not infectious before the onset of symptoms. The close contact should be advised not to donate blood when under surveillance. Serological testing of contacts is not advised.

Surveillance of high-risk contacts

High-risk contacts should be placed under active surveillance once the diagnosis has been confirmed. High-risk contacts should be asked to record their temperature twice daily and report any temperature above 38^{o}C or any symptom of illness to the assigned person in the Department of Public Health/acute hospital responsible for contact surveillance (as agreed at OCT). High-risk contacts should be asked to phone the contact surveillance person at an agreed time each day as part of active surveillance. (Continue for 21* days after the person's last contact with the index patient or fomite). They should be provided with an information leaflet, and a digital thermometer if needed. There is no need for restriction on work or movement within Ireland unless they suffer a rise in temperature above 38^{o}C at which time they should be immediately isolated in hospital and assessed as a potential VHF patient. Those incubating the infection are in general not infectious before the onset of symptoms. The high-risk contact should be advised not to donate blood when under surveillance. Serological testing of contacts is not advised. High-risk contacts should be advised not to travel abroad when under surveillance.

* Note duration of contact tracing depends on the maximum incubation period for the specific VHF diagnosed in the index case.

5.4.5 Prophylaxis

For Lassa fever and CCHF high-risk contacts

Ribavirin may be considered for post-exposure prophylaxis (PEP) for high-risk contacts of patients with Lassa fever or CCHF, although experience is limited, and Ribavirin is not well tolerated by contacts.

Bausch et al reviewed the literature concerning the use of oral Ribavirin as PEP for Lassa fever and proposed guidelines for its use.[65] They state that the decision to use PEP for any given exposure is based on a risk/benefit analysis, taking into account aspects of the disease (mode of transmission, attack rate, incubation period, pathogenesis and mortality), the drug (efficacy, adverse effects, ease of administration and cost) and the patient (willingness or anxiety regarding PEP, premorbid conditions and concomitant medications).

Having reviewed each of these elements, they argued against liberal use of Ribavirin as PEP as the secondary attack rate for Lassa fever is low, the efficacy of Ribavirin PEP is unknown, reaching the MIC or IC_{50} is not assured using tolerable oral doses, adverse events are frequent and may pose a challenge to the patient in distinguishing them from early signs of Lassa fever itself, and provision of PEP may lead to a relaxing of needed infection control precautions.

They recommend the use of Ribavirin PEP for Lassa fever exclusively in the event of a high-risk exposure defined as one of the following:

- penetration of skin by a contaminated sharp instrument, e.g. needle stick injury;
- contamination of mucous membranes or broken skin with blood or bodily secretions, e.g. blood splashing in the eyes or mouth;
- participation in emergency procedures (e.g. CPR, intubation or suctioning) without use of appropriate PPE;
- prolonged and continuous exposure in an enclosed space without use of appropriate PPE (e.g. healthcare worker accompanying patient during medical evacuation).

They noted also that titres of Lassa virus in blood and bodily secretions correlate with disease severity, and the most infectious patients are those with severe clinical conditions, usually late in the course of their disease.

The approach by Bausch is proposed for Ireland.

The oral regimen is 35mg/kg loading dose (maximum dose of 2.5g) followed by 15mg/kg (maximum dose 1g) three times a day for 10 days. The dose should be decreased in persons known to have significant renal insufficiency (creatinine clearance < 50ml/min).

It should be started immediately after the high-risk exposure, but not before counselling of the patient by the doctor. The prescribing doctor is likely to be the Infectious Disease clinician.

Patients should be informed:

- to take it with food;
- that the efficacy of PEP for Lassa fever is unknown;
- that although there are no major risks to its use, minor adverse effects often occur.

If the index case tests negative for Lassa fever, the PEP should be stopped.

Table 13. Summary of Management of Contacts

Risk category	Description	Action and advice
No risk /casual contacts	• No direct contact with the patient or body fluids • Casual contact e.g. sharing a room with the patient, without direct contact with body fluids • Shared same airplane, same hotel, visited home etc	**1.** Inform of the absence of risk **2.** Give no risk/casual contacts fact sheet (available from HPSC). **3.** Advise to call if concerned following reading fact sheet **4.** No further action
Low risk /close contacts	• Direct contact with the patient (e.g. routine medical/nursing care, transport of patient, or handling of clinical/laboratory specimens - if proper precautions carried out, including PPE) • Living with the patient • Cleaning staff with direct contact with the patient or body fluids, but where appropriate PPE was used • Skin-to-skin contact with the patient, hugging, shaking hands when ill	**1.** **Self-monitor for fever** and other symptoms compatible with VHF **for 21 days*** following last contact with the patient/fomite **2.** Report to Public Health if temp >= 38^{o}C with further evaluation as necessary **3.** Give low-risk/close contacts fact sheet (available from HPSC)
High Risk	• Unprotected exposure of skin or mucous membrane (e.g. mucosal exposure to splashes, needlestick injury) to potentially infectious blood or body fluids, including unprotected handling of clinical/laboratory specimens, or at autopsy, resuscitation • Kissed or had sexual intercourse with the patient • Direct contact with the patient's blood, urine or secretions.	**1.** **Record own temperature twice daily for 21 days*** following last contact with the patient/fomite and **report to designated Public Health H surveillance contact person at an agreed time every day (by phone),** with further evaluation as necessary **2.** Give high-risk fact sheet (available from HPSC) **3.** Inform Director of Public Health immediately if contact reports symptoms compatible with VHF and further risk assessment is required **4.** Consider the use of ribavirin PEP for Lassa fever/CCHF * duration depends on type of VHF

NOTE: If the patient has respiratory symptoms and/or the viral haemorrhagic is a new novel agent, then contact tracing may also need to include airborne contacts. This will be assessed on a case-by-case basis

If the contact develops symptoms of Lassa fever, they should be tested rapidly for Lassa fever and treatment should be switched to the IV form. Ribavirin PEP may prolong the incubation period for Lassa fever.
Frequent but mild side effects should be expected, particularly anaemia. The patient on PEP should be seen frequently and assessed when on PEP for side effects.

Relative contraindications include severe anaemia or haemoglobinopathy, pregnancy and breast feeding, coronary artery disease, renal insufficiency, decompensated liver disease and known hypersensitivity.

Baseline haemoglobin and haematocrit should be measured. Complete blood count and bilirubin level should be rechecked 5-7 days after initiation of the drug, and Ribavirin should be stopped or the dose should be readjusted if significant anaemia is noted.

These guidelines may also be used for PEP for other Arenaviruses causing haemorrhagic fever and for CCHF.

5.4.2 National and International Notification

Formal notification to HPSC and by HPSC to the World Health Organization

The DPH/MOH should notify HPSC when a ***High Risk*** case is first identified and then again on confirmation of the case. In turn, HPSC is obliged to the World Health Organization (WHO) under the International Health Regulations (2005).

Under the International Health Regulations (2005), if a case of VHF is notified, there is a legal requirement on Ireland to use Annex 2 of the IHR, the decision instrument for the assessment and notification of events that may constitute a Public Health Emergency of International Concern, and to notify WHO if appropriate (Appendix D). This is done by the IHR National Focal Point at HPSC. An event of VHF (Ebola, Lassa, or Marburg) "*shall always lead to utilisation of the algorithm in Annex 2, because this disease has demonstrated the ability to cause serious public health impact and to spread rapidly internationally".*

HPSC reporting to the European Union, under Decision 2119, EC

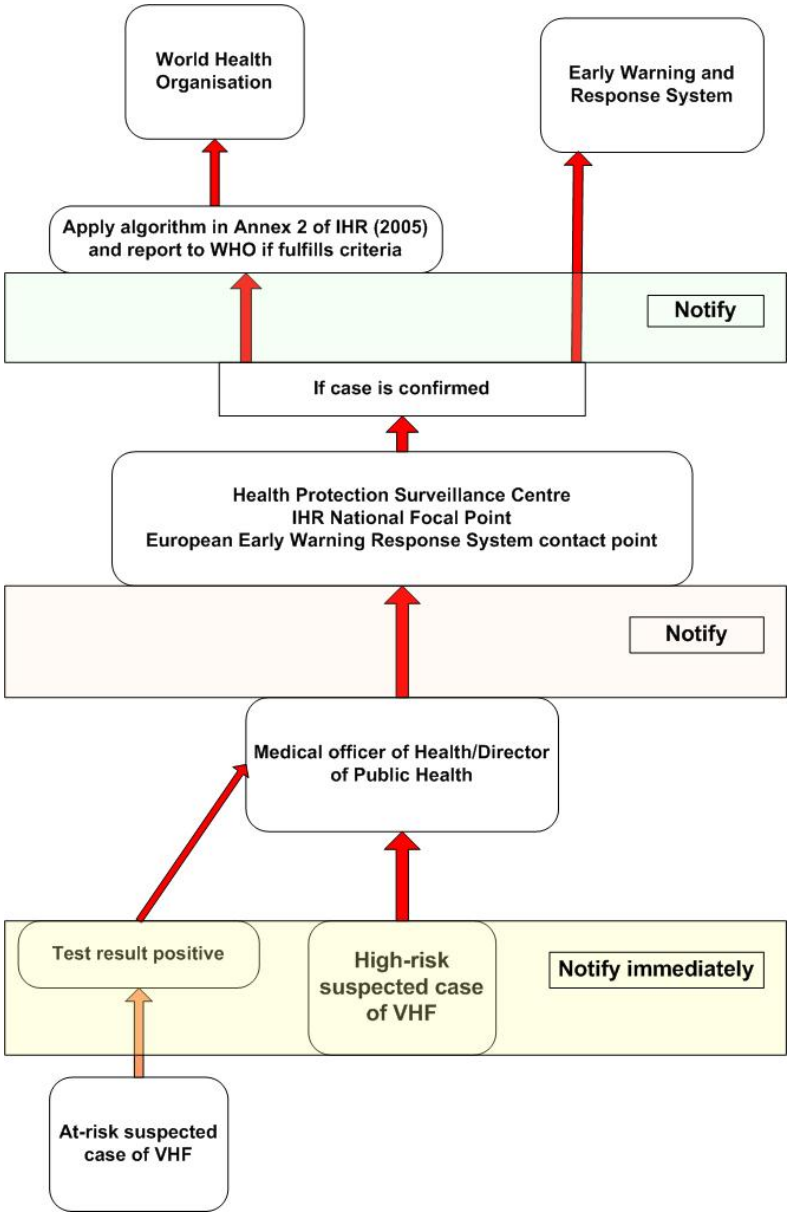
In addition, Member States of the European Union are required to notify other Member States and the European Commission via the Early Warning and Response System in the event of:

1. outbreaks of communicable diseases extending to more than one Member State of the Community;
2. Spatial or temporal clustering of cases of disease of a similar type, if pathogenic agents are a possible cause and there is a risk of propagation between Member States within the Community;
3. Spatial or temporal clustering of cases of disease of a similar type outside the Community, if pathogenic agents are a possible cause and there is a risk of propagation to the Community;

4. the appearance or resurgence of a communicable disease or an infectious agent which may require timely coordinated Community action to contain it;
5. manifestation of a disease or an occurrence that creates a potential for a disease pursuant to Article 1 of the International Health Regulations (2005) which is a communicable disease pursuant to Annex to Decision No 2119/98/EC and related measures to be notified to the World Health Organisation under Article 6 of the International Health Regulations (2005).

Detection of a case of VHF (once confirmed as per case definitions, Appendix N) would trigger an EWRS alert. This is done by the named national network contact points, Dr. Darina O'Flanagan, Director of HPSC or by Dr. Kevin Kelleher, Assistant National Director, Health Protection, Health Services Executive.

Figure 3 Summary of notification processes



5.5 Preparedness activities

VHF is a very unusual condition and has not been diagnosed to date in Ireland. However, due to the nature of the disease, the implications for contacts and the need for contact tracing, it is important to maintain preparedness to deal with a case.

The DPH/MOH should request that hospital management and/or Consultants in Emergency Medicine ensure that the VHF algorithm is visible in local Emergency Departments, with up-to-date contact numbers and web links, and information on VHF endemic areas and current outbreaks should be readily accessible by the DPH/MOH (http://www.hpsc.ie/hpsc/A-Z/Vectorborne/ViralHaemorrhagicFever/).

The DPH/MOH should agree with local Consultants in Emergency Medicine how best to circulate information on current outbreaks as they are notified (WHO IHR alerts, EWRS etc). For regular disease alerts, emergency department staff should be advised to go to the website. For urgent and recent alerts that are not currently in the public domain on websites, but that front-line staff need to know without delay, the DPH/MOH should discuss how best to do this with hospital management and Consultants in Emergency Medicine.

The DPH/MOH should work with hospital and GP colleagues to incorporate VHF specific requirements (importance of travel history, algorithms, danger/warning signs, and how to identify countries where VHF outbreaks are occurring) in communicable disease education and training within the hospital and primary care setting.

The DPH/MOH should use the national guidance to inform a local plan for response in the case of notification of a case. This would include protocols at points of entry, procedures for management of suspected cases, OCT arrangements, media management, protocols for accessing Ribavirin, up-to-date contact lists etc. The plan should also take into consideration the arrangements needed if the VHF case is part of a bioterrorism incident. This locally developed plan and procedures should be exercised, in conjunction with Emergency Planning.

Checklist

A summary checklist of actions for the DPH, in advance of any case occurring, and in the event of a case arising is available in Appendix O.

6. Transport of Infected Patients

6.1 Introduction

The transfer within the Republic of Ireland of a patient who is classified as at ***High Risk*** of VHF or those who have been confirmed as having VHF, will be necessary only if the patient is medically stable enough for transfer to the NIU, Mater Misericordiae University Hospital. The National Ambulance Service (NAS) has prepared procedures for the transportation of such patients and this chapter presents a summary of these procedures.

The NIU will contact the National Ambulance Service Command and Control Centre at Townsend Street, Dublin, to request the transportation of patients to the NIU. The Ambulance Command and Control Centre will make the following key contacts:

- contact the appropriate Regional Ambulance Control if the patient is being transferred from outside the Eastern Region;
- arrange for an available emergency ambulance to rendezvous with the Operations Resource Manager;
- contact An Garda Síochána Command and Control, Harcourt Square.

Patients will **not** be brought to the Emergency Department at the Mater Misericordiae University Hospital but to the entrance to the NIU on Berkeley Road (see map in Appendix P). If the patient has confirmed VHF, the NIU team will arrange for a high-security lockdown procedure. This involves blocking off the route between the Berkeley Street entrance and the NIU from other members of hospital staff and the general public until the patient has been transferred to the ward and the crew has exited the building. This process is not required if VHF is suspected and not confirmed. A security guard from the hospital should ensure the ambulance is secure on Berkeley Road while the patient is being transferred into the NIU.

6.2 Preparation of the ambulance and crew

When a request is made to transfer a patient, the ambulance crew and Operations Resource Manager will be directed to an agreed Ambulance Service rendezvous point, where the additional items of PPE will be issued to the crew as well as items required for the disinfection of the ambulance after the patient transfer.

Communication with staff regarding potential infection risks is very important. Staff should be aware that:

- the virus may be present:
  - in blood and body fluids, such as urine;
  - on contaminated equipment and instruments;
  - on contaminated clothing / surfaces;
  - in waste.
- exposure may occur:

- directly through exposure to blood or bodily fluids during invasive, aerosolising or splash inducing procedures;
- indirectly through exposure to the environment, surfaces, equipment or clothing contaminated with droplets of blood or bodily fluids.

