



National Guideline for Prevention, Control and Management of Nipah Virus Infection





National Guideline for **Prevention, Control and Management of Nipah Virus Infection**

Institute of Epidemiology, Disease Control and Research (IEDCR)
Directorate General of Health Services
Ministry of Health & Family Welfare
Government of the People's Republic of Bangladesh

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The entrance to the town of Nipah, which the Malaysian government quarantined in 1999 to try to stop the spread of a new deadly virus. "*It was like a ghost town,*" says Thomas Wong, a former pig farmer in Nipah. "*No one could come in. No one could leave.*"

— Sanjit Das for NPR

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MESSAGE



Nipah virus (NiV) infection remains a major public health concern in Bangladesh and globally. Over the past two decades, repeated outbreaks with high case fatality rate, human-to-human transmission, and the urgent need for early detection, coordinated response, and effective case management. Nipah remains a priority zoonotic disease under the One Health framework, requiring close collaboration among human, animal and environmental health sectors.

This third edition of the guideline on management of Nipah Virus Infection incorporates updated scientific evidence, clinical experiences, and lessons learned from recent outbreaks. It provides revised recommendations for diagnosis, infection prevention and control (IPC), and case management, emphasizing the safety of healthcare workers and caregivers. The guidelines also highlight the importance of supportive care, rapid reporting and multidisciplinary coordination to reduce morbidity and mortality associated with NiV infection.

We express our sincere appreciation to the clinicians, epidemiologists, public health specialists, laboratory scientists, anthropologists and researchers who contributed to the revision of this document. Special thanks to icddr,b, US CDC and all collaborating institutions for their continued technical and logistical support.

It is our earnest hope that this updated guideline will serve as a practical tool for clinicians and public health professionals in early diagnosis, effective management, and prevention of Nipah virus infection. Together, through continued vigilance and collaboration, we can reduce the burden of this deadly disease and safeguard public health.

Professor Dr Tahmina Shirin, PhD
Director, IEDCR

MESSAGE



Nipah virus infection remains one of the most serious public health threats facing Bangladesh because of its severity, high fatality, and the risks that arise if vigilance weakens. The possibility that viral mutations could increase human-to-human transmission further underlines the importance of preparedness and strict adherence to established guidance. The National Guideline for Prevention, Control and Management of Nipah Virus Infection therefore remains essential for protecting lives and safeguarding health systems.

Since 2001, scientists at icddr,b, working closely with the Institute of Epidemiology, Disease Control and Research (IEDCR) and the Bangladesh Forest Department, have helped establish how Nipah virus spills over from bats to humans in Bangladesh. The country remains the only one with expanded, long-term Nipah surveillance aimed at early detection, understanding disease pathways, and interrupting transmission. Evidence from this work has contributed to the World Health Organization (WHO) recognising Nipah virus as a potential pandemic threat and has informed nationally endorsed prevention and management efforts.

icddr,b continues to invest in future protection through rapid diagnostic development and collaboration with the University of Oxford on a Nipah vaccine candidate, reinforcing commitments to national and global health security.

As Nipah virus causes severe respiratory and neurological disease and spreads through bodily fluids, it places healthcare workers at heightened risk. Strict adherence to infection prevention and control (IPC) measures, including early isolation, appropriate use of personal protective equipment (PPE), and safe clinical practices, therefore remains essential.

I encourage healthcare providers and partners to follow this guideline carefully and share its knowledge widely to stay safe and save lives.

Dr Tahmeed Ahmed
Executive Director, icddr,b

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We deeply appreciate the hard work of surveillance physicians, nurses, field assistants, laboratory staff, and all frontline healthcare workers. Their commitment has been crucial for early case detection, management, and control of NiV infections. We are also especially grateful to the patients, their families, and survivors, whose involvement in care, follow-up, and research has greatly improved our understanding of the disease and helped shape more effective national response strategies.

We value our partnership with icddr,b, whose collaboration with IEDCR has strengthened hospital-based surveillance, outbreak investigations, laboratory diagnostics, and research over the years. We also acknowledge the Centers for Disease Control and Prevention (CDC), USA, for their technical support in developing these guidelines, with special thanks to the CDC Bangladesh Country Office, particularly Dr Gretchen Cowman and Dr Pallab Chakraborty.

Finally, we thank all the clinicians, epidemiologists, public health specialists, laboratory scientists, data analysts, and administrative staff who participated in consultations, drafting, reviewing, and revising this guideline. We extend our special thanks to the Communication team of icddr,b for their valuable support in designing the guideline. Their combined knowledge and dedication have been essential in creating a practical, evidence-based document to support healthcare workers, public health professionals, and decision-makers across Bangladesh.

ABBREVIATIONS AND ACRONYMS

ABC	Airway, Breathing, Circulation	JMCH	Jashore Medical College Hospital
ARDS	Acute Respiratory Distress Syndrome	KMCH	Khulna Medical College Hospital
BBB	Blood Brain Barrier	LV	Left Ventricle
BSL	Biosafety Level	MAP	Mean Arterial Pressure
BP	Blood Pressure	MCP-1	Monocyte Chemoattractant Protein-1
CBC	Complete Blood Count	MMCH	Mymensingh Medical College Hospital
CEPI	Coalition for Epidemic Preparedness Innovations	MRI	Magnetic Resonance Imaging
CHCP	Community Health Care Provider	NG tube	Nasogastric tube
CMCH	Chattogram Medical College Hospital	NiV	Nipah Virus
CNS	Central Nervous System	NiV-BD	Nipah Virus Bangladesh strain
CSF	Cerebrospinal Fluid	NiV-MY	Nipah Virus Malaysia strain
CXCL10	C-X-C Motif Chemokine Ligand 10	NiV-F	Nipah Virus Fusion Protein
CoxMCH	Cox's Bazar Medical College Hospital	NiV-G	Nipah Virus Glycoprotein
DGHS	Directorate General of Health Services	NiV-L	Nipah Virus Large Polymerase Protein
DMCH	Dhaka Medical College Hospital	NiV-M	Nipah Virus Matrix Protein
DJMCH	Dinajpur Medical College Hospital	NiV-N	Nipah Virus Nucleoprotein
DNS	Dextrose Normal Saline	NiV-P	Nipah Virus Phosphoprotein
EBS	Event-Based Surveillance	N95	N95 Respirator Mask
ELISA	Enzyme-Linked Immunosorbent Assay	NGO	Non-Governmental Organization
FDMN	Forcibly Displaced Myanmar Nationals	PCR	Polymerase Chain Reaction
FMCH	Faridpur Medical College Hospital	PHEOC	Public Health Emergency Operation Center
G-CSF	Granulocyte Colony-Stimulating Factor	PPE	Personal Protective Equipment
GCS	Glasgow Coma Scale	qRT-PCR	Quantitative Reverse Transcriptase Polymerase Chain Reaction
HDU	High Dependency Unit	RCCE	Risk Communication and Community Engagement
HSV	Herpes Simplex Virus	RMCH	Rajshahi Medical College Hospital
icddr,b	International Centre for Diarrhoeal Disease Research, Bangladesh	RNA	Ribonucleic Acid
ICP	Intracranial Pressure	RpMCH	Rangpur Medical College Hospital
ICU	Intensive Care Unit	RT-PCR	Reverse Transcriptase Polymerase Chain Reaction
IEDCR	Institute of Epidemiology, Disease Control and Research	SBMCH	Sher-E-Bangla Medical College Hospital
IFN- β	Interferon Beta	SOMCH	Sylhet M.A.G. Osmani Medical College Hospital
IgG	Immunoglobulin G	TNF- α	Tumour Necrosis Factor Alpha
IgM	Immunoglobulin M	VTM	Viral transport medium
IL	Interleukin		
IPC	Infection Prevention and Control		
ISG	Interferon-Stimulated Gene		
JBE	Japanese B Encephalitis		



INTRODUCTION

Nipah virus infection is an emerging zoonotic disease caused by the Nipah virus (NiV), an enveloped, single-stranded RNA virus. *Pteropus* bats (fruit bats) are the natural reservoir of NiV. It is recognized as one of the deadliest emerging zoonotic infections affecting humans. The case fatality ratio of Nipah virus infection has varied widely, ranging from 40% to 75%, depending on the outbreak setting, strain diversity and the availability of healthcare services for patient management [1-3]. The World Health Organization (WHO) has identified NiV as a priority pathogen for research and development due to its potential to cause severe epidemics with a high fatality ratio and the absence of licensed vaccines or specific antiviral treatments [4]. NiV poses a serious threat to global health because it can spread from animals to humans, from human-to-human, and has the potential for cross-border transmission. NiV was first discovered during an outbreak in Malaysia in 1998-99 [5]. Bangladesh has been reporting Nipah cases almost annually since its first recognized outbreak in 2001 [6]. India reported its first Nipah outbreak in 2001 (Siliguri), followed by cases in Nadia (2007) and Kerala (2018–2021, 2023–2025), reflecting recurring threats [7-9]. The Philippines also reported Nipah outbreaks in 2014 [10].