The ambulance crew must be made aware of the patient's clinical condition and the possibility of deterioration en route to the NIU. They must also be aware of arrangements in case of emergency. Female staff can decline to transfer patients if they are pregnant.

Vehicle preparations, including inspection of fuel level, roadworthiness checks etc. will be conducted and all unnecessary items of equipment should be removed from both the cab and the saloon compartments. Any additional equipment will be dependent upon the anticipated needs of the patient. In addition, if a medical escort team is to accompany the patient, they may wish to utilise their own items of equipment, so this too should be identified in a bid to avoid unnecessary duplication. However, if any doubt exists, the crew must ensure that NAS emergency resuscitative equipment is carried as a minimum. This equipment should be in a sealed bag and left sealed unless required.

The crew must then don a Tyvex suit (with feet), worn over a boiler suit, and fastened up to the neck, ensuring that their hair is tucked inside the hood of the suit. All articles of clothing, together with personal items, should be left with the Operations Resource Manager in an appropriate storage container. Once final checks have been completed, the crew should then plan their routes of travel for both journeys.

Key Points for ambulance crew and staff to remember before transferring a patient at ***High Risk*** of, or confirmed as having, VHF:

Check:

- that you have received full information about the condition of the patient and the possibility of sudden deterioration during the journey, and that you give this information to the clinical team;
- the specific arrangements for the journey, including possible escort for long road journeys;
- that you are aware of arrangements in case of an emergency (cardiac arrest, breakdown etc).

Ensure:

- that you are fully familiar with the transportation procedures prepared by the National Ambulance Service (NAS);
- that you maintain close communication with the receiving clinical team at the NIU at all times;
- that suitable PPE is worn by all members of the ambulance crew and staff at all times;
- that under no circumstances should direct oral resuscitation be carried out – a bag and mask should be used to resuscitate patients;
- that no members of staff who have been in contact with the patient leave the ambulance en route.

6.3 At the pick-up location

Prior to entering the patient's room, the crew will don the remaining PPE: disposable gloves, FFP3 mask and their safety eyewear. Only those items of equipment required to aid the removal of the patient to the ambulance will be brought into the patient's room. If the patient has respiratory symptoms, they should wear a surgical mask if tolerated.

Once in the patient's room, care must be taken to treat any spillage of blood or body fluids immediately as outlined in Chapter 3. All items of ambulance equipment should be removed from the location. This includes the removal of any materials that have been used for cleaning spillages etc., which must be stringently collected as Category A healthcare risk waste.

The ambulance crew should attempt to keep well-wishers at a distance whilst transferring the patient to the ambulance, particularly where physical contact is anticipated. Relatives/friends are not to be transported in the ambulance to the NIU or any receiving hospital. On leaving the patient's room, the crew will report to the Ambulance Command and Control Centre and provide an estimated time of arrival (ETA) to the designated hospital. Ambulance Command and Control will alert the NIU that the crew have left scene and are en-route and confirm their ETA.

6.4 En-route to hospital

The ambulance crew should be accompanied by a member of the medical staff if the patient is being transferred from a hospital. Such personnel should don the appropriate PPE (see Chapter 3) and adhere to infection prevention and control procedures.

The patient should be monitored at regular intervals as determined by the accompanying medical personnel. If the patient is clinically unstable with haemorrhagic manifestations of disease, e.g. bleeding from orifices, then it is unlikely that resuscitation in the event of a cardiac arrest would be successful.

During the journey, the ambulance crew will maintain close contact with the Ambulance Command and Control Centre. Other than for emergency evacuation purposes, the crew must not leave the vehicle under any circumstances.

If a patient deteriorates significantly when the ambulance is some distance from the NIU, the ambulance should divert to the nearest available Emergency Department. This Emergency Department must be contacted to advise them of the status of the incoming patient, so that a suitable secure area can be made available.

In the event of a breakdown, the crew will notify the Ambulance Command and Control Centre. In most instances of vehicle breakdown, the ambulance can be repaired at the roadside without the need for fleet support staff to enter the vehicle. However, if this is not possible, then arrangements will be made by the Ambulance Command and Control Centre for a replacement ambulance to complete the journey. The ambulance crew will transfer the patient to the replacement ambulance and continue to the National Isolation Unit. Arrangements will be made to bring the defective ambulance to a secure and isolated location where decontamination of the vehicle will take place.

6.5 On arrival at the hospital

The ambulance crew and patient will be met at the hospital entrance by hospital staff and escorted to the appropriate room. For patients transferred to the NIU, the ambulance crew and patient will be met at the Berkeley Road entrance by specialist hospital staff and escorted to the NIU via a ramp that leads directly into the unit.

A verbal and written report will be given to the hospital staff. No copy of the patient care record (PCR) should be retained by the ambulance personnel (the crew should re-record a new PCR for this patient when all decontamination process have been carried out).

All waste including discarded PPE, healthcare risk waste, disposable equipment, used cleaning material (paper towels, cloths, gels), sheets and blankets must be placed in yellow healthcare risk waste bags (quarter fill only) and given to staff at the National Isolation Unit for disposal as Category A waste.

Before returning the stretcher to the ambulance, the crew should remove their outer PPE (gloves, tyvex suit, masks etc) as per donning and doffing protocol and dress in new PPE as supplied by the NIU. Any recoverable items, e.g. glasses, should be placed in a clear plastic bag and handed to the NIU staff for decontamination. The crew can then return the stretcher to the ambulance and, if required, drive the ambulance to the designated site for decontamination.

6.6 Decontamination and disinfection

Facilities to decontaminate the ambulance are not available at the patient entrance to the NIU so the ambulance should be moved to another designated site on the hospital grounds to facilitate decontamination. In case of emergency where a patient is transferred to a hospital other than the NIU, an appropriate site should be located. This may also involve moving the ambulance.

Once the ambulance has been moved, an Operations Resource Manager from the NAS will meet the ambulance with the necessary materials for cleaning and disinfection, except Category A waste containers which will be supplied by the hospital.

The procedure for cleaning and disinfection of the ambulance is as follows:

- ensure PPE (gloves, tyvex suit, FFP3 masks, and goggles) is worn while carrying out the cleaning procedures;
- the doors and windows of the ambulance should be left open to assist drying;
- all exterior work surfaces, fixtures and fittings, stretcher, seats, handrails and equipment should be washed and wiped down with detergent and cloths. It is imperative that all surfaces are thoroughly cleaned and disinfected, irrespective of whether any direct contamination of blood or body fluids has occurred;
- the cloths should be placed in a Category A healthcare risk waste container;
- dry off all equipment with paper towels and dispose of all used paper towels in Category A healthcare risk waste bags;

- clean the floor, stretcher mattress and work surfaces with new clean cloths using 10,000ppm available chlorine solution;
- leave for 30 minutes to dry;
- re-wash work surfaces, stretcher, seats, handrails and equipment with detergent and cloths. Dry off all equipment with paper towels and dispose of all used paper towels in Category A healthcare risk waste container.

When finished cleaning and disinfecting the vehicle, the ambulance crew should remove their outer PPE, and secure it in a healthcare risk waste bag for disposal as Category A health care risk waste from NIU.

Once the crew and Operations Resource Manager are satisfied that any outstanding matters have been addressed, the crew should report their status to Ambulance Command and Control Centre. Once equipment and supplies in the ambulance have been replenished, the ambulance will be available to return to normal operational duties.

6.7 Post-transportation procedures

The Ambulance Command and Control Centre will maintain detailed records of all VHF transportations, including details of the ambulance personnel involved in the transfers.

Ambulance crews will receive initial advice and support from hospital staff. A clear plan of communication and support will be established for the individual crew members involved. All relevant details will be passed to NAS Occupational Health, and the crew's local managers, at the earliest opportunity. Crews concerned about their health can seek advice at any time from NAS Occupational Health.

If any member of the ambulance crew is accidentally exposed to infectious material from the patient this should be reported immediately to the Outbreak Control Team.

7. VHF in the Context of Bioterrorism

7.1 Introduction

Long before the terrorist attacks in New York and Washington on September 11th, 2001, and the subsequent mailing of milled anthrax spores in the United States, VHFs had been recognised as potential biological weapons. The deliberate release of such agents may be overt, for example prior warning may have been given, or an explosive device may have been used. Alternatively a release may be covert, in which case the release will not be apparent until the first cases are identified. It seems unlikely that Ireland would be a primary target for the release of such agents, but victims of exposure could travel to Ireland during the incubation period of these diseases.

Several VHFs have been weaponised by the former Soviet Union, Russia and the United States, while there are reports that North Korea may have weaponised yellow fever. Until 1992, the former Soviet Union and Russia produced large quantities of Marburg, Ebola, Lassa, Junin and Machupo viruses.[53, 66] Soviets researchers showed that only a few virions of Marburg virus and a small dose of Ebola in aerosol preparations caused lethal infections in monkeys. Many studies revealed Ebola, Marburg, Lassa and Junin viruses could produce lethal infections in non-human primates when administered by aerosol. [53, 66] The US weaponised yellow fever and Rift Valley fever viruses but the program under which they were developed ended in 1969. A Japanese terrorist cult, Aum Shinrikyo , was unsuccessful in their attempts to obtain Ebola virus as part of an effort to create biological weapons. [53, 66]

7.2 Which VHFs?

Amongst the agents that have been identified by the Centres for Diseases Control and Prevention (CDC) as being Category A agents (those most likely to have greatest impact) are VHF viruses.[67] The Working Group in Civilian Biodefense in the USA developed a list of key characteristics of biological agents that have the potential to pose serious risks if used as biological weapons against civilian populations:

1. high morbidity and mortality;
2. potential for person-to-person transmission;
3. low infective dose and highly infectious by aerosol dissemination, with a commensurate ability to cause large outbreaks;
4. effective vaccine unavailable or available only in limited supply;
5. potential to cause public and health care worker anxiety;
6. availability of pathogen or toxin;
7. feasibility of large-scale productions;
8. environmental stability;
9. prior research and development as a biological weapon.[66]

A number of VHFs exhibit a significant number of these key characteristics and therefore, pose a serious risk as biological weapons. These include Ebola and Marburg viruses, Lassa fever and New

World Arenaviruses, Rift Valley fever and yellow fever, Omsk haemorrhagic fever and Kyasanur Forest disease. [53, 66]

VHFs that are not classified a posing a serious risk include Dengue, Crimean-Congo haemorrhagic fever and Hanta virus. Dengue is not transmissible by small-particle aerosol and primary dengue only rarely causes VHF. For these reasons, dengue is excluded. Crimean-Congo haemorrhagic fever and Hanta virus do not appear in the above list either as the technical difficulties of large-scale production currently prevents their development as mass casualty weapons. Specifically, CCHF and Hanta virus do not readily replicate to high concentrations in cell cultures, a prerequisite for weaponisation.

7.3 Outbreaks/cases due to deliberate release

Three scenarios are outlined in the guidance *Biological threats: A health response for Ireland, Expert Committee – Contingency Planning for Biological Threats* produced by the Department of Health and Children in 2002[68]:

1. covert release of a biological agent in Ireland;
2. overt release of a biological agent in Ireland;
3. arrival of infected individuals in Ireland (secondary attack).

Health professionals have a crucial role to play in the identification of covert releases of biological agents. A high index of suspicion will be necessary for the early recognition of such covert releases. Emergency physicians, GPs or other clinicians may become aware of:

- unusual presentations of illness;
- a cluster of cases with similar symptoms;
- a syndrome suggestive of bioterrorism. [69]

Initially, it may not be possible to differentiate between intentional and naturally occurring outbreaks. Clinical manifestations of VHF are non-specific at first which may result in a delay in diagnosis. Other reasons for delayed diagnosis include clinician's unfamiliarity with these diseases, heterogeneous clinical presentation within an infected cohort, and lack of widely available diagnostic tests. [66]

However, the presentation of illness due to deliberate release of infectious agents may be more sudden, more severe and involve larger numbers than is characteristic in a natural outbreak, particularly if the agent has been aerosolised. [66] Another key difference will be the lack of usual risk factors associated with VHFs, in particular a history of travel to endemic areas in the last 21 days before onset of symptoms.

Patients may also present in Ireland having arrived from a country which was the target of a deliberate release, rather than from recognised endemic areas. The confirmed release of VHFs as agents of bioterrorism in other countries must lead clinicians to have a high index of suspicion when patients present with symptoms of VHF. [69] Note that in the UK, guidance states that a single

confirmed case in the UK, even from an endemic area, should be investigated to exclude deliberate release. [70]

7.4 Key medical and public health interventions after identification of a suspected index case of VHF

An Garda Síochána (AGS) is the lead agency in responding to deliberate release of VHFs or any other malign chemical, biological, radiological or nuclear incident. [69] The HSE will have a supporting role along with Local Authorities and other appropriate agencies as required.

All cases of suspected deliberate release of VHFs should be reported immediately to the DPH/MOH who will notify AGS. Once AGS have been notified of an incident they will conduct a threat analysis. If the risk is not discounted the *Framework for Major Emergency Management* will be activated, including actions for the HSE. [69]

The guidance on infection control, laboratory testing and public health action as outlined elsewhere in this document would apply. In addition to the recommendations on the use of Ribavirin in the management of clinically evident cases of VHFs, a proposed dosage routine for use in the improbable event of a mass casualty setting is given below.

In situations where VHFs are released deliberately in this country then the identification of cases will need to include the additional epidemiological questions:

- Were you in RELEASE SITE on RELEASE DATE from TIME PERIOD to TIME PERIOD?
- In last 21 days, have you had close contact with a person who was present at RELEASE SITE on RELEASE DATE from TIME PERIOD to TIME PERIOD?

In addition, contact tracing should include all individuals present at the site at the time of release or in the period after the release and before access to the release site was prohibited.

In situations where VHFs are released deliberately in another country then the identification of cases will need to include the additional epidemiological questions:

- In last 21 days, have you returned from a country which has been the target of a deliberate release of VHF?
- In last 21 days, have you had close contact with a person who has returned from a country which has been the target of a deliberate release of VHF?

7.5 Recommendations for ribavirin therapy in patients with clinically evident VHF of unknown aetiology or secondary to Arenaviruses or bunyaviruses

Treatment with Ribavirin should be initiated pending diagnostic confirmation. The dosage should be decided in consultation with the hospital pharmacy. In the case of pregnant women, the decision to prescribe Ribavirin should be based on individual clinical risk-benefit assessments. See table 14 for Ribavirin dosage in cases of bioterrorism.

If infection with an Arenavirus or bunyavirus is confirmed, continue the 10 day course. If infection with filovirus or flavivirus is confirmed, or if the diagnosis of VHF is excluded or an alternative diagnosis is established, discontinue Ribavirin.

Table 14. Ribavirin dosage in cases of bioterrorism

	Contained casualty setting
Adults	See Chapter 2, page 37
Pregnant women	Same as for adults after individual clinical risk-benefit assessment.
Children	Same as for adults, dosed according to weight.

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Appendices

Appendix A: Search Strategies for VHF

	MeSH search term
Mode of transmission	((((((“Hemorrhagic Fevers, Viral”[Mesh])) NOT (dengue AND (English[lang]))) NOT (yellow fever AND (English[lang]))) NOT (rift valley fever AND (English[lang]))) AND (English[lang]))) AND (transmission AND (English[lang]))
Imported cases	((((((“Hemorrhagic Fevers, Viral”[Mesh])) NOT (dengue AND (English[lang]))) NOT (yellow fever AND (English[lang]))) NOT (rift valley fever AND (English[lang]))) AND (English[lang]))) AND (imported case* AND (English[lang]))
Public health management	((((((“Hemorrhagic Fevers, Viral”[Mesh])) NOT (dengue AND (English[lang]))) NOT (yellow fever AND (English[lang]))) NOT (rift valley fever AND (English[lang]))) AND (English[lang]))) AND (public health management AND (English[lang]))
Bioterrorism	(("viral haemorrhagic fever"[All Fields] OR "hemorrhagic fevers, viral"[MeSH Terms] OR ("hemorrhagic"[All Fields] AND "fevers"[All Fields] AND "viral"[All Fields]) OR "viral hemorrhagic fevers"[All Fields] OR ("viral"[All Fields] AND "hemorrhagic"[All Fields] AND "fever"[All Fields]) OR "viral hemorrhagic fever"[All Fields]) AND ("bioterrorism"[MeSH Terms] OR "bioterrorism"[All Fields])) OR ("mass casualty incidents"[MeSH Terms] OR ("mass"[All Fields] AND "casualty"[All Fields] AND "incidents"[All Fields]) OR "mass casualty incidents"[All Fields] OR ("mass"[All Fields] AND "casualties"[All Fields]) OR "mass casualties"[All Fields])
Laboratory acquired infections	("viral haemorrhagic fever"[All Fields] OR "hemorrhagic fevers, viral"[MeSH Terms] OR ("hemorrhagic"[All Fields] AND "fevers"[All Fields] AND "viral"[All Fields]) OR "viral hemorrhagic fevers"[All Fields] OR ("viral"[All Fields] AND "hemorrhagic"[All Fields] AND "fever"[All Fields]) OR "viral hemorrhagic fever"[All Fields]) AND (("laboratory techniques and procedures"[MeSH Terms] OR ("laboratory"[All Fields] AND "techniques"[All Fields] AND "procedures"[All Fields]) OR "laboratory techniques and procedures"[All Fields] OR "laboratory"[All Fields] OR "laboratories"[MeSH Terms] OR "laboratories"[All Fields]) AND acquired[All Fields])

Appendix B: Distribution List for Consultation Document

A draft of the document was sent to the following for consultation and was also available on the HPSC website. We would like to thank those who made submissions for their considered and helpful responses to this document.

- Directors of Public Health
- Clinical Microbiologists
- Consultants in Infectious Disease
- Cathy Boyce-Barrett, Infection Prevention Society
- Consultants in Emergency Medicine
- Irish Association of Funeral Directors
- Faculty of Pathology, Royal College of Physicians in Ireland
- Paediatricians
- Irish College of General Practitioners
- Faculty of Public Health Medicine, Royal College of Physicians of Ireland
- Faculty of Paediatrics, Royal College of Physicians of Ireland
- Faculty of Occupational Health Medicine, Royal College of Physicians of Ireland
- Faculty of Pathology, Royal College of Physicians of Ireland
- Irish Association for Emergency Medicine
- Infectious Disease Society of Ireland
- Irish Society of Clinical Microbiologists
- Consultants in Public Health Medicine Communicable Disease Group
- Mr Gavin Maguire, AND Emergency Planning, HSE
- Dr Kevin Kelleher, AND Health Protection, HSE
- Ms. Dora Hennessy, Principal Officer Health Protection, Department of Health
- Dr Colette Bonner, Deputy Chief Medical Officer, Department of Health
- Mr Robert Morton, Director, National Ambulance Service, HSE
- CEO, Mater Misericordiae University Hospital
- CEO, Our Lady's Children's Hospital, Crumlin
- National Virus Reference Laboratory
- Members of the SAC sub-committee on the Management Of Deceased Individuals
- Superintendent Liam King, An Garda Síochána
- Dr Donal Collins, An Garda Síochána

- Dr Brian Smyth, Public Health Agency, Northern Ireland
- Dr Lorraine Doherty, Public Health Agency, Northern Ireland
- Dr Mandy Walsh, Health Protection Agency, UK
- Dr Dilys Morgan, Health Protection Agency, UK
- Dr Tim Brooks, Health Protection Agency, Porton Down, Wiltshire, UK
- Ms. Heather Sheeley, Health Protection Agency, Porton Down, Wiltshire, UK
- Ms. Catherine Cosgrove, Chair HSE Port Health Group
- Dr Patricia McDonald, Chair Port Health subgroup on the management of serious ID presenting at a port or airport
- Estates Directorate of the HSE

Appendix C: Published Reports on Responses to Imported Cases of VHF

C.1 Introduction

This appendix reviews published case reports on the management of imported cases of VHF and the key lessons identified in each. Imported cases identified in the published literature were reviewed. These are summarised below and provide background information that may be useful for those dealing with the clinical assessment, management and public health response to an imported case in Ireland. They informed the development of the Irish guidance.

C.2 Marburg haemorrhagic fever

Netherlands ex Uganda

Total number of contacts: 130, incl. 64 high risk; Number of secondary cases: 0

In the **Netherlands** in 2008, Marburg haemorrhagic fever was identified in a 41 year female tourist recently returned from Uganda, who had visited a bat cave, containing bats that elsewhere in Africa had been found positive for Marburg virus.[1]

This patient was referred to hospital by her GP with a three day history of fever and chills. Within two days, she deteriorated rapidly, developed liver failure, and VHF was considered in the differential diagnosis. The diagnosis was confirmed three days later, and she died on the fourth day.

A multidisciplinary response team was convened to perform a structured risk assessment; undertake risk classification of contacts; issue guidelines for follow up; provide information; and monitor the crisis response. The multidisciplinary response team included clinicians, medical microbiologists, virologists, public health specialists, staff members from the national response unit and a press officer. A press conference was held at diagnosis, and press statements were subsequently released outlining the control measures being taken. WHO was informed, as required under the International Health Regulations (IHR), and international warnings were posted on the European Early Warning and Response System (EWRS).

A total of 130 contacts were identified, of which 64 were high risk contacts (household, family contacts, and healthcare workers prior to diagnosis) and 66 low risk contacts. High risk contacts were required to record their temperature twice per day, report to the local health authorities once per day, and postpone any travel abroad. Low risk contacts were asked to record their temperature twice per day and to report to the local health authorities if it was 38^{o}C or higher. No limits were imposed on the casual contacts. Standby isolation facilities in three hospitals were arranged for admission of symptomatic contacts. The authors noted that the monitoring period led to emotional problems in the high-risk contacts particularly, and psychological support was provided by the hospital occupational health department, as required. At time of identification of contacts, two had left for holidays in other countries. The national authorities in these countries followed up with

these patients. Two contacts left for other countries prior to completing monitoring, which were again followed up by the health authorities in the country of travel or by the Dutch authorities.

A serosurvey was undertaken in 85 (65%) contacts to identify asymptomatic seroconversion. Blood samples were taken 5-7 months after possible exposure. All samples tested negative.

The Dutch authors said that the co-ordinated risk assessment and contact monitoring, together with factual updates for the public and health professionals led to little public concern or alarm.

United States ex Uganda

Total number of contacts: 260, incl. high risk 0; Number of secondary cases: 0

The first imported case of a filoviral haemorrhagic fever in the United States occurred in 2008, in Colorado, in a 44 year old female who had recently returned from a safari in Uganda.[2] She was ill in January 2008, with acute hepatitis, nausea, chills, rash and vomiting of unknown aetiology. Initial testing for VHF was negative. The patient requested repeat testing six months later, after she learned of a fatal case of Marburg haemorrhagic fever in a Dutch tourist who had visited the same cave she had visited in Uganda, the Python Cave. Serology was positive for Marburg haemorrhagic fever. The original samples were then re-examined and were positive using nested RT-PCR (though remained negative on traditional RT-PCR). A retrospective contact investigation was carried out. A contact was defined as a person who had physical contact with the patient, her body fluids, or contaminated materials or was in the same room as the patient during her acute illness. In all, 260 contacts were identified. No high risk exposure or history of febrile illness was identified.

The accompanying editorial stated that travellers should be aware of the risk of acquiring Marburg haemorrhagic fever in endemic areas, and avoid entering caves or mines inhabited by bats. It also said that health care workers should have a low threshold for suspicion in such returning travellers.

South Africa ex Rhodesia (Zimbabwe)

Number of primary contacts (case 1): 35; Number of secondary cases: 2

In 1975, an Australian male died in a Johannesburg hospital after an acute haemorrhagic illness with fever.[3] He had recently travelled from Rhodesia (now Zimbabwe). Shortly after his illness, his travelling companion and one of the nurses who had looked after him fell ill with the same illness. The two additional cases recovered, and this illness was confirmed as being due to Marburg haemorrhagic fever. As soon as the companion became ill, VHF was suspected (Lassa fever), and strict barrier nursing was introduced. In addition, all the primary contacts of the first case were isolated in the hospital (n=35) and less close contacts were kept under daily surveillance. One healthcare contact developed Marburg haemorrhagic fever. She had cared for the patient prior to his death, during which time there was a massive haematemesis and haemoptysis followed by cardio respiratory arrest.

C.3 Lassa fever

There have been 12 cases of Lassa fever imported into the UK, these having occurred between 1971 and 2009. Galbraith *et al*, in a paper which reviewed the published experience with VHF, identified eight cases of Lassa fever who were transferred to Europe or North America between 1969 and 1977.[4] In these cases there was no spread of infection among their passenger contacts, and there was no spread of infection to clinical or nursing staff. More than 1200 contacts were placed under surveillance, and none developed Lassa fever. Cases published since this review are summarised below.

U.K. ex Nigeria

Total number of contacts: 328, incl. 0 high risk; Number of secondary cases: 0

In January 2009, the UK reported an imported case of Lassa fever in a 66 year old male who had recently travelled from Nigeria to the UK.[5] He experienced fever, malaise, loss of appetite and abdominal pain during the flight. He was admitted to hospital with diarrhoea, fever and confusion two days later. The initial working diagnosis was typhoid fever, and VHF was not diagnosed until two weeks later. He was commenced on Ribavirin, but died from complications exacerbated by pre-existing medical conditions.

An Incident Control Team was established, and the case reported under IHR regulations to the WHO. A press release was issued, and information was provided to all general practitioners in the area, and to all emergency departments. All contacts had a risk assessment performed. This included passengers on the flight. Contacts were assigned to one of three categories: no risk (casual contact, no direct contact with potentially infectious material), low risk (close direct contact with the case, but didn't handle body fluids, or did so with personal protective equipment (PPE)), and high risk (unprotected exposure of skin or mucous membranes to potentially infectious blood or body fluids, or unprotected handling of laboratory or clinical specimens).

In total, 328 contacts were identified: high risk (0), low risk (173), and no risk (121). 34 contacts were not contactable. Low and high risk contacts were asked to record their temperature once per day. There was active surveillance for high risk contacts and passive surveillance for low risk contacts. No restriction was placed on work or movement for asymptomatic adults in any of the risk categories. A designated senior nurse was available 24 hours a day to answer queries. The authors reported that since the airline had no record of any ill passenger or a passenger seeking assistance on the flight, the risk to other passengers was deemed negligible. The funeral director was advised that the coffin remain sealed, and that no viewing of the body take place. Oral Ribavirin was not recommended for patients who might have been exposed to the case, in the absence of proven effectiveness for prophylaxis. There were no secondary cases.

The authors reported that clinical diagnosis of Lassa fever is difficult, and that such a delay is not uncommon in imported cases of Lassa fever. They advise that in persons coming from Africa, clinical histories should include careful assessment of travel to regions where uncommon diseases are endemic.

They also stated that as healthcare workers dealing with the patient in advance of knowing the diagnosis had worn appropriate PPE, no high risk contacts were identified.

U.K. ex Mali

Total number of contacts: 125, incl. 7 high risk; Number of secondary cases: 0

Atkin et al reported on an imported case of Lassa fever in London, 2009.[6] This was the 12th case of Lassa fever on record in the UK, and the second case of Lassa fever imported in 2009. This case was a male patient in his twenties who was medically evacuated from Mali with a clinical history of fever and falciparum malaria, non responsive to treatment. He deteriorated rapidly, developed multiorgan failure and died.

Following diagnosis an incident control team was called to discuss risk assessment of contacts, safe decontamination of the environment and management of the body. In all, 125 contacts were identified: high risk (7), low risk (74) and no risk (44), using the same criteria as described by Kitching et al above. The German air ambulance crew were followed up by the German authorities. High risk contacts were given information explaining the benefits and side effects of Ribavirin prophylaxis and were left to make an informed choice. No high risk contacts took Ribavirin. There were no secondary cases.

The authors noted that this first documented case imported from Mali has implications for the risk assessment of travellers returning from there.

U.K. ex Nigeria

Total number of contacts: 173, incl. 124 first-line contacts; Number of secondary cases: 0; Number positive on serological: 0

In 1982, Cooper *et al* reported on a case of Lassa fever which occurred in a Nigerian female, who presented with fever, vomiting and abdominal pain.[7] She had recently returned from Nigeria, although she initially stated that she had not visited a rural area. Five days following admission she was diagnosed with Lassa fever and her husband subsequently said that she had in fact visited a rural area prior to onset of illness. In all, 173 persons were identified as contacts, and placed under surveillance. They were asked to record body temperature for 21 days from date of last contact with the patient or her specimens. Arrangements were made to assess and manage any contacts in hospital if they developed fever. As had happened in the Netherlands case, a number of contacts travelled abroad during the surveillance period and arrangements were made to ensure that they had completed the period of surveillance and remained well.

The authors reported that this single case caused a wave of disruption that spread to all parts of the hospital and caused an immense amount of work for the surveillance team. They said that there may be a tendency to overreact to the risks of spread of infection within the community, while insufficient emphasis is directed towards the risks in the hospital. Surveillance imposes a considerable work load on public health services within the community, which is costly in terms of time, energy and resources. All this may be counterproductive and may distract from more urgent measures required within the hospital.

U.K. ex Sierra Leone

Number of contacts requiring active surveillance: 125; Number of secondary cases: 0

The most detailed paper on the public health response to a case of Lassa fever was reported by Crowcroft *et al* in 2004.[8] This related to a case of Lassa fever in an aid worker who was medically evacuated from Sierra Leone to the UK with a febrile illness. VHF was not clinically suspected at the time of transfer. Once the diagnosis was made, an Incident Control Team (ICT) was set up. They reported that the ICT grew in membership and representation (26 members) as different staff groups became involved. Facts about the case were communicated to relevant local, national and international authorities. A database of close contacts was developed; fact sheets on Lassa fever and the process of monitoring and Ribavirin prophylaxis were prepared. Contacts were asked to report their temperatures daily. Ribavirin prophylaxis was offered to those with established exposure to blood/body fluids with a dose of 600mg 4 times a day for 10 days. For those on Ribavirin prophylaxis, the period of temperature monitoring was increased by 10 days as Ribavirin can prolong the incubation period. Haemoglobin and liver function were monitored. Healthcare workers taking Ribavirin could continue to work. In all, 125 contacts needed monitoring, these necessitating 3,000 contacts between contacts and the health service.

Coordination of monitoring was resource intensive, requiring five Public Health Consultants, four Specialist Registrars, two Fellows in EPIET, and one microbiologist. In all, 63% of staff were followed up with serological testing – none of these were positive. Ribavirin was poorly tolerated. Side effects reported included headache, nausea, abdominal pain, diarrhoea, vaginal thrush, nightmares and feeling faint. One person reduced the dose due to headaches, and one person discontinued on day seven due to the development of clinical jaundice.