Nipah outbreaks in Bangladesh are usually seasonal, occurring from December to April, coinciding with the harvesting season of raw date palm sap, a practice deeply rooted in Bangladeshi culture. Consumption of raw date palm sap contaminated by fruit bat secretions or excreta is identified as the primary route of NiV transmission from bats to humans in Bangladesh. Additionally, human-to-human transmission, particularly among caregivers, has been consistently documented through contact with respiratory droplets, oral secretions, and other bodily fluids of infected individuals [11–13]. With a high case fatality ratio, NiV is a continuing threat in South and Southeast Asia and poses a threat for health security. Because of these repeated outbreaks, high mortality, and lack of specific treatment and vaccine, NiV has been highlighted as a top priority in pandemic preparedness strategies by global health agencies such as the WHO, the Coalition for Epidemic Preparedness Innovations (CEPI), and Gavi, the vaccine alliance [14, 15].

This guideline provides a comprehensive framework for the prevention, detection, clinical management, and containment of NiV infections in Bangladesh. It is intended for healthcare workers, public health professionals, and policy-makers involved in clinical management, outbreak preparedness and response of NiV infection.

EPIDEMIOLOGY OF NIPAH VIRUS INFECTION

NiV infection is a zoonotic disease characterized by a high case fatality rate and considerable epidemic potential. Since its initial emergence in 1998, NiV has caused repeated outbreaks across South and Southeast Asia, especially in Bangladesh and India. A clear understanding of its transmission dynamics, seasonal trends, and geographic distribution is crucial for developing and implementing effective surveillance, prevention, and response measures.

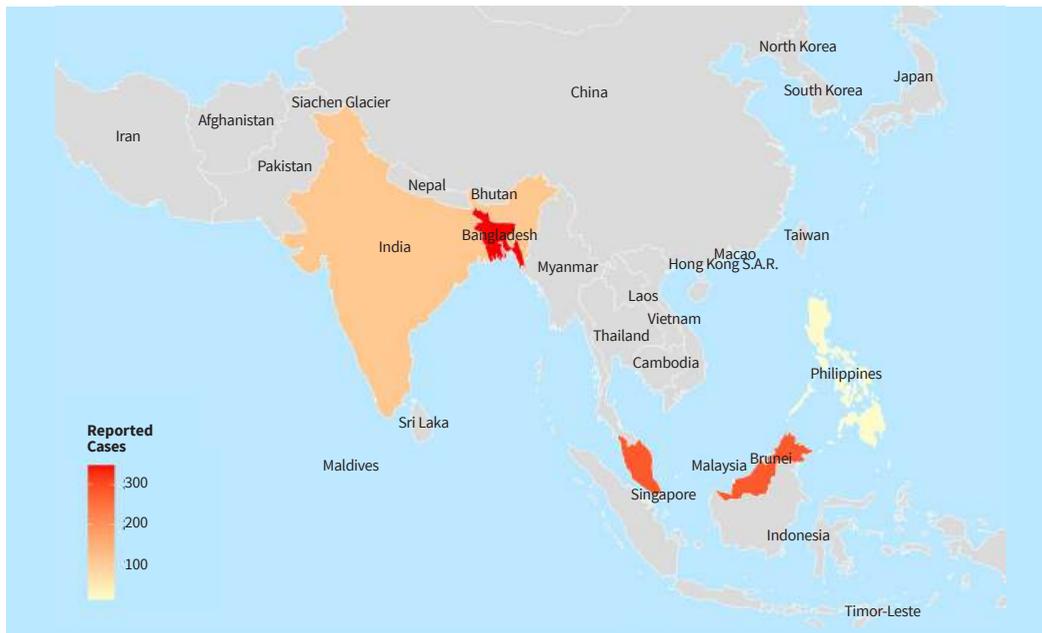


Figure 1: Global map for Nipah-affected countries (1998–2025)

2.1 GLOBAL SCENARIO

A total of 748 human NiV cases with 442 deaths (fatality rate: 59%) have been reported globally till August 2025 [16, 17]. NiV was first discovered during a large outbreak in Malaysia and Singapore between 1998 and 1999. The virus was transmitted from *Pteropus* fruit bats to pigs, and subsequently to humans, largely through occupational exposure in pig farms and abattoirs [18,19]. Following this outbreak, several countries, including India, Bangladesh, and the Philippines, reported subsequent human outbreaks and evidence of NiV circulation among the *Pteropus* bats.

Table: Global Epidemiological Summary of Nipah Virus Outbreaks (1998-2025)

Country Name	Year	Reported Cases	Reported Deaths	Case Fatality Ratio
Malaysia	1998-1999	265	105	40%
Singapore	1999	11	1	9%
Philippines	2014	17	9	53%
India	2001, 2007, 2018-2025	108	78	72%
Bangladesh	2001-2025	347	249	72%

In India, outbreaks were reported in West Bengal and Kerala, with confirmed human-to-human transmission, particularly in healthcare settings [7, 20, 21]. The Philippines reported a Nipah outbreak in 2014 linked to horse-to-human transmission and subsequent human-to-human spread, resulting in multiple fatalities [10]. Surveillance in the bat population has also detected NIV antibodies in fruit bats and NIV RNA in bat secretions across several Southeast Asian countries, indicating the potential for future zoonotic spillovers [22].

2.2 BANGLADESH SCENARIO

Bangladesh has been recognized as a Nipah-endemic country since the first confirmed human outbreak in Meherpur district in 2001. From 2001 to 2025 (figure 3), a total of 347 confirmed human NIV cases have been reported across 35 districts (out of 64), with an alarmingly high overall case fatality ratio of approximately 72% [17]. Initial outbreaks were mostly limited to the northwest and central regions of the country; however, in recent years, cases have been reported from districts beyond this known belt.

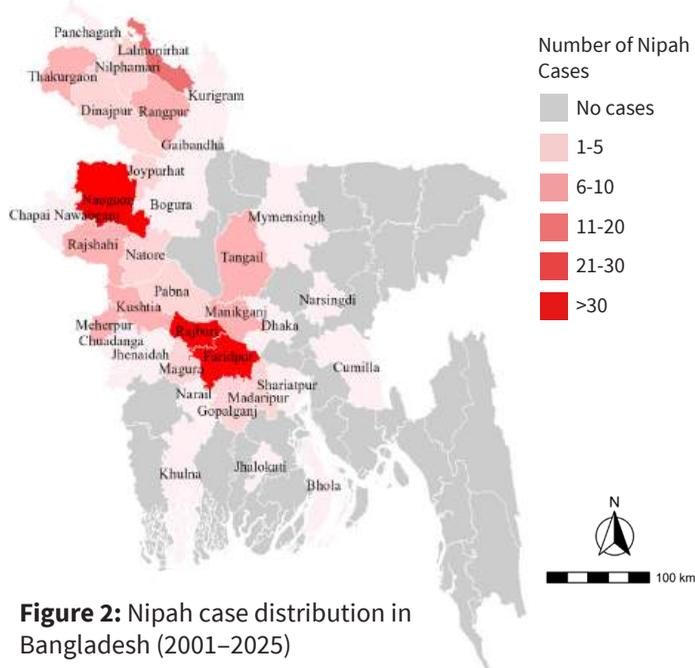


Figure 2: Nipah case distribution in Bangladesh (2001–2025)

This pattern suggests that the virus remains within its natural reservoir and highlights the risk of outbreaks extending into areas where human cases have not been identified before [17].

Among the 347 cases, nearly half were primary cases linked to contaminated raw date palm sap consumption, and 29% were identified as secondary cases (human-to-human transmission).

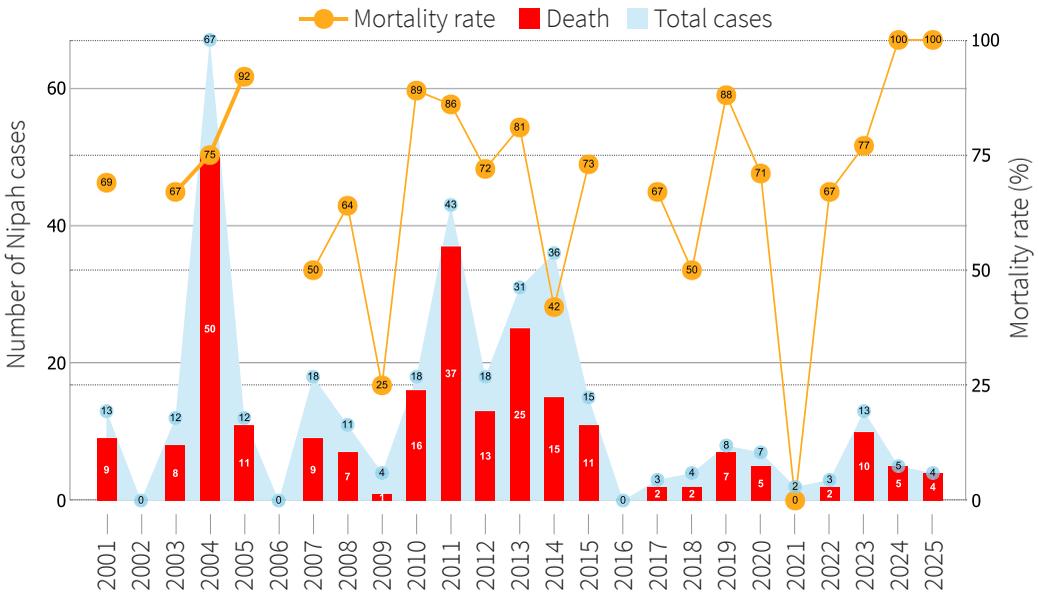


Figure 3: Annual reported Nipah virus cases and mortality in Bangladesh, 2001–2025