The authors reported that the most formidable public health task was that of effective communication. Vast amounts of time and resources were needed to inform all the local, national, and international authorities. In light of their experience with contact tracing, they recommended that the number of contacts actively monitored in future be kept to a minimum, and that self monitoring of low risk contacts is a better option. They also said that Ribavirin prophylaxis was poorly tolerated and that is should be restricted to contacts at highest risk, with informed consent explaining the lack of clear evidence as to its benefit.

Germany ex Ivory Coast

Total number of contacts: 232, incl. 30 high risk; Number of probable secondary cases: 1 (asymptomatic serological positive)

An imported case of Lassa fever was described by Haas et al in Germany in 2000.[9] This was a female patient who had been symptomatic for five days with fever and cough when she flew from the Ivory Coast to Germany via Lisbon. She was hospitalised the same day, and after deteriorating clinically, she was transferred to a specialised unit. Lassa fever VHF was diagnosed one day later, and she subsequently died after four days.

In total 232 contact persons were identified, and their level of exposure was assessed through interviews using a standardised questionnaire. Information was obtained for 157 of the contacts, and 149 were tested serologically. High risk contacts were persons with unprotected exposure of

skin or mucous membranes to blood or secretions of the index patient, including intimate contact such as kissing or unprotected handling of specimens obtained from the patient; close contacts were persons with direct physical contact with the index patient and casual contacts defined as persons who were in the same room as the index patient or who travelled on the same flight. Eighteen high risk exposures and 12 close contacts were identified.

All tests on plane contacts were negative, indicating a very low risk of transmission under the conditions of a commercial flight of three hours duration. One probable secondary case occurred in a doctor who, late in the patient's illness, inserted an IV line, obtained blood samples and administered an infusion without PPE. The person took Ribavirin prophylaxis and did not develop any symptoms of disease.

They reported that, in all, 16 contacts received Ribavirin, and adverse events occurred, though they could not prove a causal relationship with the drug. The commonest adverse event was an elevated bilirubin level, which occurred in eleven people, and a decrease in haemoglobin level, which occurred in nine. Temporary side effects reported included skin rash, tachycardia, myalgia, diarrhoea and abdominal pain. In one case there may have been an association between Ribavirin and worsening of a pre-existing tachyarrhythmia. One person stopped prophylaxis after four days because of jaundice, and another experienced an increase in lipase level. Monitoring of blood parameters in contacts who took Ribavirin was required.

The negative results for casual contacts and contacts early on (pre-day 9 of the illness) suggest a minute risk for transmission during the initial stages of infection. Later on in the patient's illness, there was transmission, and this coincided with an increase in the viral RNA concentration in serum of the index patient and the detection of Lassa viral RNA in saliva on day 10. This offers the possibility that Lassa virus is transmitted by coughing. They advise that the stage of illness and/or the level of viraemia at the time of exposure should be included in the risk assessment of transmission.

United States

In 2006, Macher and Wolfe reported that five cases of Lassa fever had been imported from West Africa to the United States (US) since 1969.[10] They described the symptoms of the second imported case (1975) and the symptoms and long term follow up of the third imported case (1975). One patient developed sensorineural deafness and the second patient had acute and chronic neurological and neuropsychiatric complications, which the authors believe may represent sequelae of Lassa fever induced damage to the brain. The fifth case is described in more detail below.

United States ex Sierra Leone

Total number of contacts: 188, incl. 5 high risk; Number of secondary cases: 0

In New Jersey, in 2004 a 38 year old Liberian male, resident in US for 5 years, became ill with Lassa fever in Sierra Leone, and then travelled two days later to the US via London.[11] This was the first report of an imported case in the US since 1989, and the fifth ever imported case. He was admitted to hospital shortly after arrival in the US, with fever, chills, sore throat, diarrhoea and back pain. Four days post hospitalisation, VHF was considered, when he developed adult respiratory distress

syndrome and there had been no improvement following antibiotic and antimalarials treatment. He died shortly afterwards.

In all, 188 persons were identified as contacts: 5 high risk, and 183 low risk. Nineteen of the low risk contacts were exposed on the plane. High risk was defined as exposure from a percutaneous injury (e.g. a needlestick or cut with a sharp object) or blood, tissue or other body fluids that are potentially infectious (e.g. urine, vomitus, or stool); exposure from direct unprotected contact with potentially infectious material (e.g. touching vomitus with an ungloved hand) mucosal exposure (e.g. of eyes, nose or mouth to splashes or droplets of potentially infectious blood and body fluids or sexual contact with a symptomatic patient. Low risk was defined as sharing a room or sitting in a vehicle within 6 feet (i.e. coughing distance) of a potentially infectious patient without direct contact with a potentially infectious material; providing routine medical care while using PPE appropriately, routine cleaning and laundry of contaminated linens and surfaces while using PPE appropriately; transport of a potentially infectious patient or specimen without direct contact with potentially infectious material; or handling of clinical specimens while using PPE appropriately. Follow up for high risk contacts was twice daily temperature check for 21 days after last exposure, with a public health nurse visit daily. Low risk contacts recorded their own temperatures twice daily and reported the results (laboratory workers and air passengers were asked to self monitor). No restriction was placed on work or movement for asymptomatic adults at either high or low risk. Ribavirin prophylaxis was not offered to contacts, in the absence of proven effectiveness.

In an accompanying editorial, the editors advised clinicians to consider both common and uncommon causes of fever in addition to routine evaluation, in those patients recently returned from Africa. They also stressed the need for consistent application of infection control practices.

United States ex Liberia

Total number of contacts: 141, incl. 1 high risk; Number of secondary cases: 0

More recently in 2010, the sixth imported case of Lassa fever to the US was reported.[12] This case involved a 47 year old Liberian national, who lived in the US. He travelled to Liberia during which time he reported sleeping in a rural village in a dwelling infested with rats. He became symptomatic on the day of departure, and sought medical attention on day 5 of his illness in the US.

Lassa fever was diagnosed on day three of his hospitalisation. The patient recovered. Ribavirin was not used for either the case or his contacts. Contact precautions and subsequently airborne precautions were taken. No high risk contacts were identified apart from his wife, who remained well. A total of 140 low risk contacts were provided with a leaflet on Lassa fever, and asked to seek medical consultation if fever or other signs and symptoms of Lassa fever appeared. No secondary cases were identified.

The authors reported that the experience in regions where Lassa fever is endemic, is that viral aerosolisation is not seen, and that when universal precautions are taken, transmission is unlikely. However aerosol precautions were undertaken once Lassa fever was suspected, given the theoretical potential for acquiring infection through inhalation of airborne virus from respiratory secretions, or copious diarrhoea.

C.4 Crimean-Congo haemorrhagic fever

France ex Senegal

Total number of contacts: 181, incl. 0 high risk; Number of secondary cases: 0

A case of CCHF was imported into **France** in 2004, the first imported case of CCHF in Northern Europe or the United States in the published literature.[13] A 60 year old female was hospitalised in Senegal with flu like illness. She subsequently developed haematemesis and shock and was evacuated to Rennes for treatment. She was isolated in intensive care with contact isolation precautions. She recovered and was discharged 10 days later.

Contact tracing was initiated and contacts were followed up for 10 days after last possible contact. In all, 181 contacts were identified, including healthcare workers, fellow patients, ambulance drivers and visitors. In commenting on this case, the authors said that the illness didn't occur in a major metropolitan area, with a large community of migrant workers such as Paris, or Marseille, nor was it Lassa fever, the commonest cause of imported VHF in industrialised countries. Hence even in the absence of any international alert about an ongoing epidemic of VHF, every febrile patient with a haemorrhagic syndrome coming from an area where VHF has been reported must be considered as VHF until proven otherwise.

In addition 2 other imported cases have been identified, one fatal case from Zimbabwe to the UK in 1998, and one case from Bulgaria to Germany in 2001.[14]

C.5 Novel Arenavirus infection (Lujo virus)

South Africa, ex Zambia

Number of secondary cases: 3; Number of tertiary cases: 1

A nosocomial outbreak of disease, involving 5 patients occurred in South Africa during September/October 2008.[15] The index case was a travel agent who lived on an agricultural smallholding in Zambia. Dormice and rodents were seen in the vicinity of her home. Three days following a cut to her shin, she developed severe headache and malaise. Two days later she flew to South Africa to attend a wedding, and during this time she felt cold. On return to Zambia three days later she developed diarrhoea and vomiting, followed by fever, severe chest pain, sore throat. Two days after this, she felt better, but developed a rash, and severe myalgia and facial swelling. This was initially attributed to an allergic reaction to antibiotics which she had been prescribed. However, later that evening she was admitted with severe sore throat, and was evacuated by air to South Africa. On arrival in South Africa she had cerebral oedema, acute respiratory distress syndrome, and deteriorating renal function. She had thrombocytopenia. Despite intensive care, including haemodialysis, she died two days following arrival.

Patient 2 was the paramedic who had attended the index case on the flight. He developed headache, myalgia and fever, 9 days after the flight. He was admitted to hospital in Zambia, but evacuated to South Africa, 3 days later. A link between the 2 cases was identified and a presumptive diagnosis of VHF was made. He died 11 days after onset of symptoms. Contact tracing of the two patients was initiated, and a nurse, who had attended and cleaned the body of patient 1, became ill and died. A

cleaner at the hospital where patient 1 was treated also developed symptoms and died. She had cleaned the cubicle where the patient had been. A second nurse, who had attended patient 2, including inserting an iv line without PPE became ill. This nurse was treated with Ribavirin. She subsequently improved and was discharged. Laboratory testing identified a novel Arenavirus, since named Lujo virus. Contact tracing of all contacts of known patients for 21 days from the last date of contact with a case or fomites in Zambia and South Africa didn't identify any additional cases.

This was the first highly pathogenic Arenavirus to be identified in Africa in 4 decades. The authors state that this outbreak is a warning that pathogenic Arenaviruses could be more widely prevalent in Africa than presently recognised, and reinforces the need for strict screening of internationally transferred patients to ensure early recognition of infectious diseases and the maintenance of appropriate infection control precautions at all times.

*Table A1. Patients with imported Lassa fever, worldwide, 1969–2011**

Year of import	From	To	Occupation	Clinical outcome	Reference
1969	Nigeria	United States	Nurse	Survived	16
1971	Sierra Leone	United Kingdom	Nurse	Survived	17
1971	Sierra Leone	United Kingdom	Physician	Survived	17
1972	Sierra Leone	United Kingdom	Nurse	Survived	18
1974	Nigeria	Germany	Physician	Survived	19
1975	Nigeria	United Kingdom	Physician	Died	19
1975	Sierra Leone	United States	Aid worker	Survived	
1976	Sierra Leone	United States	Aid worker	Survived	20
1976	Nigeria	United Kingdom	Engineer	Survived	21
1980	Upper Volta	Netherlands	Aid worker	Survived	22
1981	Nigeria	United Kingdom	Teacher	Survived	23
1982	Nigeria	United Kingdom	Diplomat	Survived	7
1984	Sierra Leone	United Kingdom	Geologist	Survived	24
1985	Sierra Leone	United Kingdom	Nurse	Survived	25
1987	Sierra Leone/Liberia	Israel	Engineer	Survived	26
1987	Sierra Leone	Japan	Engineer	Survived	27
1989	Nigeria	Canada	Agricultural specialist	Survived	28
1989	Nigeria	United States	Engineer	Died	29
2000	Cotê d'Ivoire/Burkina Faso/Ghana	Germany	Student	Died	30
2000	Sierra Leone	United Kingdom	Peacekeeper	Died	30
2000	Nigeria	Germany	Unknown	Died	30
2000	Sierra Leone	Netherlands	Physician	Died	30
2003	Sierra Leone	United Kingdom	Peacekeeper	Survived	31
2004	Sierra Leone/Liberia	United States	Businessman	Died	11
2009	Nigeria	United Kingdom	Unknown	Died	5
2009	Mali	United Kingdom	Worked in remote location; occupation unknown	Died	6
2010	Liberia	United States	N/A – visiting family	Survived	12

* Adapted and updated version of table provided in Macher AM, Wolfe MS. Historical Lassa fever Reports and 30-year Clinical Update, *Emerging Infectious Disease,* 12 (5), 5 May 2006.

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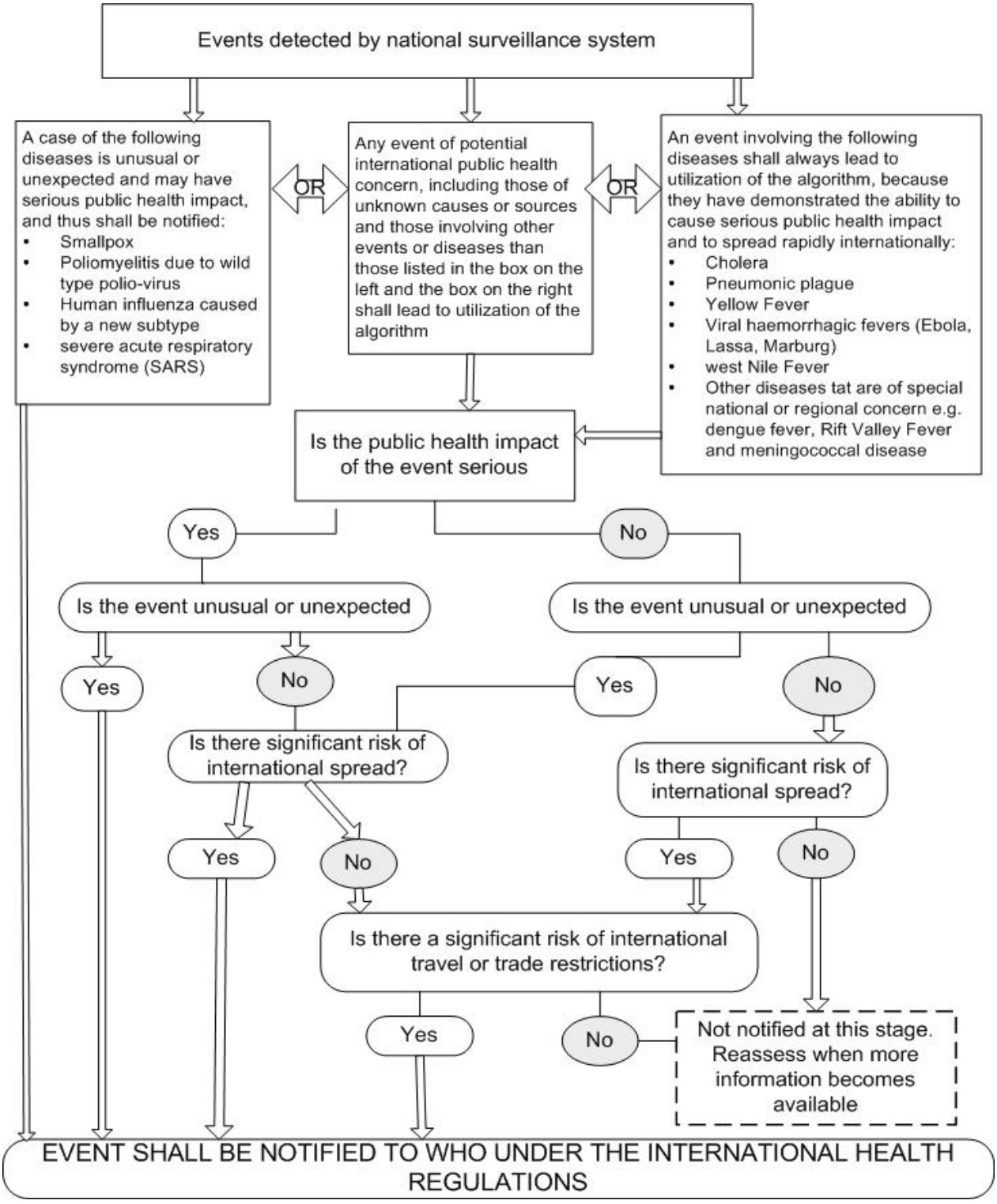
Appendix D: Annex 2: Decision Instrument for the Assessment and Notification of Events That May Constitute a Public Health Emergency of International Concern