2.3 NIPAH VIRUS AND STRUCTURE

NiV is an enveloped, negative-sense, single-stranded RNA virus with a genome approximately 18.2 kb in length. It contains six structural genes which encode six structural proteins (N, P, M, F, G, L) and three non-structural proteins (C, V, W). Among them, the glycoprotein (NiV-G) and fusion protein

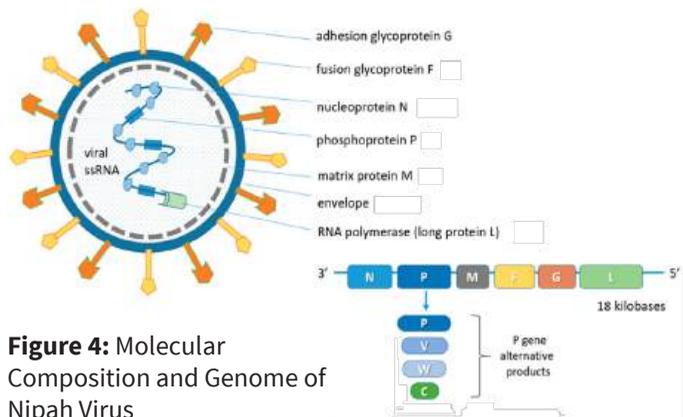


Figure 4: Molecular Composition and Genome of Nipah Virus

(NiV-F) are surface proteins of NiV. The remaining four proteins are inner proteins comprising matrix protein (NiV-M), phosphoprotein (NiV-P), nucleoprotein (NiV-N), and the large protein or RNA polymerase protein (NiV-L) [23].

Till now, two distinct genetic lineages of NiV have been identified:

- NiV-Malaysia (NiV-MY): Identified during the 1999 Malaysia outbreak, associated with limited human-to-human transmission.
- NiV-Bangladesh (NiV-BD): First detected in 2001, responsible for repeated outbreaks in Bangladesh and India, with a higher frequency of human-to-human transmission and respiratory involvement. NiV-BD has two sublineages, NiV-BD 1 and NiV-BD 2, causing outbreaks all over the country; however, these sublineages do not differ in epidemiology or clinical features [24].

2.4 RESERVOIR

Pteropus fruit bats, commonly known as flying foxes (such as *Pteropus medius* and *Pteropus vampyrus*), are known natural reservoirs of the NiV. These bats serve as asymptomatic carriers and shed viruses through their saliva, urine, and faeces. This makes them a source of infection, especially in countries like Bangladesh, India, Malaysia, and Philippines, where human and bats often come into close contact [25, 26].



Figure 5: Reservoir Host of Nipah Virus: The *Pteropus* Fruit Bat

In Bangladesh, *Pteropus medius* (formerly *P. giganteus*) has been consistently implicated in human infections, particularly via contamination of date palm sap [27].

Satellite telemetry studies show *Pteropus* species like *P. vampyrus* and *P. medius* can migrate hundreds of kilometres, underscoring the risk of transboundary spillover and a broader regional public-health threat [28].

OTHER ANIMALS

Domestic animals

In Bangladesh, serological studies have detected antibodies against Nipah virus in domestic animals such as cattle, goats, and pigs, indicating possible exposure to NiV or related viruses. During the 1998–1999 outbreak in Malaysia and Singapore, pigs played a major role as an intermediate/amplifying hosts, with infected pigs transmitting the virus to humans, particularly pig farmers and slaughterhouse workers. In the Philippines, a 2014 outbreak implicated horses as potential intermediate hosts, with limited evidence of horse-to-human transmission [29–31].

Peridomestic animals

NiV antibodies were detected in cats and dogs from six locations in Bangladesh, where there were reported cases of human NiV infection during 2013–2015 [32].

2.5 TRANSMISSION

i. Zoonotic Spillover (Bat-to-Human)

- The primary route of spillover in Bangladesh is the consumption of raw date palm sap (*kacha khejurer rosh*), which bats (mainly *Pteropus medius*) often contaminate with saliva or urine while feeding [33]. Infrared camera studies confirm bat visits to sap-collection sites [12].
- Fruit bats also gnaw on fruits, and humans or animals consuming partially eaten fruit or dropped fruit theoretically could acquire infection [34], though this has not been implicated in epidemiological studies in Bangladesh [35].



Figure 6: Date palm sap-producing tree, and ways of bats contaminating the shaved surface of the tree. (photo: M. Salah Uddin Khan)

ii. Human-to-Human Transmission

- Close contact with infected individuals, particularly via respiratory droplets, saliva, urine, and other body fluids, can lead to secondary transmission among family members, visitors, and healthcare workers. Person-to-person transmission has been documented consistently in Bangladesh and India since 2004 [1, 7, 9, 27, 36].
- In Bangladesh, approximately 29% of Nipah cases are secondary, who acquired the infection while coming in close contact or while caregiving [17].
- In India, during the 2001 outbreak in Siliguri (West Bengal), 33 healthcare workers and hospital visitors became ill after exposure to Nipah patients, highlighting the risk of nosocomial (hospital-based) transmission [37]. In the May 2018 outbreak in Kerala, 22 out of 23 cases were linked to person-to-person transmission, primarily in healthcare settings, including family caregivers and hospital staff [38]. The index case was likely infected through bat exposure, with subsequent secondary transmission occurring within hospitals [38]. Similar patterns were observed in Kerala outbreaks in 2021 and 2023, where limited human-to-human transmission was reported, mostly involving individuals with close contact during severe respiratory illness or caregiving [39–42].
- In 2023, NiV-RNA was detected in the breast milk of a mother infected with NiV in Bangladesh. Although the detection of Nipah RNA in breast milk does not confirm the infectivity or transmissibility of the virus, this finding suggests that further research is needed to explore the potential role of breast milk in NiV transmission [43].

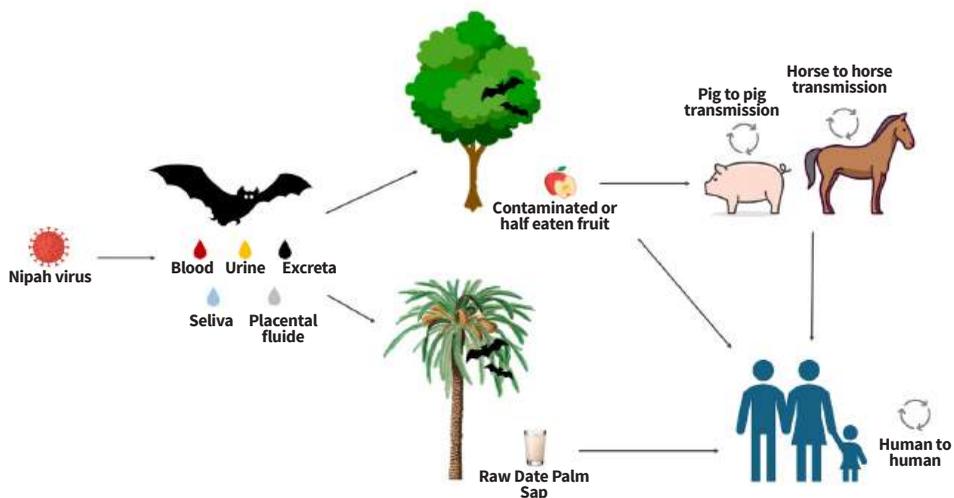


Figure 7: Nipah virus transmission pathway

2.6 NIPAH SEASON

In Bangladesh, Nipah cases are mainly detected between December and the end of April. This period coincides with the peak availability of raw date palm sap, which is widely consumed during these months. During these months, communication with the surveillance hospital authority, surveillance activities at the hospital level, transportation, and sample testing are reinforced systematically [27].

In August 2025, a Nipah case was reported in Bangladesh, underscoring that while most outbreaks cluster in the 'Nipah season', the risk of infection also persists beyond these months.

Nipah seasonality in India appears less defined compared to Bangladesh. Although outbreaks in West Bengal, India (2001, 2007) occurred during winter, the majority of cases in India (Kerala, 2018-2019, 2021, 2023-2025) were detected between May and September, suggesting a different pathway of transmission from bats to people.

PATHOPHYSIOLOGY OF NIPAH VIRUS INFECTION

The pathophysiology of Nipah virus infection in humans is not yet fully understood. Patients are so far detected only after developing symptoms and progressing to severe illness requiring hospital admission, which limits understanding of the exact disease mechanisms. From some research studies, a few insights into the pathophysiology of Nipah virus infection have been identified, which are outlined below-

Primary cellular infection by NiV occurs in lymphoid tissues, followed by systemic dissemination of the virus only in those cells where Ephrin B2 and B3 receptors are available. Secondary cellular infection includes endothelial cells, which leads to increased vascular permeability throughout the body. This increased permeability allows for viral infiltration of the brain and central nervous system (CNS), allowing for direct infection of CNS cells. The later stages of infection result in widespread vasculopathy marked by viral inclusions and syncytia formation affecting multiple organ systems, including the CNS [44].