Appendix E: Clinical Risk Assessment Form

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Viral Haemorrhagic Fevers
Clinical Risk Assessment Form
Version 1.2, 06/03/2012

hpsc

Section A - Patient Details

Enter the details in section A or attach patient label in space provided in section B

Surname: Forename:

Address:

Sex: F M NK Date of Birth: Age:

Emergency Dept/Ward: Patient's Hospital Number:

Section B - Patient label

Place patient label below

Section C - Assessed by

Name of assessor: Date of assessment:

Medical council number:

Section D - Travel history

Has the patient returned from an area known to be endemic for VHF (www.hpsc.ie) **in the last 21 days**? Yes No Unknown

If yes, which country City/Region/Town

Section E - Signs & Symptoms

	Yes	No	Unknown
Fever >38°C			
History of fever			
Fever >38°C persisting 72 hours after use of antimalarials or antimicrobials			

	Yes	No	Unknown
Headache			
Rash			
Myalgia			
Cough			
Pharyngitis			
Vomiting			
Other			

	Yes	No	Unknown
Diarrhoea			
Retrosternal pain			
Haematemesis			
Melaena			
Bleeding			
Bruising			

	Yes	No	Unknown
BP systolic <90 mmHg			
Respiratory rate >20/min			
Pulse >90bpm			

If other symptoms, please specify:

Was onset of symptoms sudden or gradual? Sudden onset Gradual onset

Date of onset of first symptoms:

Fever + travel to endemic area + bleeding or signs of bleeding increase the likelihood of VHF diagnosis. Please complete questions overleaf to assess exposure.

Clinical Risk Assessment Form v1.2

Page 2 of 2

Section F - Exposure

Has the patient...

	Yes	No	Unknown
1. Lived or worked in basic rural conditions where Lassa fever/CCHF is endemic?	☐	☐	☐
2. Travelled to any area where a VHF outbreak has recently occurred (in the last 6 months)?	☐	☐	☐
3. Received a tick bite &/or removed a tick &/or crushed a tick with their bare hands in a CCHF endemic area?	☐	☐	☐
4. Travelled to a rural environment where contact with livestock or ticks is possible in a CCHF endemic area?	☐	☐	☐
5. Visited caves or mines in a VHF endemic area?	☐	☐	☐
6. Had exposure to an area contaminated by bats?	☐	☐	☐
7. Eaten food which could have been contaminated by rats in a Lassa fever endemic area?	☐	☐	☐
8. Swept/cleaned dust which could have been contaminated by rats in a Lassa fever endemic area?	☐	☐	☐
9. Handled or butchered dead primates or been involved in drying, smoking their meat or consuming their meat in a VHF endemic area?	☐	☐	☐

For details of current outbreaks and maps of endemic/risk areas see www.hpsc.ie

Has the patient...

	Yes	No	Unknown
10. Come into contact with the body fluids of, or had direct contact with, a live or dead individual or animal, known or strongly suspected to have VHF, e.g. during routine patient care, transport of patient, resuscitation, autopsy?	☐	☐	☐
11. Handled clinical/laboratory specimens (blood, urine, faeces, tissues, laboratory cultures) from a live or dead individual or animal known or strongly suspected to have VHF?	☐	☐	☐
12. Received IM or IV injections while in an endemic country?	☐	☐	☐

Has the patient...

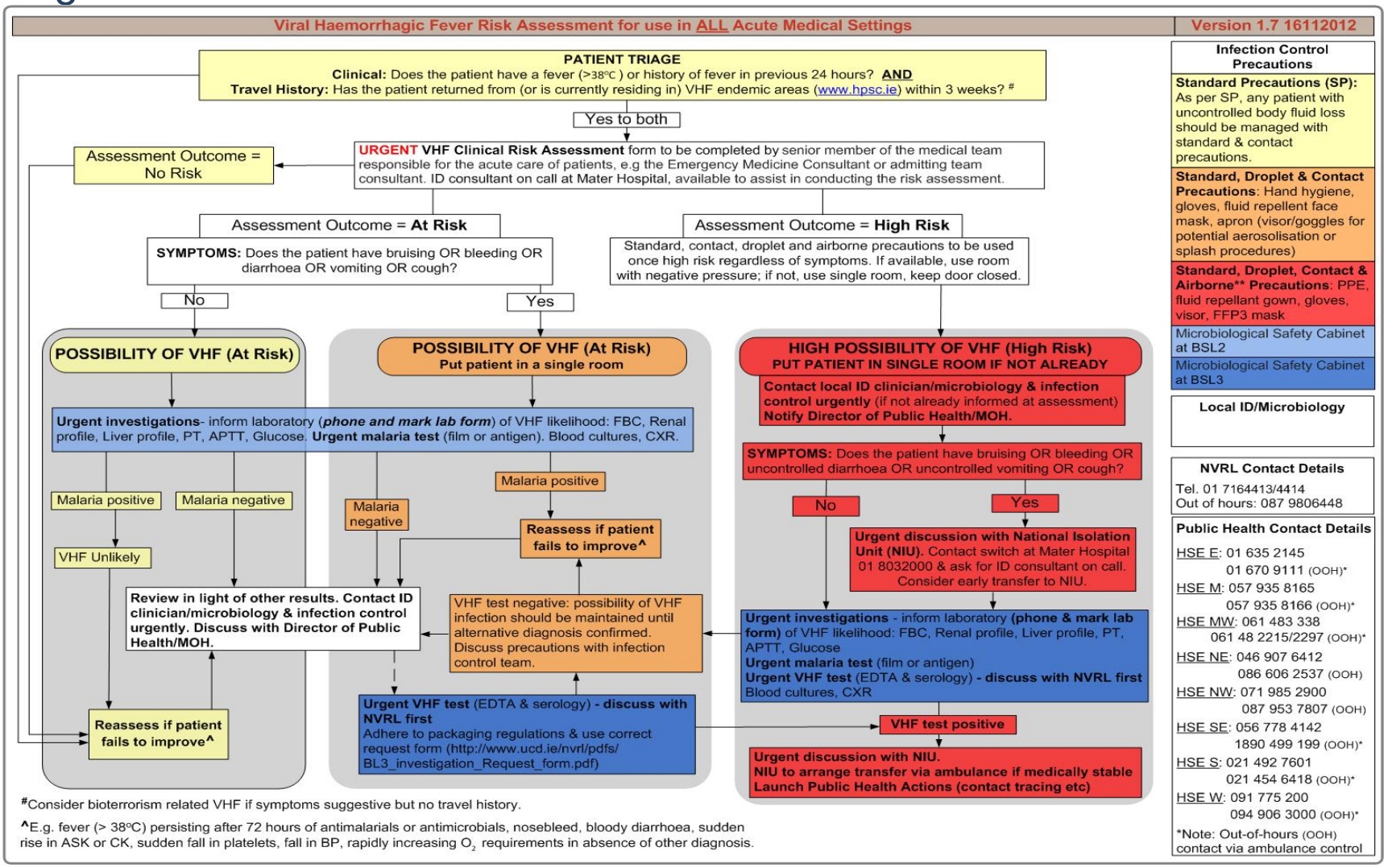
	Yes	No	Unknown
13. Had close contact with a live or dead individual known or strongly suspected to have VHF e.g. kissed, been breastfed by?	☐	☐	☐
14. Had sex in the last 3 months with an individual known or strongly suspected to have VHF?	☐	☐	☐
15. Been involved in the funeral preparations of an individual known or strongly suspected to have VHF?	☐	☐	☐
16. Come into contact with body fluids of a live or dead individual known or strongly suspected to have VHF either directly, e.g. handled blood, urine, or indirectly, e.g. soiled clothes or bedding?	☐	☐	☐

Assessed category of VHF risk

If **YES** to ANY of questions 1-17 AND **FEVER**. See VHF algorithm for immediate actions.	→ **High Possibility of VHF (High risk)**
If **NO** to ALL of the above; AND **YES** to **TRAVEL** from endemic area in last 21 days AND **FEVER**; VHF is possible, but malaria more likely	→ **Possibility of VHF (At Risk)**
If **no** to ALL of the above; AND **NO** to **TRAVEL**; AND **YES** to **FEVER**; VHF is unlikely.	→ **VHF Unlikely (No Risk)**

Reassess if fails to improve, e.g. nosebleed, bloody diarrhoea, sudden rise in ASK or CK, sudden fall in platelets, fall in BP, rapidly increasing O_2 requirements in absence of diagnosis. Consider bioterrorism related VHF if symptoms suggestive but no travel history.

Appendix F: VHF Risk Assessment Algorithm for Use in All Acute Medical Settings



Appendix G: Summary of VHF Risk Categories

AT RISK

Febrile patients (fever >38°C or history of fever in the previous 24 hours) who have within 3 weeks before the onset of fever travelled in a country where VHF is endemic but who have no additional risk factors that would place them in the high-risk category.

HIGH RISK

This category applies to 2 situations as follows:

Situation 1

Febrile patients (fever >38°C or history of fever in the previous 24 hours) who have:

- cared for a live or dead patient or animal known or strongly suspected to have VHF;

or

- come into contact with the body fluids (blood, urine, faeces), tissues or dead body of such a patient or animal;

or

- Handled clinical specimens (blood, urine, faeces, tissues, laboratory cultures) known or strongly suspected to contain the agent of VHF.

Situation 2

Febrile patients (fever >38°C or history of fever in the previous 24 hours) who have within 3 weeks before the onset of fever travelled in a country where VHF is endemic **AND** one or more of the following:

- have already had a fever (fever >38°C) persisting after 72 hours of antimalarials or antimicrobials;
- lived or worked in basic rural conditions where Lassa fever is endemic i.e. West/ Central Africa;
- travelled to any area where a VHF outbreak has occurred;
- received a tick bite and or/crushed a tick with their bare hands and/or travelled to rural environments where contact with livestock or ticks is possible, in a CCHF endemic area;
- visited mines or caves in a VHF endemic area;
- had exposure to an area contaminated by bats in an Ebola/Marburg endemic area;
- eaten food likely to have been contaminated by rats in a Lassa fever endemic area;
- swept/cleaned dust which may be contaminated by rats in a Lassa fever endemic area;
- handled or butchered dead primates or been involved in drying, smoking their meat or consuming their meat in a VHF endemic area;
- received IM or IV injections while in an endemic country;
- been involved in the funeral preparations of an individual known or strongly suspected to have VHF.

Bioterrorism related VHF should be suspected in the following circumstances:

- temperature >=101°F (38.3°C) of < 3 weeks duration;
- severe illness and no predisposing factors for haemorrhagic manifestations; and
- at least 2 of the following haemorrhagic symptoms: haemorrhage or purple rash, epistaxis, haematemesis, haemoptysis, blood in stools, other haemorrhagic symptoms;
- and no other established alternative diagnosis.

Appendix H: Review of Evidence for Mode of Transmission

H.1 Mode of transmission reported in outbreaks in endemic areas

During the first outbreak of Ebola (Sudan, 1976) close and usually prolonged contact with an acutely ill patient was identified as necessary for transmission to occur. A sample of 17 highly infected households was studied to better identify the pattern of transmission. This revealed that those who nursed the patient had an attack rate of 81%, while the attack rate among those who simply touched the patient during the acute stage of disease was relatively low at 23%. The international study team concluded that airborne transmission was unlikely and that bodily fluids, such as urine and blood, were the most likely source of infection. They also stated that the frequency of spread by droplet was most likely to be low given there were not large numbers of secondary cases.[1]

The Report of the International Commission on an outbreak in Zaire at the same time concluded that the virus was probably rarely transmitted by aerosols but infection via large droplets remained a possibility. The Commission found that excess illness among females aged 15-29 years was associated with receipt of parenteral infections at the hospital or of one it's clinics. Five needles and syringes were issued to staff each morning for use that day. There were not sterilised between different patients but rinsed in a pan of warm water; sometimes they were boiled at the end of the day.[2]

Studies have shown that barrier nursing methods are not universally applied. Cases among healthcare workers in endemic areas of sub-Saharan Africa have been linked to direct contact with patients and their bodily fluids without appropriate PPE. A report on cases of Marburg HF among healthcare workers during an outbreak in Congo, 1998-2000, showed that five of the cases identified never wore gloves, while the sixth case wore gloves inconsistently, and none wore full PPE. The reasons varied from temporary shortages of single use items to the preference for invasive techniques, particularly IM injections, for the treatment of diseases such as malaria. On other occasions healthcare workers chose not to wear any PPE when treating sick relatives or colleagues.[3] During an outbreak of Marburg HF in Angola, 2005, transmission to patients within healthcare settings was also facilitated by the lack of generic infection control measures. Healthcare workers often wore the same pair of soiled gloves while caring for multiple patients, and continued to give unnecessary injections.[4]

A seroprevalence study of CCHF in a high-risk population in Turkey showed that tick exposure was the most statistically significant transmission route for CCHF in this population. Participants in the study were randomly selected from districts based on residence of known cases in the Tokat and Sivas provinces, but excluded those with an occupational risk for CCHFV infection, e.g. healthcare workers, veterinary and slaughter house workers. These provinces are considered to be an epicentre for CCHFV epidemics following four epidemic seasons. Seroprevalence was 12.8% among 782 high-risk persons. As well as exposure to tick bite or removal of tick, other statistically significant exposures included animal husbandry and farming. Among the study population 11.4% (n=89) persons had a history of close contact with a patient infected with CCHF. Of these, 15.7% (n=14)

were seropositive but this route of transmission was not statistically significant for this study population.[5.]