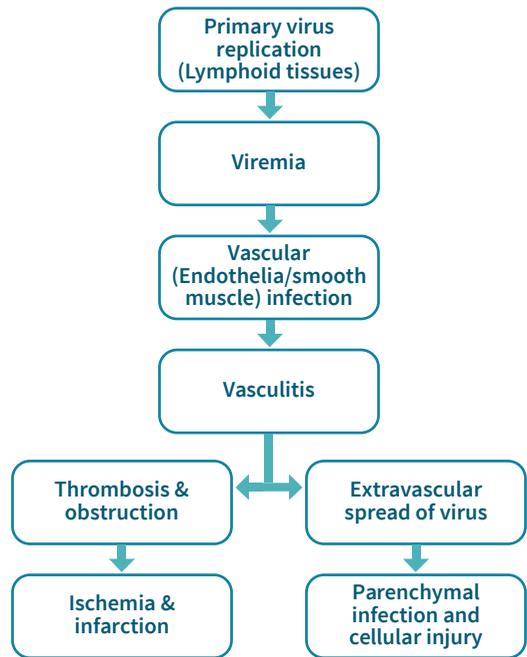


Figure 8: Pathogenesis of Nipah Virus infections

RESPIRATORY MANIFESTATION

NiV targets and replicates within the bronchial epithelial cells. These cells serve as the primary site of early viral entry and multiplication. As infection progresses, NiV antigens are detected in both the bronchi and alveoli, particularly within type II pneumocytes, indicating a spread deeper into the pulmonary system.

Following local replication, the virus infects the airway epithelium, triggering the release of a wide range of pro-inflammatory cytokines and chemokines, such as MCP-1, IL-6, IL-8, IP-10, CXCL10, G-CSF, and TNF- α . This cytokine storm contributes to local immune dysregulation and promotes inflammation in the respiratory tract. These inflammatory signals also play a key role in compromising the integrity of the surrounding pulmonary endothelial cells, which the virus invades in later stages.

Once the vascular endothelium is breached, NiV gains access to the bloodstream. The virus can then disseminate systemically, either as free viral particles or within host immune cells, such as monocytes or macrophages—a mechanism known as the Trojan horse model.

CNS MANIFESTATION

The central nervous system (CNS) becomes vulnerable to infection through two primary routes:

- I. Hematogenous dissemination – where NiV crosses a disrupted blood–brain barrier (BBB) by infecting or damaging brain microvascular endothelial cells.
- II. Olfactory neuroinvasion – where the virus travels through the olfactory nerves into the brain via anterograde transport from the nasal cavity.

Once in the CNS, the virus causes widespread damage, including encephalitis, microinfarctions, and seizure activity, which can progress to coma. The infection of brain endothelial cells is accompanied by further BBB disruption, driven by cytokine release (e.g., IFN- β , IL-6, ISGs) and downregulation of tight junction proteins (TJs). This enhances BBB permeability and facilitates deeper penetration of virus and immune mediators into the neural parenchyma, leading to neuronal injury, oedema, and neuroinflammation.

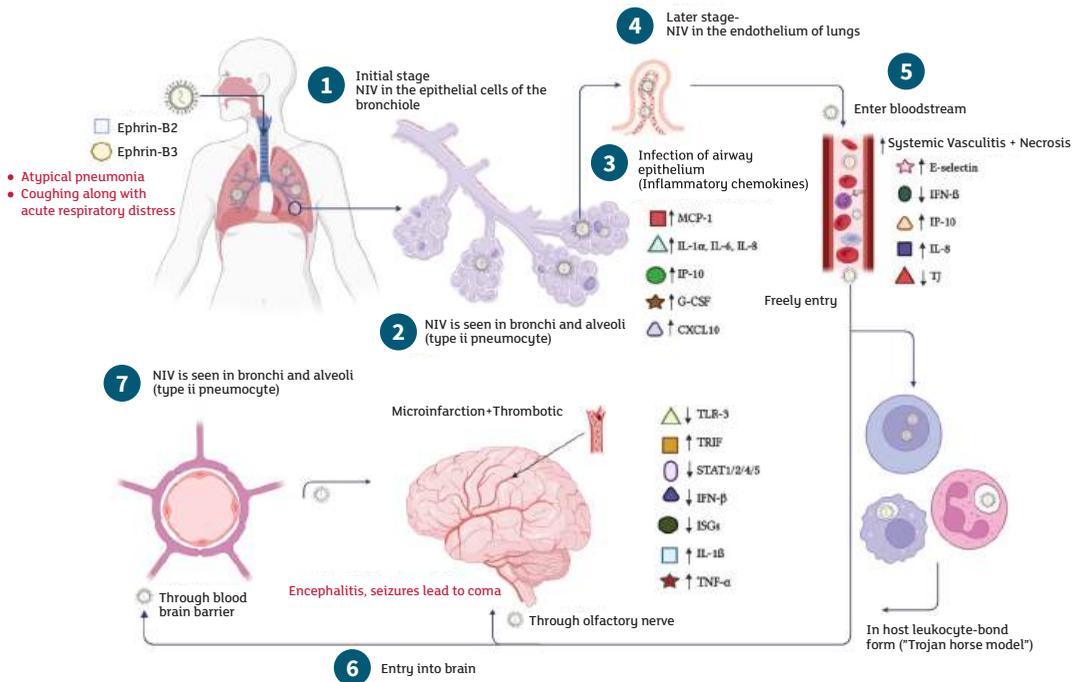


Figure 9: Pathophysiology of NiV infection. (1) Bronchial epithelial cells harbour NiV during the initial stages of infection. (2) The bronchi and alveoli contain NiV antigen. (3) When the airway epithelium becomes infected, inflammatory mediators are released. (4) The virus makes its way to the pulmonary endothelial cells (ECs) in due time. The brain is susceptible to viral infections that can be transmitted through the bloodstream (5,6 and 7) [45].

CARDIOVASCULAR MANIFESTATION

NiV infection can involve the cardiovascular system, likely as part of its systemic and neurotropic pathogenesis. Myocardial involvement may present as tachycardia, hypertension, and electrocardiographic abnormalities such as ST-segment and T-wave changes, which are indicative of cardiac stress or ischemia. In some patients, left ventricular (LV) hypokinesia has been observed on echocardiogram, suggesting impaired myocardial contractility. Elevated Troponin-I levels further support the possibility of viral myocarditis or secondary myocardial injury. These cardiac manifestations may result from direct viral invasion, a systemic inflammatory response, or neurogenic mechanisms, as the virus affects autonomic control centers in the brain [46].

CLINICAL SPECTRUM OF NIPAH VIRUS INFECTION

4.1 EPIDEMIOLOGICAL LINK AND RISK EXPOSURE

An epidemiological link for NiV infection refers to contact with a confirmed or probable Nipah case, or exposure to a recognized source of infection within the last 28 days. This includes consuming raw date palm sap, fermented sap (tari), as well as close contact with sick animals that could potentially carry the virus.

A thorough exposure history is a crucial component of early case detection. Whether in the outpatient department, emergency room, hospital ward, or during bedside evaluation, structured history-taking helps identify key epidemiological clues and risk behaviours. As suspected Nipah cases often present with acute fever or a history of fever along with respiratory symptoms and or evidence of acute neurological symptoms, taking a detailed and structured clinical history is crucial for identifying suspected patients. Physicians should ask whether the patient has recently consumed raw or fermented date palm sap, bat-eaten or dropped fruit, had close contact with a confirmed or suspected Nipah case or encephalitis patient, or visited a healthcare facility where such patients were treated. History should also include possible occupational exposure, such as working with bats, livestock, sap collection, or fruit orchards, as well as any recent travel to outbreak-prone areas. Inquiring about similar illnesses or sudden deaths in the household or neighbourhood can help identify potential clustering of cases. Collecting this epidemiological and exposure history supports timely case identification, early laboratory testing, case isolation, and public health response, which are critical for breaking the chain of transmission and ensuring appropriate care.

4.2 CASE DEFINITIONS

4.2.1 Suspected case

Historically, Nipah infection in humans has been documented in three forms: encephalitis, pneumonia/pneumonitis, and both.

Suspected Nipah encephalitis

Fever/history of fever (axillary temperature $>38.5^{\circ}\text{C}$ / 101.3°F) AND any evidence of acute brain pathology (e.g. altered mental status, or new onset seizures, or new neurological deficit either diffuse or localized to the brain).

Suspected Nipah pneumonitis

Onset of illness within the last seven days AND fever/ history of fever (axillary temperature >38.5°C / 101.3°F) AND severe shortness of breath (i.e. dyspnea prevents patient from walking unassisted for 10 steps) AND chest radiograph consistent with diffuse acute respiratory distress syndrome.

4.2.2 Confirmed case

An individual is classified as having confirmed Nipah infection if there is laboratory confirmation (direct or indirect evidence) of Nipah virus infection in at least one of the specimen, through one or more of the following methods:

- Detection of IgM or IgG antibodies against Nipah virus, or
- Detection of Nipah virus RNA by PCR.

This classification applies regardless of whether the individual exhibits clinical features of Nipah encephalitis or pulmonary presentation.

4.3 INCUBATION PERIOD

- The median incubation period of NiV infection is 8 days.
- For primary cases infected through raw date palm sap consumption, the incubation period ranges from 2 to 28 days, with a median of 7 days from exposure to onset of illness.
- For secondary cases resulting from human-to-human transmission, the incubation period typically ranges from 6 to 11 days, with a median of 9 days.