H.2 Transmission to household contacts

A study of the intrafamilial spread of Ebola during an outbreak in Sudan in 1979, suggested that the virus was not easily transmitted via the airborne route. In this outbreak, the 29 secondary cases had 103 asymptomatic family members. Even among families who lived in confined and poorly ventilated accommodation, illness occurred more frequently among those who had direct physical contact with a case, with an increased risk if they provided nursing care to the infected person.[6]

A report on secondary cases of Ebola HF in the Masinidi district of Uganda in 2000 revealed that transmission among the family of the index case (18 cases) was the result of multiple simultaneous contacts. According to local tradition during times of crisis, the extended family moved even closer together so that they all lived with-in the same few huts. One healthcare worker was infected before the introduction of barrier nursing precautions, while five others were infected due to lapses in barrier nursing after the procedures were introduced. The only transmission within the wider community was a single household contact (a house maid) of a healthcare worker who refused to be hospitalised for a couple of days. Before the outbreak was recognised, the family of the index case had normal everyday contact with their neighbours, including attending a funeral with a large number of family members and neighbours from Kenya. Surveillance of these contacts for 3 weeks did not detect any suspect cases.[7]

A report on the Marburg HF outbreak in Angola, in 2005, highlighted the difficulties in encouraging people to voluntarily admit themselves to an isolation ward for the altruistic motive of protecting their families. Cures offered by traditional healers were enticing compared to admission to an isolation ward where “death is certain”. As a result patients hid from case-finding teams and were cared for at home by family members for longer thus increasing the risk of transmission among family members in the later stages of illness.[8] Despite education and information campaigns to highlight that patients had a “better chance of surviving if treated at the hospital”, only 14% of cases identified during that outbreak were isolated.[4, 8]

During the outbreaks of Marburg virus in Marburg, Frankfurt and Belgrade in 1967, many of the cases, most of whom were married and had children, were at home during the first week of their illness but no cases of family infection were reported, with one exception. In this case transmission was considered to be nosocomial. The secondary case was the wife of the Belgrade index case. She was a physician and had drawn blood at home for testing.[9]

Similarly, in 1976 none of the household contacts of a laboratory scientist who was infected with Ebola virus through a needlestick injury at a research facility developed disease. The case had 44 contacts in total, including 3 household contacts, 23 work contacts, 16 social contacts, and 2 healthcare workers.[10]

In 2000, a population seroprevalence study was undertaken in Guinea which measured LV IgG and information on personal exposure to potential risk factors for Lassa fever. There were 977

participants. The study identified two risk factors for positive serology. The first was having recently had an injection (odds ratio [OR] = 1.8 [1.1-3.1]) and the second, having lived with someone displaying haemorrhage (OR = 1.7 [1.1-2.9]. While there are drawbacks to this study, such as it was not possible to distinguish whether injections were a consequence of or a risk factor for Lassa fever and there were more samples among urban residents than those living in rural areas, it does highlight the importance of person-to-person transmission, in particular close contact with cases of Lassa fever in the final stages of illness.[11]

H.3 Lack of transmission to healthcare workers when standard precautions were used

There are examples of no onward transmission in hospital settings where standard precautions were adhered to before VHF was diagnosed.

In London, January 2009, there were 328 healthcare contacts of an imported case of Lassa fever including medical, nursing, domestic, phlebotomy and porters/transport staff. These persons all had potential direct contact with the case or exposure to body fluids. Appropriate standard PPE had been worn by all staff. No secondary cases were identified.[12] In February 2009, 125 contacts were identified following the death of an imported case of Lassa fever. This included 76 hospital staff who were exposed in the 8 hours between admission and death. Standard universal barrier precautions were followed and visors were used during resuscitation. These precautions are less than those currently recommended in that hospital for dealing for patients with VHF but there were no secondary cases.[13]

In July 2008, there were no secondary cases following the diagnosis of Marburg haemorrhagic fever in a tourist returning to the Netherlands. This was despite the fact that she was initially admitted to a room with 3 other patients before being transferred 2 days later when VHF was included in the differential diagnosis. Surveillance of contacts for 21 days from last exposure and serological follow-up some months later did not reveal any further infections.[14]

A study among healthcare workers who had cared for patients with Crimean-Congo haemorrhagic fever, conducted in October 2003, reported a lack of transmission of CCHF from patients to healthcare workers. During 2002/2003, over 100 confirmed cases of CCHF were cared for in a large referral tertiary-care hospital in Ankara, Turkey. Seventy-five per cent of cases were admitted before the disease was recognised. None of the healthcare workers was CCHF IgM positive and only one was CCHF IgG positive. This HCW was not at risk from occupational exposure, had no history of tick bites but had visited an endemic region eight years earlier. None of the team who had operated on a confirmed CCHF patient became seropositive. The lack of onward transmission was attributed to strict adherence to simple general precautions e.g. use of gloves during phlebotomy, environmental disinfection with hypochlorite solutions and use of gowns and masks to protect against bodily fluids. Masks were worn by only 11% of HCWs who worked in the units where the CCHF patients were cared for. The authors concluded that this study provided further support for the premise that VHFs are not readily transmitted from person to person by airborne routes.[15]

H.4 Evidence for airborne transmission

Person-to-person airborne transmission has been suspected in a few instances for VHF, but airborne transmission appears to be rare. This is supported by reports that outbreaks have been controlled with the use of standard and contact precautions, but without the use of airborne precautions.

Data evaluating transmission by the airborne route are scarce but the possibility of such transmission remains in rare instances from patients in advanced stages of disease.[1,6] There is also a potential risk to laboratory workers as small clouds of aerosolized viruses can be released in laboratory accidents, such as breakage of containers within centrifuges.

H.4.1 Cases with unexplained routes of transmission

In most outbreaks of VHF, the exposures and routes of transmission have been established for most cases. However, there are some instances where airborne or droplet transmission was a possibility.

- In June 2009, a nosocomial outbreak of CCHF involving 6 cases occurred in Iran, four of which were healthcare workers. Two cases were infected by percutaneous exposure, and three others were probably infected through direct contact with blood, clothes and bed sheets. Of these three contacts, one was admitted to the same bed as the index case before it had been thoroughly disinfected; one was exposed to the blood of the index cases while wearing perforated gloves; and the third had always worn intact gloves while caring for the index case, but did not always use a face shield or surgical mask and eye protection.[16]

- The first case of patient to patient nosocomial transmission of CCHF was described in 2006. The secondary case was in a patient who had shared a room with the index case for 5 days before CCHF was diagnosed. The secondary case was considered to have a nosocomial infection as she had been in hospital for 30 days before the index case was admitted (incubation period of CCHF: 3-5 days). It is not known for certain how the secondary case became infected but it is postulated that it could have been through contact with infected blood or bodily fluids as the two patient shared the same toilet. Airborne transmission was considered a remote possibility.[17]

- Follow-up of contacts (n=157) of a symptomatic patient with Lassa fever who arrived by air in Germany in January 2000 revealed one probable secondary case. This person was a physician who had inserted an intravenous line, obtained blood samples and administered an infusion, did not wear gloves or a mask but couldn't recall contamination of the skin with the patient's blood. The doctor was also exposed to a cough from the patient during a throat examination. There was no evidence of any other possible routes of transmission. This probable secondary case was serological positive but was never symptomatic.[18]

H.4.2 Laboratory accidents

Airborne transmission is not thought to be the dominant route of transmission for VHFs, with the exception of mechanical aerosolisation during medical or laboratory procedures. Arenaviruses are

transmitted to humans by the inhalation of small particle aerosols derived directly from rodent excreta or saliva containing the virus and these viruses pose a particular risk to laboratory workers where techniques present an opportunity for the aerosolisation of the virus.[19] There have been two reported cases of laboratory-acquired Brazilian HF (Sabia virus). The first was a laboratory technician who was infected during studies to characterise the virus, probably by aerosol [20], and the second was a virologist in Yale, US, who was infected following a leak in a high-speed centrifuge.[21] Aerosol transmission is also the suspected source in 6 cases (1 death) of Machupo virus up to 1980.[22]

Transmission by aerosolisation in the laboratory and by needlestick injury has also been documented for Omsk HF, a member of the flaviviruses.[23] Up to 1979, 87 cases of laboratory-acquired infections of Kyasanur Forest Disease were reported, with inhalation of aerosols during cultivation the most frequently reported route of transmission. [24, 25]

H.4.3 Transmission from non-human primates

An outbreak investigation into a combined Simian Haemorrhagic Fever and Ebola virus infection among cynomolgus monkeys at a primate quarantine facility in Reston, Virginia, United States, in 1989 suggested that the route of transmission between animals was aerosol or droplet, though there were no specific studies were conducted at the time to investigate this feature. Other observations relating to the mode of transmission of Ebola virus during the outbreak included: direct contact was not necessary; blood transfer was not essential; throat swabs were often positive for Ebola virus and the virus was cultured repeatedly from urine and faeces.[26] Johnson *et al.* (1995) reported aerosol transmission of Ebola virus to non-human primates in an experimental primate model.[27]

In April 1990, CDC reported on filovirus infections among persons with occupational exposure to non-human primates. Antibody to one or more filovirus antigens was detected in six of 178 persons tested. Four of the six, showed serologic evidence of recent infection, all of whom worked as animal handlers. One person is likely to have been infected when he lacerated his finger while performing an autopsy of a dead animal. The mode of transmission is unknown for the other three. The other two persons had evidence of past infections and had regular contact with non-human primates over a number of years.[28] In an update in June, 1990, it was reported that seropositivity to one or more filovirus test antigens was not evenly distributed between staff groups; 9.8% (26/266) of staff at the import quarantine facility tested positive compared with 5.6% (16/284) of staff who worked with monkeys (or monkey tissues/bodily fluids) outside the quarantine facility. This compares with 2.7% (12/449) of samples randomly selected from a cross-sectional adult primary-care outpatient population. None of the 42 staff who tested positive reported any illness likely to have been caused by a filovirus.[29]

This is in contrast to other reports on animal handlers. Hennesson W reported that during the Marburg virus outbreak of 1967 none of the animal caretakers in Marburg, Frankfurt or Belgrade who were not in contact with blood became ill, nor did those who took the usual precautions when working with viruses. The proportion of those who became ill varied with occupational exposure; 68.9% (20/29) staff with exposure to blood became ill compared with 30.7% (4/13) of staff who were exposed to tissue cultures.[30]

The only case of Côte d'Ivorie Ebola virus was in a veterinarian who performed an autopsy on an infected chimpanzee. The chimpanzee was part of a troop that had been studied since 1987. The autopsy was performed following the sudden death of 12 members of the troop.[31]

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Appendix I: Checklist of Supplies for Acute Hospitals in Preparation for ***High Risk*** or **Confirmed** Cases of VHF

Waste supplies

- Category A waste containers (x4)
- Blood spill kits
- Sharps boxes (<10 litres)
- 'Quarantined' signs for waste
- 'Query Category A Waste' signs

Personal Protective Equipment

- Alcohol hand gel
- Surgical masks (patient)
- Fluid repellent face masks (FFP3)
- Disposable fluid resistant long sleeve gowns
- Aprons (for buddy)
- Scrubs of different sizes
- Goggles
- Visors
- Gloves of different sizes

Other supplies

- Disposable linen
- Disposable cutlery and crockery
- 'Restricted entry' door signs
- Sign-in book
- Solidifying agent for body fluids

Appendix J: VHF Risk Assessment for Use by Ambulance Service Personnel at Airports

Viral Haemorrhagic Fever Risk Assessment for use by Ambulance Personnel at Airports — **Version 1.3 13062012**

Before entry on aeroplane, ensure standard precautions. See side panel for relevant Infection Control Precautions.
Passengers, other than those sitting one seat from the ill patient, should be allowed to disembark from the plane.
If possible passengers should not pass the ill patient when exiting the aeroplane (use front and rear exits).
Contact details of the following should be taken:

- Passengers seated one seat, in all directions, from ill patient should be taken (see picture opposite*)
- Persons who reported direct contact with the patient
- The crew who served that section of the plane.

These contact details will be required by the Dept of Public Health.
These passengers should then disembark.
Assess the patient.

CLINICAL: Does the patient have a fever (>38ºC) or history of fever in previous 24 hours?
AND
TRAVEL HISTORY: Has the patient returned from (or is currently residing in) VHF endemic areas within 3 weeks? (Contact Control for up to-date list; www.hpsc.ie)

Yes to both → Remove patient from aeroplane to assessment room in airport. Control to contact National Isolation Unit (NIU) for risk assessment 01-8032000. Initiate direct phone contact between Paramedics and NIU to facilitate risk assessment.

No → Remote Risk Assessment by NIU physician

Assessment Outcome = No Risk
VHF very unlikely. Assess and treat as indicated.
→ Transport to nearest Emergency Department

Assessment Outcome = At Risk
Ambulance Service VHF Procedures activated
Control to notify Director of Public Health/ MOH of case at risk of VHF.** See side panel for contact details.
SYMPTOMS: Does the patient have bruising OR bleeding OR diarrhoea OR vomiting OR cough?
- No → Transport patient to location as advised by NIU physician (may be local ED, NIU etc.)
- Yes → Apply Standard, Droplet & Contact Precautions; patients with respiratory symptoms should wear a surgical mask. → Transport patient to location as advised by NIU physician (may be local ED, NIU etc.)

Assessment Outcome = High Risk
Ambulance Service VHF Procedures activated
Control to notify Director of Public Health/ MOH of case at high risk of VHF.** See side panel for contact details.
Apply Standard, Droplet, Contact & Airborne precautions; patients with respiratory symptoms should wear a surgical mask. → Transport patient to location as advised by NIU physician (may be local ED, NIU etc.)

Infection Control Precautions

Standard Precautions (SP): As per SP, any patient with uncontrolled body fluid loss should be managed with standard & contact precautions.

Standard, Droplet & Contact Precautions: Hand hygiene, gloves, fluid repellent face mask, apron (visor/goggles for potential aerosolisation or splash procedures)

Standard, Droplet, Contact & Airborne Precautions: PPE, fluid repellant gown, gloves, visor, FFP3 mask

Public Health Contact Details

HSE E: 01 635 2145
01 670 9111*
HSE M: 057 935 8165
057 935 8166*
HSE MW: 061 48 3338
061 48 2215/2297*
HSE NE: 046 907 6412
086 606 2537
HSE NW: 071 985 2900
087 953 7807
HSE SE: 056 778 4142
1890 499 199*
HSE S: 021 492 7601
021 454 6418*
HSE W: 091 775 200
094 906 3000*
*Out of hours contact public health via ambulance control

*Relevant area for trace-backs, viral haemorrhagic fevers (Lassa, Marburg, Ebola) ECDC Risk assessment guidelines for diseases transmitted on aircraft 2nd ed. Stockholm: ECDC;2010

**Requirement to contact Director of Public Health/Medical Officer of Health under Infectious Disease Aircraft Regulations.

Appendix K: VHF Case Exposure Assessment & Contact Identification Form

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Viral Haemorrhagic Fevers
Case Exposure Assessment & Contact Identification Form
Version 1.1, 30/01/2012

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Section A - Patient Details

Surname: Forename:

Address:
Home:

Work:

Sex: F M NK Date of Birth: Age:

	Home	Work
Mobile telephone number:		
Landline telephone number:		
Email address:		

Section B - Hospital Details

Patient's Hospital Number:

Hospital Name:

Ward/Room:

Date of presentation:

Section C - Clinical Assessment

Attached a copy of the completed clinical assessment form to this surveillance form

Based on the clinical assessment form...

Assessment outcome: High Risk At Risk

Most likely exposure:
- Travel related (qs1-8)
- Contact of known/suspected case (qs 15-20)
- Occupational exposure (qs 9-14)
- Unknown exposure

Section D - Transfer to NIU

Was the patient transferred to the National Isolation Unit? Yes No Unknown

If no, reason why not:
- Patient too ill for transfer
- Patient deteriorated en route

If yes, date of transfer:

Was the patient transferred to a hospital other than the National Isolation Unit? Yes No Unknown

Hospital Name:

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Section E - Test Results

Malaria Test Results:

	Date	Test type		Positive	Negative
Malaria test 1		☐ Film	☐ Antigen	☐	☐
Malaria test 2		☐ Film	☐ Antigen	☐	☐

VHF Test Results:

Test	Date	Result

Type of Viral haemorrhagic fever:

☐ Ebola
☐ Marburg
☐ Crimean-Congo Haemorrhagic Fever
☐ Lassa fever
☐ Other arenavirus, please specify

☐ Other viral haemorrhagic fever If other, please specify:

Diagnosis other than VHF:

☐ Malaria
☐ Typhoid
☐ Other diagnosis

If other, please specify:

Date of diagnosis:

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Section F - Travel History

Please complete the following questions in chronological order for each country or region visited during the last 21 days before onset for Ebola, Marburg or Lassa, or last 13 days before onset for CCHF.

Country/Region Visited - 1

Country:

Region/Town:

Urban or rural area - please tick as appropriate ☐ Urban ☐ Rural

Risk Activities - please tick as appropriate:

☐ Outdoor activity in rural area
☐ Received a tick bite and/or crushed a tick with your bare hands
☐ Contact with a person who was ill
☐ Contact with cattle or rats
☐ Visited caves or mines
☐ None identified

Date of arrival: Date of departure:

Country/Region Visited - 2

Country:

Region/Town:

Urban or rural area - please tick as appropriate ☐ Urban ☐ Rural

Risk Activities - please tick as appropriate:

☐ Outdoor activity in rural area
☐ Received a tick bite and/or crushed a tick with your bare hands
☐ Contact with a person who was ill
☐ Contact with cattle or rats
☐ Visited caves or mines
☐ None identified

Date of arrival: Date of departure:

Country/Region Visited - 3

Country:

Region/Town:

Urban or rural area - please tick as appropriate ☐ Urban ☐ Rural

Risk Activities - please tick as appropriate:

☐ Outdoor activity in rural area
☐ Received a tick bite and/or crushed a tick with your bare hands
☐ Contact with a person who was ill
☐ Contact with cattle or rats
☐ Visited caves or mines
☐ None identified

Date of arrival: Date of departure:

Most likely country/region of infection:

Date of FINAL departure from endemic/risk area:

If the patient visited more than 3 countries/regions, please print another copy of this page and staple to the back of the form

Please go to section G

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VHF Case Exposure Assessment & Contact Identification Form v1.1

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Section G - Port of Entry Details

Port of Arrival:

Name: _____ From: _____

Via: _____ And _____

Arrived by:

☐ Ferry ☐ Airplane ☐ Road via Northern Ireland

Date of arrival: __ __ / __ __ / __ __ __ __ Time of arrival (HH:MM): __ __ : __ __

Was the patient symptomatic when travelling? ☐ Yes ☐ No ☐ Unknown

If yes, please specify:

If passenger on an aircraft...

Airline: _____ Flight Number: _____

Where did you sit? Row _____ Seat _____

If you cannot remember your row/seat number, where you sitting...

☐ Front of the plane	☐ Back of the plane	☐ Beside an emergency exit
☐ Central aisle	☐ Window seat	☐ Near a toilet
☐ Economy	☐ Business/Premium/First class	☐ Over the wing

For airline seating plans see http://www.seatguru.com/. *Search by flight number or route.*

If passenger on a ferry...

Ferry company: _____ Ship name: _____

Type of passenger: ☐ Foot ☐ Vehicle

Did you have a cabin? ☐ Yes ☐ No ☐ Unknown

If yes... Cabin number _____ Deck _____

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Section H - Details of occupational exposure

Category of worker:

☐ Cleaner ☐ Doctor ☐ Nurse Assistant ☐ Nurse ☐ Laboratory scientist ☐ Paramedical ☐ Other

If other, please specify: _____

Exposure location(s):

Name of hospital/laboratory: _____

Ward/Room: _____

Exposed to:

Please tick if applicable

Blood ☐ Sweat ☐ Clinical/laboratory specimen ☐

Urine ☐ Vomit ☐ Laboratory culture ☐

Faeces ☐

Other laboratory specimens ☐ Please specify: _____

Other bodily excretions/secretions ☐ Please specify: _____

Exposed due to accident:

Please tick if applicable

Needle stick injury ☐

Laboratory accident ☐

Other accident ☐ Please specify: _____

Date of last exposure: _____

PPE:

Did you wear PPE at the time of exposure? ☐ Yes ☐ No ☐ Unknown

PPE worn - please tick as appropriate ☐ Gloves ☐ Mask ☐ Gown ☐ Goggles

If several exposures, most likely source of infection:

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Section I - Details of exposure to known/suspected case

This section should only be completed if a contact assessment form was NOT completed previously.

Relationship to case:

☐ Husband/Wife/Partner ☐ Boy-/Girl-friend ☐ Child ☐ Sibling ☐ Housemate ☐ Other

If other, please specify: _____

Do you live with the case? ☐ Yes ☐ No ☐ Unknown

When the case was ill did you...

	Yes	No	Unknown
Share a room with the case?	☐	☐	☐
Have sex with the case?	☐	☐	☐
Shake hands	☐	☐	☐
Hug	☐	☐	☐
Kiss	☐	☐	☐
Look after the case	☐	☐	☐

	Yes	No	Unknown
Did you handle body fluids, e.g. urine, faeces or blood, from the case?	☐	☐	☐
Did you handle clothes, bedding or other items soiled by blood, urine or other secretions?	☐	☐	☐
If yes to either of the above questions, did you wear gloves or other protective equipment?	☐	☐	☐

If yes, what did you wear/use? Please tick appropriate.

☐ Gloves ☐ Mask ☐ Apron/Gown ☐ Glasses/Goggles ☐ Other

Date of last exposure: |_|_| |_|_| |_|_|_|_|

Most likely exposure/source of infection:

_____

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Health Service Executive

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Section J - Details of Contacts

Household:

	Name	Phone number
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

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VHF Case Exposure Assessment & Contact Identification Form v1.1

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Section K - Details of Contacts

Healthcare workers:

	Name	Location
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

VHF Case Exposure Assessment & Contact Identification Form v1.1

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Section L - Details of Contacts

Other contacts:

	Name	Phone number
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

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Section M - Summary of Contacts

Total number of contacts

___ Household	___ Healthcare workers	___ Other contacts

	Yes	No	Unknown	
1. Have all contacts been contacted?	☐	☐	☐	Number not contactable ___
2. Have all contacts been assessed?	☐	☐	☐	Number not assessed ___
3. Were any contacts diagnosed with VHF?	☐	☐	☐	If yes, total number ___

Secondary infections

CIDR Event ID _____

CIDR Event ID _____

CIDR Event ID _____

CIDR Outbreak ID _____

Section N - Case Classification & CIDR Event ID

CIDR event ID of case: _____

Final case classification:
☐ Probable
☐ Confirmed

Section O

Comments:

Signed: _____

Position: _____

Date ___

Appendix L: VHF Contact Assessment Form

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Viral Haemorrhagic Fevers
Contact Assessment Form
Version 1.0, 25/10/2011

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Section A - Contact Information

Contact of Event ID

Surname: Forename:

Address:

Home:

Work:

Sex: F M NK Date of Birth: Age:

	Home	Work
Mobile telephone number:		
Landline telephone number:		
Email address:		

Section B - GP Contact Details

Surname: Forename:

Address:

Telephone number:

Is there an out of hours service? Yes No Unknown

If yes, please provide name of service and telephone number

Section C - Type of Contact

Type of contact:

Healthcare	*Please go to Section D for additional questions*
Household	*Please go to Section E for additional questions*
Travel (airline etc)	*Please go to Section F for additional questions*
Other	*Please go to Section G for additional questions*

If other, please specify:

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Section D - Healthcare Contacts

Category of worker:

☐ Cleaner ☐ Doctor ☐ Nurse Assistant ☐ Nurse ☐ Laboratory scientist ☐ Paramedical ☐ Other

If other, please specify: _____

	Yes	No	Unknown
1. Did you have any direct contact with the patient, e.g. during routine patient care?	☐	☐	☐
If yes, did you wear PPE?	☐	☐	☐

PPE worn - please tick as appropriate: ☐ Gloves ☐ Mask ☐ Gown ☐ Goggles

	Yes	No	Unknown
2. Did you handle body fluids, e.g. urine, faeces or blood, or clinical/laboratory specimens?	☐	☐	☐
If yes, did you wear PPE?	☐	☐	☐

PPE worn - please tick as appropriate: ☐ Gloves ☐ Mask ☐ Gown ☐ Goggles

	Yes	No	Unknown
3. Did you have any unprotected exposure of your skin or mucous membranes to infectious body fluids, including handling clinical/laboratory specimens from the case?	☐	☐	☐
4. Were you involved in resuscitation of the case?	☐	☐	☐
5. If the patient died, were you involved in the autopsy?	☐	☐	☐

Describe in detail your contact with the case:

Length of exposure:

Date of first exposure: | | | | | | | | Date of last exposure: | | | | | | | |

Assessment:

If questions 1 -5 are ALL answered No → No risk / casual contacts

If question 1 or 2 is Yes AND appropriate PPE was worn → **Low risk / Close contacts**

If question 1 or 2 is Yes AND appropriate PPE was not worn
OR If question 3, 4, or 5 is answered Yes → **High risk contacts**

Please go to Section H

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Section E - Household Contacts

Relationship to case:

☐ Husband/Wife/Partner ☐ Boy-/Girl-friend ☐ Child ☐ Sibling ☐ Housemate ☐ Other

If other, please specify: ☐

1. Do you live with the case? ☐ Yes ☐ No ☐ Unknown

If No, please go to Section G

When the case was ill did you...

	Yes	No	Unknown
2. Share a room with the case?	☐	☐	☐
3. Have sex with the case?	☐	☐	☐

When the case was ill did you...

	Yes	No	Unknown
4. Shake hands	☐	☐	☐
5. Hug	☐	☐	☐
6. Kiss	☐	☐	☐
7. Look after the case	☐	☐	☐

	Yes	No	Unknown
8. Did you handle body fluids, e.g. urine, faeces or blood, from the case?	☐	☐	☐
9. Did you handle clothes, bedding or other items soiled by blood, urine or other secretions?	☐	☐	☐
10. If yes to question 8 or 9, did you wear gloves or other protective equipment?	☐	☐	☐

If yes, what did you wear/use? Please tick appropriate.

☐ Gloves ☐ Mask ☐ Apron/Gown ☐ Glasses/Goggles ☐ Other

Describe in detail your contact with the case:

Length of exposure:

Date of first exposure: ☐ Date of last exposure: ☐

Assessment:

If questions 1 Yes	→ Low risk / Close contacts
If questions 2, 4, 5 or 7 is Yes AND question 8 is No	→ Low risk / Close contacts
If question 3 or 6 is Yes OR If question 8 or 9 is answered Yes AND question 10 is No	→ High risk contacts

Please go to Section H

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Section F - Travel (airline etc) contacts

Relationship to case:

☐ Passenger ☐ Pilot/Driver ☐ Flight attendant/Guide ☐ Other

If other, please specify: _____

If passenger on an aircraft...

Airline: _____ Flight Number: _____

Where did you sit? Row _____ Seat _____

If you cannot remember your row/seat number, where you sitting...

☐ Front of the plane	☐ Back of the plane	☐ Beside an emergency exit
☐ Central aisle	☐ Window seat	☐ Near a toilet
☐ Economy	☐ Business/Premium/First class	☐ Over the wing

See http://www.seatguru.com/ for seating plans. Search by flight number or route (airport of arrival/departure & date).

	Yes	No	Unknown
1. Did you have any unprotected exposure of your skin or mucous membranes to infectious body fluids e.g. kissing, sex?	☐	☐	☐
2. Did you handle body fluids, e.g. urine, faeces or blood, from the case?	☐	☐	☐

Describe in detail your contact with the case:

Length of exposure:

Date of first exposure: _____ Date of last exposure: _____

Assessment:

If there was no direct contact with the case or body fluids but shared same airplane, hotel, coach etc → No risk / casual contacts

If question 1 or 2 is answered yes → **High risk contacts**

Please go to Section H

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Section G - Other Contacts

	Yes	No	Unknown
1. Did you have any unprotected exposure of your skin or mucous membranes to infectious body fluids e.g. kissing, sex?	☐	☐	☐
2. Did you handle body fluids, e.g. urine, blood, faeces, from the case?	☐	☐	☐

Describe in detail your contact with the case:

Length of exposure:

Date of first exposure: |_|_|_|_|_|_|_|_| Date of last exposure: |_|_|_|_|_|_|_|_|

Assessment:

If there was no direct contact with the case or body fluids but shared same airplane, hotel, coach, hotel etc → No risk / casual contacts

If question 1 or 2 is answered yes → **High risk contacts**

Please go to Section H

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Section H - Health Status of Contact

	Yes	No	Unknown
Are you currently well?	☐	☐	☐
Have you fever, or history of fever?	☐	☐	☐
Have you any haemorrhagic symptoms?	☐	☐	☐

Please go to Section I

Section I - Checklist

Action:	No risk/Casual contact	**Low risk/Close contacts**	**High risk contacts**
Information leaflet provided:	☐ Yes	☐ Yes	☐ Yes
Surveillance:	☐ None needed	☐ Self monitoring	☐ Active*
Chemoprophylaxis:	☐ Not needed	☐ Not advised	☐ For consideration

**Use High Risk Contact Surveillance Form*

Calculate period of surveillance:

Date of last exposure: |_|_|/|_|_|/|_|_| Today's Date: |_|_|/|_|_|/|_|_|

Difference between date of last exposure and today: |_|_| days

Period of surveillance remaining: 21 - difference between dates = |_|_| days

In case of illness, has this person been provided with contact details for health services/ public health? ☐ Yes ☐ No

Definition of direct contact

Direct contact is defined as contact of skin or mucosa with blood or bodily fluids of case

Comments

Name of interviewer _____ **Date** |_|_|/|_|_|/|_|_|

Appendix M: VHF Contact Surveillance Form

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Health Service Executive

Viral Haemorrhagic Fevers
High Risk Contact Surveillance Form
Version 1.0, 24/10/2010

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Section A - Using this form

Contact of Event ID | | | | | | | | | |

Surname: _____ Forename: _____

Has this person been assessed using the VHF contact assessment form? ☐ Yes ☐ No ☐ Unknown

If no, please complete the assessment before filling in this form.

If yes, risk category assigned to this person:

☐ No risk / casual contact
☐ Low risk / Close contact
☐ High risk contact

If high risk category, please continue.
Otherwise active daily surveillance is not necessary.

Please attach this form to the contact assessment completed for this high risk contact.
Please print additional copies of page 2 or 3 as required

Section B - Period of Surveillance

Period of surveillance:

From the VHF contact assessment form, enter the period of surveillance remaining | | days

Date of **first** day of surveillance: | | | | | | | | Day Number: | |

Date of **last** day of surveillance: | | | | | | | | Day Number: 2 1

Signature _____

Each day the person completing the daily surveillance should sign the section for that day (pages 2 -3)

Section C - Ribavirin Prophylaxis

Is this contact taking prophylactic ribavirin? ☐ Yes ☐ No ☐ Unknown

If yes, please use the ribavirin prophylaxis monitoring form in addition to this form.