4.4 SYMPTOMS

The following symptoms are mostly observed in Bangladeshi cases:

- | | | |
|----------------------------|---|-------------------------------|
| 1. Fever | 7. Vomiting | 11. Convulsion |
| 2. Unconsciousness | 8. Drowsiness | 12. Muscle pain |
| 3. Fatigue/weakness | 9. Personality change/altered mental status (Disorientation, drowsiness, confusion) | 13. Irritability/restlessness |
| 4. Headache | | 14. Diarrhoea |
| 5. Increased salivation | 10. Cough | 15. Joint pain |
| 6. Difficulty in breathing | | 16. Stiff neck |

Asymptomatic and mild infections have been reported, but only a minority of infected persons (<10%) were found to be truly asymptomatic.

4.5 GENERAL SIGNS

1. Raised temperature (Fever)
2. Increased heart rate (Adults ≥ 100 /min; Children ≥ 140 /min)
3. Muscle tenderness
4. Hypertension or hypotension
5. Neck stiffness or neck rigidity
6. Reduced or low GCS score

4.7 RESPIRATORY SIGNS

1. Increased respiratory rate (Adults ≥ 25 /min; Children ≥ 40 /min)
2. Hypoxia or low oxygen saturation
3. Cyanosis (Bluish discolouration of lips or extremities)
4. Crackles or abnormal lung sounds (e.g., crepitations)

4.6 NEUROLOGICAL SIGNS

1. Oculoparesis
2. Pupillary abnormality
3. Facial weakness
4. Bulbar weakness
5. Limb weakness
6. Reduced deep tendon reflexes
7. Plantar-absent/extensor

4.8 DIFFERENTIAL DIAGNOSIS

1. Other Viral Encephalitis e.g. Herpes Simplex Encephalitis, Japanese B Encephalitis (JBE), Dengue Encephalitis
2. Bacterial Meningitis
3. Cerebral Malaria
4. Acute Severe Respiratory Infections
5. Febrile Seizure

4.9 RECOMMENDATION FOR HEALTHCARE WORKERS SUSPECTING A NIPAH CASE

If a healthcare worker suspects a case of Nipah virus infection based on the case definition and clinical presentation, they are advised to immediately isolate the patient and notify the Institute of Epidemiology, Disease Control and Research (IEDCR) and or icddr,b through the Nipah surveillance contact no.:  **10655 (IEDCR hotline), +8801907801856 (IEDCR) or +8801304068800 (icddr,b) (24/7 service)**. Upon notification, the surveillance team will provide instructions for sample collection, transportation, and coordination with the national reference laboratory.

Table 1: Differential diagnosis of Nipah Virus disease

Characteristic	Nipah Virus Infection	Herpes Simplex Encephalitis	Japanese B Encephalitis	Dengue Encephalitis	Bacterial Meningitis	Cerebral Malaria	Acute Severe Respiratory Infections	Febrile Seizure
Fever pattern	High, abrupt onset	Fever with insidious onset	High fever, abrupt	Moderate to high fever	High, rapid onset	High, periodic	High fever, abrupt	Sudden rise in fever triggers seizure
Neurological symptoms (e.g., confusion, coma)	Common, often early; may progress to coma	Prominent; altered consciousness, focal deficits	Frequent; altered sensorium, convulsions	Rare in mild disease	May occur, but not primary feature	Prominent; altered sensorium, coma	Less common, only in critical illness	Seizures without CNS infection; child otherwise normal
Respiratory involvement	Common; cough, respiratory distress	Rare	Rare	Not typical	Uncommon	Possible respiratory distress due to acidosis	Very prominent; primary feature	Absent
Seizures	Frequent	Common	Very common	Rare	Possible	Common	Uncommon	Defining feature (fever-triggered)
Rash	Usually absent	Absent	Absent	Common (especially Zika/Dengue)	Absent	Absent	Absent	Absent

Characteristic	Nipah Virus Infection	Herpes Simplex Encephalitis	Japanese B Encephalitis	Dengue Encephalitis	Bacterial Meningitis	Cerebral Malaria	Acute Severe Respiratory Infections	Febrile Seizure
CSF Findings	Lymphocytic pleocytosis, elevated protein, normal glucose	Lymphocytic pleocytosis, elevated protein, normal glucose	Lymphocytic pleocytosis, elevated protein	Mild lymphocytic pleocytosis	Neutrophilic pleocytosis, very high protein, low glucose	Mild pleocytosis, elevated protein	Usually normal unless complications	Normal
Exposure History	Exposure to bats or taking raw date palm sap/half-eaten or dropped fruit; contact with NIV cases	No specific exposure; reactivation	Mosquito bite in endemic area	Mosquito exposure	Exposure to infected persons, otitis/sinusitis	Travel to/residence in malaria-endemic area	Contact with respiratory case	No specific exposure
Seasonality	Mostly in winter months (December to April)	All year	Monsoon/post-monsoon	Rainy season	All year	All year in endemic areas	All year with seasonal peaks	Any febrile illness in children
Diagnostic tests	RT-PCR, ELISA for IgM/IgG, virus isolation	CSF PCR for HSV	IgM ELISA in CSF/serum	PCR, IgM/IgG serology	CSF Gram stain, culture	Peripheral smear, rapid antigen test	RT-PCR for specific respiratory viruses	No specific test; diagnosis is clinical

LABORATORY DIAGNOSIS

Nipah virus (NiV) is a highly pathogenic zoonotic virus. With its high case fatality ratio and potential for human-to-human transmission, early and accurate diagnosis is critical for outbreak control and patient management.

5.1 SPECIMEN TYPES

Diagnostic Purpose

- Throat Swab/ Oropharyngeal swab*
- Blood

*In case of any death case Oropharyngeal swab is taken for diagnostic purpose.

Additional Specimens for research purpose

- Cerebrospinal fluid (CSF)
- Urine
- Human breast milk (in lactating mother)
- Cord blood (in pregnant mother)
- Placental tissue (in pregnant mother)
- Post-mortem tissue samples (e.g., brain, lung)

Sample Collection Protocol¹

5.2 INVESTIGATIONS

5.2.1 Diagnostic tests

Diagnosis of acute infection is done by NiV RNA through PCR in blood and oropharyngeal swab. Anti-NiV IgM and IgG antibodies are measured using an enzyme-linked immunosorbent assay (ELISA) to diagnose Nipah infection. A positive result in any of these tests should be considered confirmatory. However, molecular and serological testing together create a more comprehensive diagnostic picture than either approach alone.

Since samples from suspected Nipah cases must be processed and analysed in strictly controlled environments following biosafety level 3 (BSL-3) standard operating procedures, these samples are only tested at the One Health Laboratory at icddr,b and the Molecular and Serology Laboratory of IEDCR. Tests must not be attempted at any other laboratory in Bangladesh without appropriate government authorization.

- Enzyme-linked immunosorbent assay (ELISA) – Anti-Nipah IgG & IgM
- Polymerase chain reaction (PCR)

¹ For details please see Annexes – 7

5.2.2 Routine Tests

(to assess general health status and organ function, monitor disease progression and response to treatment))

Table: Laboratory and Radiological findings of Nipah Virus disease [9]

Routine haematological tests (CBC, Liver function test, S. Electrolytes)	<ul style="list-style-type: none"> ▪ Thrombocytopenia ▪ Leucopenia ▪ Raised liver enzymes ▪ Hyponatremia
Cerebrospinal fluid analysis	<ul style="list-style-type: none"> ▪ Lymphocytic pleocytosis ▪ Raised proteins ▪ Normal glucose levels
Imaging (MRI of brain)	<ul style="list-style-type: none"> ▪ 2-7mm multifocal discrete lesions in the subcortical and deep white matter
NiV-specific tests	<ul style="list-style-type: none"> ▪ ELISA for detection of antibodies ▪ Polymerase Chain Reaction (PCR) ▪ Virus isolation (for research purposes and requires BSL-4 facility)

All of the tests should be done with proper precaution (please see Annexe 7) and samples should be discarded according to the standard protocol²

² NiV is a biosafety level (BSL) 4 agent, however, BSL 2 laboratory facilities are sufficient for routine diagnosis if the virus is inactivated during/right after specimen collection and isolation is not attempted.

MANAGEMENT OF NIPAH VIRUS INFECTION

NiV infection is different from other viral infections or pathogens because of its potential for transmission from human-to-humans, with high mortality and no definite treatment or vaccine identified so far. So, the management essentially involves infection control practices and triaging, isolation and management of patients, including intensive supportive care.

6.1 TRIAGING OF PATIENTS

Ideally, patients presenting with fever should first report to the Fever Triage, where they undergo primary evaluation with appropriate precautions before admission. However, in low-resource settings, this approach may not always be feasible. Nevertheless, during large outbreaks or in seasons, admitting suspected patients through the Fever Triage can help reduce transmission and ensure early initiation of treatment.

- Ensure strict adherence to proper triaging and infection control practices.
- Ensure personal safety; wash hands, wear and dispose apron, mask and gloves as appropriate.
- General measures – ABCDE approach (Airway, Breathing, Circulation, Disability, Exposure)
- Conduct patient assessment and plan for appropriate care, including intensive supportive care. The most important step in patient care is intensive supportive care.