For **High Risk Contacts** only

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Health Service Executive

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Section C - Daily surveillance

Date: | Day No.: | Time (HH:MM): : | Temperature: °C

	Yes	No	Unknown		Yes	No	Unknown		Yes	No	Unknown
Headache				Chest pain				Diarrhoea			
Neck rigidity				Abdominal pain				Rash			
Mood changes				Jaundice				Bruising			
Muscle pain				Sore throat				Bleeding			
Joint pain				Nausea				Other, please specify			
Backache				Vomiting							

Comments:

Signature

Date: | Day No.: | Time (HH:MM): : | Temperature: °C

	Yes	No	Unknown		Yes	No	Unknown		Yes	No	Unknown
Headache				Chest pain				Diarrhoea			
Neck rigidity				Abdominal pain				Rash			
Mood changes				Jaundice				Bruising			
Muscle pain				Sore throat				Bleeding			
Joint pain				Nausea				Other, please specify			
Backache				Vomiting							

Comments:

Signature

Date: | Day No.: | Time (HH:MM): : | Temperature: °C

	Yes	No	Unknown		Yes	No	Unknown		Yes	No	Unknown
Headache				Chest pain				Diarrhoea			
Neck rigidity				Abdominal pain				Rash			
Mood changes				Jaundice				Bruising			
Muscle pain				Sore throat				Bleeding			
Joint pain				Nausea				Other, please specify			
Backache				Vomiting							

Comments:

Signature

Date: | Day No.: | Time (HH:MM): : | Temperature: °C

	Yes	No	Unknown		Yes	No	Unknown		Yes	No	Unknown
Headache				Chest pain				Diarrhoea			
Neck rigidity				Abdominal pain				Rash			
Mood changes				Jaundice				Bruising			
Muscle pain				Sore throat				Bleeding			
Joint pain				Nausea				Other, please specify			
Backache				Vomiting							

Comments:

Signature

For **High Risk Contacts** only

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VHF High Risk Contact Surveillance Form v1.0

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Section C - Daily surveillance

Date: | Day No.: | Time (HH:MM): : | Temperature: °C

	Yes	No	Unknown		Yes	No	Unknown		Yes	No	Unknown
Headache				Chest pain				Diarrhoea			
Neck rigidity				Abdominal pain				Rash			
Mood changes				Jaundice				Bruising			
Muscle pain				Sore throat				Bleeding			
Joint pain				Nausea				Other, please specify			
Backache				Vomiting							

Comments:

Signature

Date: | Day No.: | Time (HH:MM): : | Temperature: °C

	Yes	No	Unknown		Yes	No	Unknown		Yes	No	Unknown
Headache				Chest pain				Diarrhoea			
Neck rigidity				Abdominal pain				Rash			
Mood changes				Jaundice				Bruising			
Muscle pain				Sore throat				Bleeding			
Joint pain				Nausea				Other, please specify			
Backache				Vomiting							

Comments:

Signature

Date: | Day No.: | Time (HH:MM): : | Temperature: °C

	Yes	No	Unknown		Yes	No	Unknown		Yes	No	Unknown
Headache				Chest pain				Diarrhoea			
Neck rigidity				Abdominal pain				Rash			
Mood changes				Jaundice				Bruising			
Muscle pain				Sore throat				Bleeding			
Joint pain				Nausea				Other, please specify			
Backache				Vomiting							

Comments:

Signature

Date: | Day No.: | Time (HH:MM): : | Temperature: °C

	Yes	No	Unknown		Yes	No	Unknown		Yes	No	Unknown
Headache				Chest pain				Diarrhoea			
Neck rigidity				Abdominal pain				Rash			
Mood changes				Jaundice				Bruising			
Muscle pain				Sore throat				Bleeding			
Joint pain				Nausea				Other, please specify			
Backache				Vomiting							

Comments:

Signature

For **High Risk Contacts** only

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

VHF High Risk Contact Surveillance Form v1.0

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Section D - Outcome

Surveillance of Outcome

Please tick as appropriate

- ☐ Patient remained well
- ☐ Patient lost to follow-up
- ☐ Patient diagnosed with VHF
- ☐ Patient diagnosed with illness other than VHF

If patient diagnosed with illness other than VHF

Diagnosis: _____ Date _____

If patient diagnosed with VHF, date of diagnosis _____

CIDR Event ID _____

CIDR Outbreak ID _____

Comments

Signature _____ **Date** _____

For **High Risk Contacts** only

Appendix N: Case Definitions for Viral Haemorrhagic Fevers

Viral Haemorrhagic Fevers (EU 2008)

Clinical criteria

Any person with at least one of the following two:

- fever;
- haemorrhagic manifestations in various forms that may lead to multi-organ failure.

Laboratory criteria

At least one of the following two:

- isolation of specific virus from a clinical specimen;
- detection of specific virus nucleic acid in a clinical specimen and genotyping.

Epidemiological criteria

At least one of the following:

- travel in the last 21 days to a region where VHF cases are known or believed to have occurred;
- exposure within the last 21 days to a probable or confirmed case of a Viral Hemorrhagic Fever whose onset of illness was within the last six months.

Case classification

Possible case: N/A
Probable case: Any person meeting the clinical criteria and with an epidemiological link
Confirmed case: Any person meeting the clinical and the laboratory criteria

Appendix O: VHF Checklists of Actions for Director of Public Health

1. In advance of any case arising:

- ☐ Request that hospital management and/or ED consultants ensure that the VHF algorithm is visible in local Emergency Departments, with up to date contact numbers and web links
- ☐ Know how to access information on current endemic areas and outbreaks (http://www.hpsc.ie/hpsc/A-Z/Vectorborne/ViralHaemorrhagicFever/)
- ☐ Agree mechanism with ED/hospital management re how to alert clinical staff regarding outbreaks/alerts
- ☐ Work with hospital and GP colleagues to incorporate VHF specific requirements (importance of travel history, algorithms, danger/warning signs, and how to identify countries where VHF outbreaks are occurring) in communicable disease education and training within the hospital and primary care setting
- ☐ Ensure that procedures, protocols are in place at points of entry, in case of first presentation of a potential case on a plane, boat etc
- ☐ Identify how to source Ribavirin (which may be used for high risk contacts of possible bioterrorism related cases, and Lassa fever cases)
- ☐ Develop local plan, based on national guidance. Agree locally in advance procedures for management, OCT arrangements, media management, spokespersons etc in event of case arising. Ensure relevant contacts list is up to date.
- ☐ Consider arrangements if the VHF is part of a bioterrorism incident. i.e. that the An Garda Síochána (AGS) will be the lead responder under the Major emergency Management Framework
- ☐ Exercise procedures and plans, in conjunction with Emergency Planning

2. In event of possible case – *High Risk*:

Communications

- ☐ Inform DPH staff
- ☐ Inform HPSC, AND Health Protection
- ☐ Consider whether to put Regional Crisis Management Team on standby alert
- ☐ Consider how media will be managed: DPH led, national or both
- ☐ Ensure NVRL has been notified

Logistics/management

- ☐ Consider need for deployment of staff to work on management of the incident – once confirmed, it will be viewed as a public health emergency
- ☐ Prepare to convene Local Outbreak Control Team: Consider if there is any possibility of bioterrorism - If, yes, this complicates management, as AGS is the lead response agency under the Major Emergency Management Framework
- ☐ Invite ID physician/admitting physician, occupational health, hospital infection team, microbiology, haematology, hospital management communications person, representative from HPSC, and National Director Health Protection, onto OCT

Prepare for contact tracing activities

- ☐ Assemble and amend if necessary:
  - Contact categorisation forms and contact tracing surveillance forms for high risk contacts (Appendices J and K)
  - Ensure availability of supplies of Ribavirin for chemoprophylaxis if relevant
  - Check that thermometers are available if needed & transport arrangements
- ☐ Review arrangements, agreed locally, re where a symptomatic contact should be clinically assessed (GP or hospital)
- ☐ Ensure availability of PPE , though unlikely to be needed

If presentation is a point of entry

- ☐ If incident first identified at point of entry – consider arrangements for provision of information, follow up of co travellers, staff etc

Liaison with NIU and ambulance service re transfer

- ☐ Ensure arrangements are in place for secure transfer of patient to NIU, if stable. See Chapter 6.

Infection control issues

- ☐ Consider infection control issues that might arise, particularly outside hospital sites. These include cleaning of ambulance, GP surgery, Out of Hours offices, health clinic etc. See Chapter 3.

3. Actions once notified of a confirmed case

Communications

- ☐ Inform Department Public Health staff
- ☐ Inform HPSC, Assistant National Director Health Protection – who will notify WHO of a Public Health Emergency of International Concern (PHEIC)
- ☐ Put Regional Crisis Management Team on standby alert
- ☐ Inform media leads

Logistics/management

- ☐ Deploy Department staff to work on management of the incident - invoke the Departmental Public Health Emergency Plan
- ☐ **Convene and Chair Local Outbreak Control Team**, in consultation with hospital where patient is being managed. Team should include Admitting/ID physician, hospital occupational health, hospital infection team, microbiology, communications person, representative from HPSC, and/or National Director Health Protection. OCT to meet regularly to manage situation: case, contacts, infection control, patient transfer, epidemiological and laboratory investigation, public perceptions of risk etc. Assign media spokespersons.
- ☐ Link with the National Public Health Outbreak Response Team (NPHORT), and the National IHR Focal Point(NFP) at HPSC
- ☐ Prepare regular briefing reports for the NFP and WHO
- ☐ Debrief and review procedures, write the report

Contact tracing

- ☐ Identify the type of VHF, and from this any possibility of potential airborne spread (see Table 1 and Appendix C)
- ☐ Determine if the patient has/had acute respiratory symptoms with intense coughing or sneezing prior to diagnosis.
- ☐ Trace the movements of the patient for up to 3 weeks prior to onset of illness with a view to establishing the source of infection and preparing a list of all contacts who are at risk of developing the disease
- ☐ Identify and interview all potential contacts using a standardised form (Appendices K and L) and assign a risk category to these potential contacts. [Note: If the VHF can be spread via aerosol, and/or the patient had acute respiratory symptoms, this will then affect the type of surveillance needed – may need to expand contact tracing to include those who shared the same airspace].

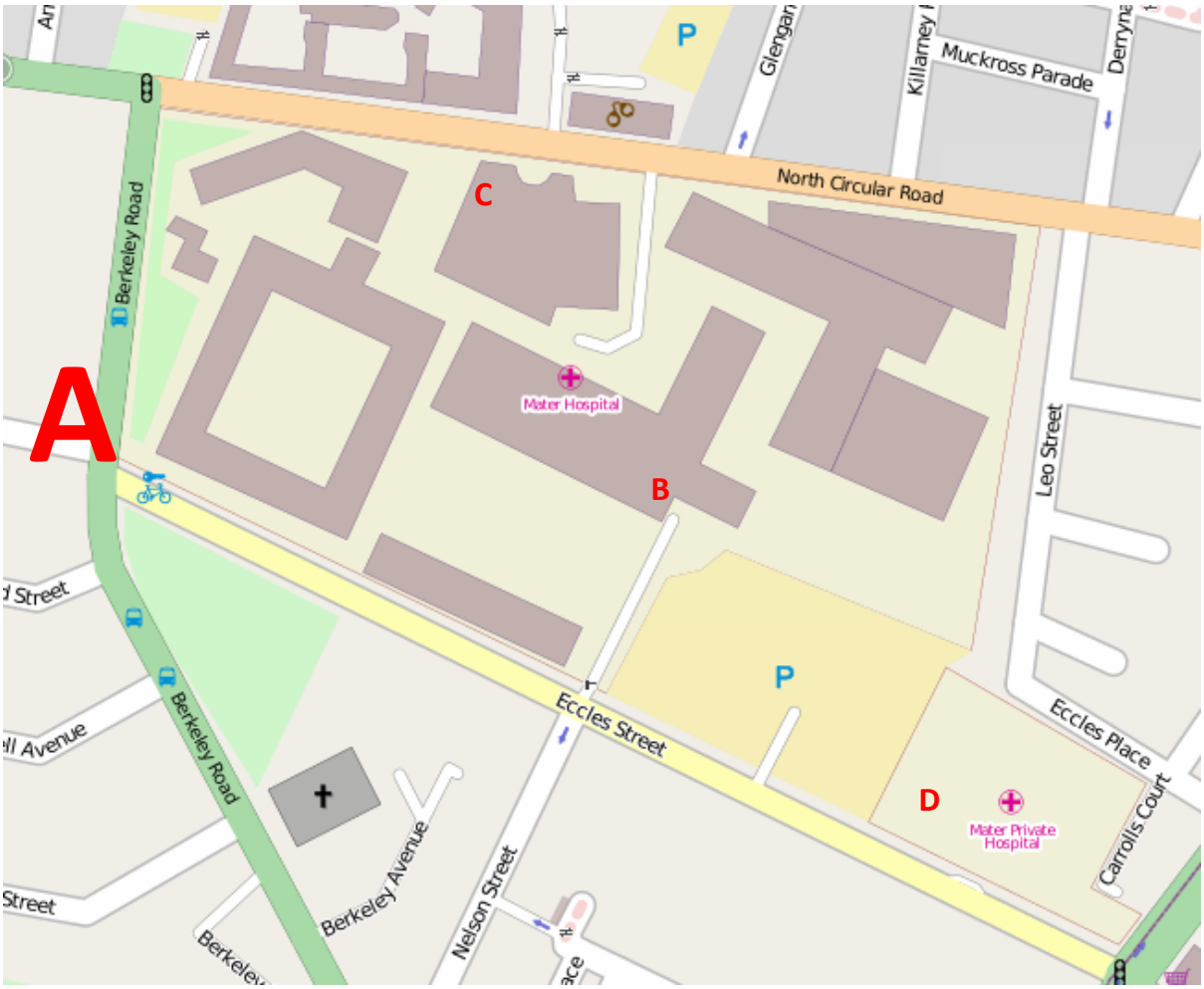
Surveillance of close/low risk and high risk contacts (non- airborne VHF)

- ☐ Follow Table 13
- ☐ There is no need for restriction on work or movement within Ireland unless they suffer a rise in temperature above 38^{O}C at which time they should be immediately isolated and treated as a potential VHF patient
- ☐ The close/low-risk and high-risk contact should not donate blood when under surveillance

Chemoprophylaxis (Lassa fever or CCHF)

- ☐ Consider Ribavirin for post-exposure prophylaxis for high-risk contacts of patients with Lassa fever or CCHF – experience is limited.

Appendix P: Campus Map, Mater Misericordiae University Hospital, Dublin



Source: OpenStreetMaps

A: **<u>Ambulance entrance to NIU</u>** (corner of Eccles Street and Berkley Road)

B: Ward Block

C: Accident and Emergency; Out-patients department

D: Mater Private Hospital

Glossary of Terms

AND	Assistant National Director
AGS	An Garda Síochána
CCHF	Crimean-Congo haemorrhagic fever
CFR	Case Fatality Rate
Crimean-Congo HF	Crimean-Congo haemorrhagic fever
DPH	Director of Public Health
DPH/MOH	Director of Public Health/Medical Officer of Health
Ebola HF	Ebola haemorrhagic fever
ED	Emergency Department
EWRS	Early Warning and Response System
GP	General Practice
ID physician	Infectious Disease physician
IHR	International Health Regulations
HCW	Healthcare worker
HF	Haemorrhagic fever
HPSC	Health Protection Surveillance Centre
NFP	National IHR Focal Point
NIU	National Isolation Unit
NPHORT	National Public Health Outbreak Response Plan and Team
NVRL	National Virus Reference Laboratory
Marburg HF	Marburg haemorrhagic fever
Micro/ID	Microbiologist/Consultant in Infectious Disease
OCT	Outbreak Control Team
PEP	Post-exposure prophylaxis
PHEIC	Public health emergency of international concern
PPE	Personal protective equipment
VHF	Viral haemorrhagic fever
WHO	World Health Organistion

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