Setting up an isolation facility

Who should be kept in isolation facility/ward/Cabin/ICU

- Anyone having a history of close contact with a confirmed Nipah case
- Any individual with suspected Nipah infection (symptoms matching with suspected Nipah case definition)
- Healthcare provider and attendant of patient who has come in close contact (Annexe 3) with the confirmed or suspected Nipah patient
- Patients with high clinical suspicion – Encephalitis/ARDS/Myocarditis during the Nipah season

6.2 ISOLATION FACILITY

- Enter all the details of HCWs entering the isolation facility in the register to ensure appropriate follow-up.
- Only HCWs trained in infection control practices should be posted in the isolation facility.
- Monitor staff health; sick people should not be allowed at work.
- They must report immediately through the contact numbers provided if they develop any health-related problems during the period and up to another 28 days after the last day of handling a suspected or confirmed case.
- Infection control practices should be strictly adhered to and audited.
- Proper instructions should be followed while entering the room.
- The entry of the healthcare provider should be through the designated donning area.
- The exit should be separate for the healthcare provider and there should be facility for doffing and an appropriate facility for hand washing/bathing.
- Patient entry and shifting should be separately marked.
- The deceased should be handled separately as per protocols.
- A single room with an attached toilet facility must be provided for each patient.
- Separate equipment (BP apparatus, stethoscope, thermometer, pulse oximeter) for each room and use only disposable consumables to be used.

Requirements for an isolation room

- Standard should be equivalent to High Dependency Unit (HDU)
- Exhaust fan should be switched on
- Separate Pulse oximeter, Non-invasive BP, stethoscope, BP machine, thermometer, torch light, hammer etc.
- Supply of adequate
 - disposable gloves,
 - gown (either disposable/autoclavable),
 - surgical mask/N95 mask,
 - hand washing facilities,
 - chlorhexidine hand washing solution/alcohol 60%
- One mechanical ventilator for each four bedded HDU
 - Heat and Moisture Exchange Filters (HMEF)
 - Close circuit suction apparatus

6.3 SUPPORTIVE/GENERAL TREATMENT

Before starting the supportive treatment of a suspected or confirmed case following things should be available -

- Isolation (preferably in a separate unit)
- Barrier nursing e.g. personal protection using masks, gloves, gowns, shoe covers
- Hand washing facility with soap & water before and after handling/visiting patients

Supportive or General treatment as follows -

- a. Resuscitation (if needed): ABC (Annexe 2)
 - Airway
 - Breathing
 - Circulation
- b. Care of unconscious patient: posture change, care of eye, bladder, bowel and mouth
- c. O₂ inhalation if there is respiratory difficulty
- d. Nutritional support: oral/NG tube feeding according to the condition of the patient
- e. Maintain fluid and electrolyte balance [Adults: 5% DNS, Children: 5% DNS, half or quarter strength saline (Normal Saline)] ****DA saline should be avoided**
- f. Fluid restriction: 30% restriction, particularly in children. 2/3 of the daily maintenance can be given to children if the child is not in shock
- g. Maintain the intake and output chart

6.4 SYMPTOMATIC TREATMENT

- a. Treatment of fever: Paracetamol -15mg/kg/dose or 500 mg for adults if temperature $\geq 101.3^{\circ}\text{F}$ ($>38.5^{\circ}\text{C}$). (Not more than 4 times in 24 hours)
- b. Treatment of convulsion:
 - I. If patient presents with convulsion:
 - **Adult:** IV Diazepam 10 mg stat, if persists Inj. Levetiracetam 500 mg 8 hourly (give as per expert opinion)
 - **Children:** per rectal diazepam: 0.5mg/ kg (maximum 10mg) as stat dose, if persists IV Fosphenytoin 30 ml/kg
 - It can be repeated once again after 10 minutes
 - II. If seizure persists despite above measures, treat as status epilepticus
 - III. If presents with history of convulsion(s): Give maintenance treatment with IV phenobarbitone (Adult: 60 mg BD; Children: 5 mg/ kg/ day BD)

- c. Treatment of raised intracranial pressure (i.e., bradycardia, hypertension, papilledema and deterioration of consciousness)
 - I. Elevation of head to 30° with straight head
 - II. Mannitol
 - **Adult:** 200ml IV running stat and 8 hourly until features of raised ICP resolved or not beyond eight doses of mannitol (check creatinine before this)
 - **Children:** 2.5 - 5 ml/kg over 20 minutes as bolus dose stat and 6 hourly not beyond eight doses of mannitol
- d. Treatment of hypoglycemia (<40 mg/dl or <2.2 mmol/L)
 - **Adult:** 25% glucose-40 ml IV
 - **Children:** 10% glucose 5 ml/kg bolus and can be repeated if necessary
- e. Treatment of Shock:
 - I. 0.9% Normal Saline
 - **Adult:** 1 litre in 1st hour
 - **Children:** 20ml/kg over 20 mins
 - II. Norepinephrine (when needed):
 - **Adult:** 0.05–0.1 microgram/kg/min, titrate gradually to maintain target mean arterial pressure (MAP ≥65 mmHg).
 - **Children:** 0.05–0.1 microgram/kg/min, titrate according to blood pressure response.

6.5 OTHER TREATMENT

- I. Currently, there is no specific treatment for Nipah infection. (Several treatment options are under clinical development, for details please see Annexe 11)
- II. Broad spectrum antibiotics (for aspiration pneumonia/secondary bacterial infection; as per expert physician suggestions)

6.6 CRITERIA FOR TRANSFERRING PATIENT TO ICU

- a. Signs of impending respiratory failure
 - Respiratory rate: Adult: > 30/min Children: > 70/min
 - O₂ saturation < 90%
 - Central cyanosis

despite breathing in Oxygen 5 litres/min through mask.

In children, severe chest indrawing is also important.

- b. Uncontrolled seizures
- c. GCS < 8
- d. Hemodynamic instability (i.e., bradycardia, hypotension and capillary refilling time > seconds)
- e. Multiple organ failure

6.7 CRITERIA FOR REFERRAL TO HIGHER CENTER

It is ideal to manage the patient at the admitting facility if adequate treatment and other necessary services are available there, as transferring patients increases the risk of transmission and further spread. However, if referral becomes necessary due to limitations in resources, the following criteria should be followed when arranging transfer:

1. Deteriorating level of consciousness
2. Uncontrolled convulsion
3. Worsening respiratory distress
4. Uncontrolled haemodynamic instability

Care during transportation of the patient

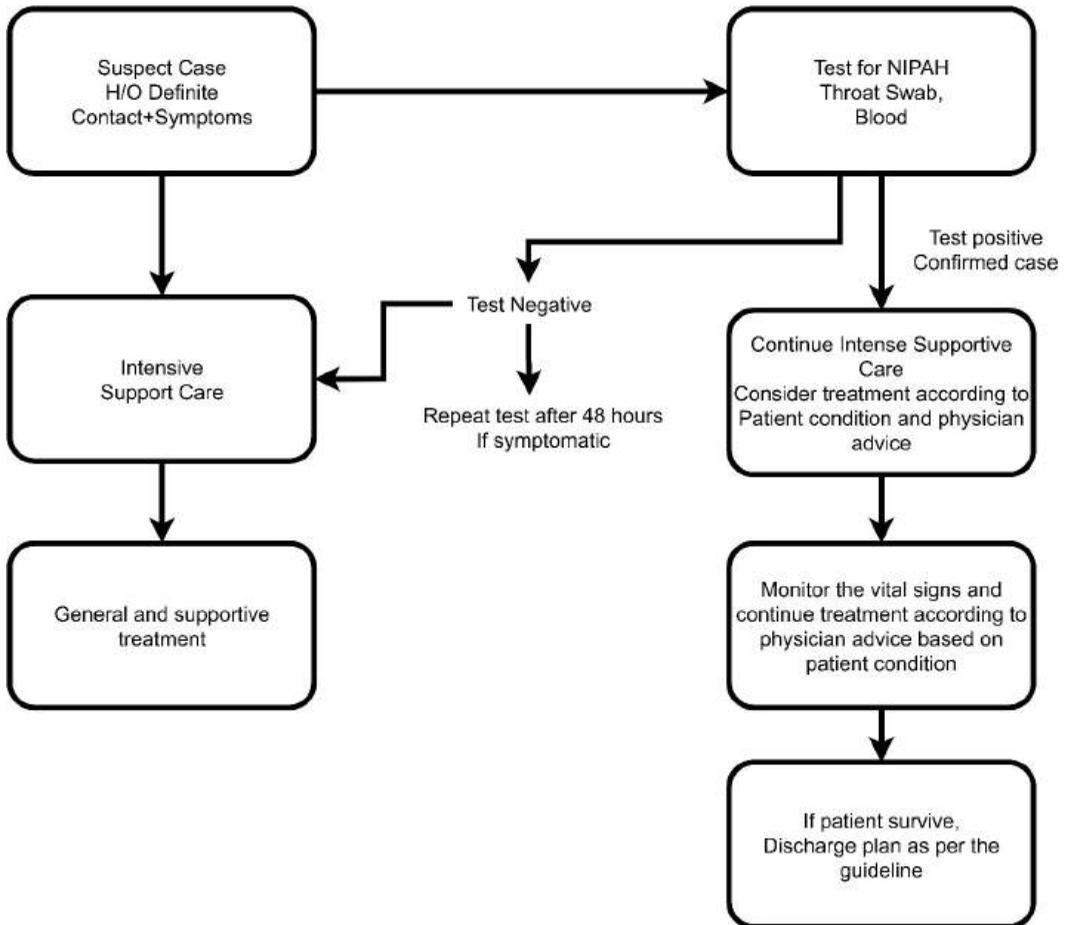
1. Maintaining patent airway
 - lateral position
 - airway suction if required
2. Oxygenation
3. Monitoring during transport
4. Personal protection for the person related to transport

6.8 DISCHARGE CRITERIA

If two consecutive throat swab samples test negative for Nipah virus by RT-PCR and the patient is clinically stable, the treating physician may consider the patient fit for discharge .

Suspected cases kept under isolation must not be discharged before confirmation of a negative result. (To know about the frequency of the test, please see Annexe 7)

6.9 NIPAH PATIENT MANAGEMENT FLOW CHART



PREVENTION AND CONTROL OF NIPAH VIRUS INFECTION

7.1 GOAL

To prevent Nipah virus transmission from:

- Bat or any other suspected source to Human
- Human-to-human, including:
 - Patient to Healthcare worker
 - Patient to Caregiver / Close contact
 - Patient to Other patients (with unrelated illnesses)

7.2 STRATEGIES FOR PREVENTION

1. Community Awareness

- Inform the public about transmission routes and protective practices.

2. Early Case Detection

- Utilize multiple surveillance systems for rapid identification of suspected cases.

3. Case Management

- Prompt isolation, supportive care, and referral as needed.

4. Infection Control Measures

- Household Level: Use personal protective practices during care and handling.
- Community Level: Promote safe cultural practices (e.g., funeral rites) (For details, please see Annexe 10).
- Hospital Level: Ensure strict IPC (Infection Prevention and Control) protocols, PPE usage, and safe waste disposal.

7.3 PREVENTION AND CONTROL

Prevention and control of Nipah transmission depend on addressing the risk factors, and the following approaches should be implemented to prevent and control Nipah transmission in Bangladesh:

7.3.1 Risk Factor 1: Consumption of Raw Date Palm Sap, Tari, Half-eaten fruit and dropped fruit

Approach: Deliver nationwide risk communication messages against the consumption of raw date palm sap all over the year specially from October to April or any outbreak situation whenever required.

At the National Level:

- Mass media campaigns using:
 - Documentary films and TV scroll
 - Radio messages
 - Advertisements
 - Print media (e.g., newspaper)
 - Digital billboard
 - SMS (Govt Info)
 - Leaflets and posters etc.
 - Social media

At the Local Level:

Dissemination of key messages (see Box 1) through:

- a. Person-to-person outreach or group/yard meetings in:
 - Local health administration
 - Local bazaars
 - School grounds
 - NGOs
 - Mosques and other religious centers
 - Political and social bodies
 - Public gatherings
- b. Health Assistants and Field Health Workers, using:
 - Multimedia projectors to present the short documentary
 - Support from the District Information Office
 - Training and refresher training for healthcare worker

Box 1: KEY MESSAGE FOR THE PREVENTION OF NIPAH TRANSMISSION THROUGH CONSUMPTION OF RAW DATE PALM SAP

- Do not drink raw date palm sap
- Do not eat leftover food or dropped fruit and drinks of Nipah patients
- Even protected collection sites (with nets or bamboo covers) are not safe.
- Molasses is safe for consumption.
- Avoid direct contact with bat and bat urine
- Don't eat bat meat

7.3.2 Risk Factor 2: Person-to-Person Transmission of Nipah Virus

Person-to-person transmission of Nipah virus from

- a. Patient to caregiver
- b. Patient to healthcare worker
- c. Touching objects used by patients (utensils, linens, clothes, etc.) or during handling a deceased person

a. Prevention of Transmission from Nipah patient to caregiver

Approach: Immediately disseminate messages as soon as a cluster or outbreak is identified in any area and the awareness sessions.

Social media campaigns using:

- Documentary films and TV scrolls
- Radio messages
- Advertisements
- SMS (Govt Info)
- Leaflets and posters etc.
- Social media could also be utilized to reach a wider audience

Box 2: KEY MESSAGE FOR PREVENTION OF PERSON-TO-PERSON NIPAH TRANSMISSION

- Wash hands thoroughly with soap and water for at least 20 seconds after touching Nipah patients or patient surroundings and whenever recommended (follow hand hygiene protocol for standard precaution)
- Alcohol containing hand sanitizer after contact with the patient (follow hand hygiene protocol for standard precaution).
- Sleep in a separate bed from the patient.
- Maintain a distance of at least two full-stretched arm (2 meter/6 feet) from the patient.
- Keep the patient's personal items separate (clothes, utensils, bedding, etc.).
- Wash used items of the patient separately using soap and water.

b. Prevention of transmission from Nipah patient to the health care worker

Approach 1: Provide message to health care workers at District level and Upazilla level and below before and during Nipah season (see Box 3)

Box 3: KEY MESSAGE FOR PREVENTION OF NIPAH TRANSMISSION AT HOSPITAL SETTING

- Admit all patients presenting with fever and unconsciousness, convulsion, or difficulty in breathing to the designated isolation ward or facility.
- Use mask (preferably N95) and gloves during history taking, physical examination, sample collection, and other care-giving activities for suspected Nipah cases.
- Patients who are under investigation or confirmed to have NiV infection should ideally be isolated in an isolation room– healthcare staff directly involved in patient care should don PPE comprising gowns, gloves, N95 masks and eye protection (face shield/ eye goggles) when attending to these patients.
- Less physical contact with suspected Nipah cases with proper protection.

Follow standard infection prevention and control (IPC) measures, including:

- Hand hygiene: Wash hands thoroughly with soap and water for at least 20 seconds and alcohol containing hand sanitizer after contact with the patient.
- Use of personal protective equipment (PPE)
- Safe handling of patient, equipment and linen

Ensure regular (at least quarterly) and proper training

Box 4: PRECAUTIONS FOR ISOLATION WARD HEALTH CARE WORKER

- Segregate Nipah patients from other patients within the isolation ward.
- Restrict the number of healthcare workers and service providers allowed in the isolation area.
- Maintain a minimum of 1 meter (3 feet)—approximately one fully stretched arm’s length—between patient beds in isolation room.

Additional Infection Control Measures:

- Barrier nursing: Use of PPE and strict isolation.
- Environmental cleaning and decontamination: Routine disinfection of surfaces and patient-care areas
- Safe waste disposal: Proper segregation, handling, and disposal of medical and infectious waste.

Approach 2: Provide instruction to follow infection control practices during provision of care for potential infectious patients on a regular basis.

- Identify suspected, probable, or confirmed Nipah patients and ensure isolation as per guidelines (see Box 4).
- Health care providers must strictly use personal protective equipment (PPE) while providing care to any possible encephalitis case (see Box 5).
- Donning-doffing training will be provided.
- Disposable items used for suspected Nipah cases must be disposed of according to standard infectious waste disposal protocols (see Box 6).
- Reusable items must be properly cleaned and decontaminated before reuse, following standard protocols (see Box 6).

Box 5: PERSONAL PROTECTION DURING CARE FOR NIPAH PATIENTS

Use of Personal Protective Equipment (PPE)

- Ensure availability of PPE all the time.
- During history taking and physical examination:
 - Wear a surgical mask, surgical gloves, and gown.
- During specimen collection and invasive procedures (e.g., nasopharyngeal suction, endotracheal intubation):
 - Wear N95 respirator, surgical gloves, and gown, Face shield/Goggles.

Maintain Hand Hygiene

- Wash hands with soap and running water for at least 20 seconds, and
- Use 1–2 ml of alcohol-based hand sanitizer (containing chlorhexidine or 70% alcohol) after any patient contact.

Use of Disposable Items

- Use disposable items for procedures such as:
 - Nasogastric (NG) tube insertion
 - Oxygen mask
 - Endotracheal intubation
- If disposable items are not available, sterilize reusable items using:
 - Autoclave, or
 - 2% glutaraldehyde solution

Box 6: WASTE DISPOSAL AND DECONTAMINATION PROTOCOLS

Waste Disposal

- Waste should be segregated at the point of generation to enable appropriate and safe handling.
- Keep disposable and non-disposable PPEs/items in separate containers or biohazard bags.
- Place sharp waste in designated rigid containers (e.g., puncture-proof box or bottle).
- Sharp objects (e.g. needles, syringes, glass articles) and tubing that has been in contact with blood or body fluids should be placed inside puncture-resistant waste containers and sealed.
- All solid, non-sharp, infectious waste should be collected using leak-proof waste bags in covered bins.
- Appropriate PPE recommendations should be followed when handling infectious waste
- Decontaminate medical waste using:
 - Autoclaving, or
 - Chemical disinfectants such as sodium hypochlorite (e.g., Clotech)
- Residual clinical specimens (e.g., CSF, blood, throat swabs) from suspected or confirmed Nipah patients must be discarded after chemical disinfection using 1% sodium hypochlorite, and never stored outside designated high-containment facilities.

Environmental Cleaning

- Clean and disinfect patient rooms daily using detergent and sodium hypochlorite, with extra attention to frequently touched surfaces (e.g., doors, windows, tables, door knobs) and practice of non-touch technique.

Decontamination of Reusable Items

- Soak in 0.05%–0.5% bleach or soap/detergent solution for 10–30 minutes.
- Sterilize using autoclave before reuse.

c. During Handling of Deceased Patients (Family/Community Level)

Secretions and excretions from a deceased Nipah patient are potentially as infectious as from a living patient. Therefore, strict precautions must be followed during transportation, washing, and burial/cremation of the body.

Approach: Precautions should be followed while handling the corpse of a suspected Nipah patient.

- Health care workers/mortuary staff should wear PPEs (disposable surgical mask - preferably N95, gloves and gown, face shield/goggles) while handling corpse of Nipah case
- The handling of human remains should be kept to a minimum (e.g. specimen collection, transport or burial of the body).
- Specimen collection from deceased and/or post-mortem of patient remains should be limited to essential evaluations only and should be performed by a trained person.
- IPC and safe-burial recommendations should be adhered to in principle, but may need to be adapted to consider cultural and religious concerns (e.g. discussion with religious leader/local chief or equivalent about their practices and adaptations to ensure that the greatest respect is given to removal and disposal of the deceased).
- On the management of deceased bodies of suspect or confirmed cases of NiV, the handling of the body should be kept to a minimum. The ward/hospital staff should ensure the following:
 - Ensure the body is double-bagged in sealed and leak-proof heavy-duty plastic cadaveric body bags before the body is taken out of the isolation room.
 - The surface of each body bag is wiped down with a suitable disinfectant (e.g. bleach), sealed and affixed with a 'biohazard' label. Hand washing with soap and water and rub hands with alcohol containing hand sanitizer, should be done immediately after handling the corpse
- Used PPE should be disposed of using standard protocol for infectious waste disposal (see Box 6)
- Healthcare worker should provide message to family members/community personnel/transport driver and persons accompanying of the deceased person (dead by Nipah infection) to follow precautions during transportation and handling of the deceased from the hospital to the community (See Box 7 & Annexe 10)
- The health authority should counsel/instruct the ambulance driver and family members during discharge or transfer to a higher center regarding personal protection and IPC measures.

Box 7: KEY MESSAGE FOR PREVENTION OF NIPAH TRANSMISSION FROM DECEASED BODY TO PERSON

For Family Members and Community Caregivers

- Avoid close contact with the face or respiratory secretions of the deceased during transportation or grief rituals.
- Cover your own face with a cloth or scarf while participating in the washing/ritual bathing of the body.
- Individuals who will conduct the handling of the body and the burial are wearing the recommended PPE and are working in an environment where they can follow safe procedures for putting on and taking off PPE.
- Cleaners/hygienist⁴ and mortuary/burial worker⁵ should wear the same PPE recommended for other health and care givers, with the exception that 1) the outer pair of gloves should be heavy duty (utility) gloves, 2) aprons should be heavy duty, and 3) their shoes should be waterproof boots. Wash hands thoroughly with soap after handling the body. If possible, take a full-body bath with soap.

Handling Reusable Items of the Deceased

- Wash all reusable items (clothing, utensils) with soap or detergent.
- Expose bedding materials such as mattresses, quilts, and pillows to direct sunlight for three consecutive days.

⁴ Cleaners/hygienists include health and care workers handling linens or waste, cleaning the environment.

⁵ Mortuary/burial workers include health and care workers involved in handling dead bodies.

NATIONAL NIPAH SURVEILLANCE SYSTEM

Since 2006, the Institute of Epidemiology, Disease Control and Research (IEDCR), in collaboration with icddr,b, has established a human NiV surveillance system in selected district-level government hospitals where previous outbreaks had occurred.

8.1 CURRENT NIPAH SURVEILLANCE SYSTEMS

In Bangladesh, the Nipah surveillance system includes:

- Active Surveillance in 13 tertiary care hospitals, including facilities serving the Forcibly Displaced Myanmar Nationals (FDMN)
- Passive Surveillance in 2 district hospitals and Infectious Diseases Hospital (IDH), Dhaka
- Enhanced Surveillance in over 500 healthcare facilities across the country
- Event-Based Surveillance (EBS) operating 24/7 to monitor and respond to potential Nipah-related events in real-time

8.2 OBJECTIVES OF SURVEILLANCE

- To detect cases of human Nipah infection
- Outbreak response and mitigation
- To characterize pathogenesis and viral shedding of Nipah patients and compare these characteristics between primary and secondary cases
- To raise awareness for personal protection and infection control
- Long-term follow-up of the Nipah survivors to detect relapse of Nipah encephalitis and monitor sequelae

8.3 SURVEILLANCE ACTIVITY

8.3.1 Active Surveillance

The ongoing active surveillance system for Nipah virus infection in Bangladesh is jointly implemented by the Institute of Epidemiology, Disease Control and Research (IEDCR) and icddr,b. It functions at the field level through the deployment of two key personnel: field assistants and surveillance physicians.

Field Assistants are responsible for screening all admitted patients who present with encephalitis, fever with altered mental status, or severe respiratory illness. Screening is conducted using the

national suspected Nipah virus case definitions. Field assistants also collect clinical specimens following established biosafety procedures.

Surveillance Physicians verify suspected cases, obtain informed consent from patients or attendants, and document clinical and epidemiological information in standardized case investigation forms. They coordinate closely with surveillance activities and outbreak follow-up when necessary.

This active surveillance system operates year-round to support early detection and rapid response, with increased vigilance during the high-risk season from December to April.

These sites are selected based on historical outbreak trends, geographic representation of risk areas, and institutional readiness to support integrated surveillance activities [17,27].

Current Active Surveillance Sites

Sl. No.	Name of the hospitals	Location	Surveillance initiation year
1	Faridpur Medical College Hospital (FMCH)	Faridpur	March 2006
2	Rajshahi Medical College Hospital (RMCH)	Rajshahi	February 2006
3	Rangpur Medical College Hospital (RpMCH)	Rangpur	February 2006
4	Chattogram Medical College Hospital (CMCH)	Chattogram	December 2018
5	Khulna Medical College Hospital (KMCH)	Khulna	December 2018
6	Sher-E-Bangla Medical College Hospital (SBMCH)	Barishal	December 2020
7	Mymensingh Medical College Hospital (MMCH)	Mymensingh	December 2020
8	Sylhet M.A.G Osmani Medical College Hospital (SOMCH)	Sylhet	January 2021
9	Cox's Bazar Medical College Hospital (CoxMCH)	Cox's Bazar	August 2023
10	Dinajpur Medical College Hospital (DJMCH)	Dinajpur	October 2023
11	Shaheed Ziaur Rahman Medical College Hospital (SZMCH)	Bogura	June 2024
12	Jashore Medical College Hospital (JMCH)	Jashore	March 2024
13	Dhaka Medical College Hospital (DMCH)	Dhaka	January 2026

8.3.2 Passive Surveillance

Passive surveillance is the system where routine reporting of suspected cases of Nipah virus infection is carried out by designated healthcare facilities based on clinical suspicion and established case definitions.

Currently, passive surveillance is conducted at Rajbari General Hospital (RGH), Tangail Sadar Hospital (TSH), and the Infectious Diseases Hospital (IDH). At these facilities, designated healthcare providers report suspected Nipah virus cases to icddr,b or IEDCR using standardized reporting forms and established communication channels. These facilities are located in regions with a history of Nipah outbreaks or a high risk of spillover events due to ecological and behavioural risk factors [17,27].

8.3.3 Enhanced Surveillance

Enhanced surveillance aims to increase the sensitivity of detecting suspected Nipah cases. From December to April, surveillance activities are extended to sub-district level government and private healthcare facilities located near sentinel surveillance sites, particularly in areas with ecological risk, previous outbreak history, or potential for rapid disease transmission.

In 2025, enhanced Nipah surveillance is being conducted in over 550 healthcare facilities across Bangladesh. These facilities include upazila health complexes, district hospitals, medical college hospitals, private hospitals, clinics and referral centers located in both high-risk and sentinel districts [17, 27].

8.3.4 Event-Based Surveillance (EBS)

Event-Based Surveillance (EBS) is a 24/7 system operated by IEDCR and icddr,b throughout the year to detect and respond to unusual health events that may indicate Nipah virus infection. It collects unstructured reports from hospitals, media, communities, and local health workers.

When a suspected event is reported, IEDCR and icddr,b verify the information and initiate rapid investigation if needed. EBS is especially valuable in identifying cases in areas not covered by routine surveillance and supports early outbreak detection and response.

Contact no.:  **10655** (IEDCR hotline), **+8801907801856** (IEDCR) or **+8801304068800** (icddr,b)

[Nipah virus outbreak investigation]⁶

⁶ [*** For detailed procedures and protocols regarding outbreak investigation, please refer to the “Nipah Outbreak Investigation Standard Operating Procedure (SOP)” developed by IEDCR and icddr,b. This SOP outlines step-by-step guidance on case confirmation, field investigation, contact tracing, sample collection, and intersectoral coordination during suspected or confirmed Nipah virus outbreaks ***]

RISK COMMUNICATION AND COMMUNITY ENGAGEMENT (RCCE)

Effective risk communication and community engagement (RCCE) are essential components of Nipah virus infection management, as well as outbreak preparedness and response. Timely, transparent, and culturally appropriate communication helps to build public trust, reduces fear and misinformation, and encourages safe practices such as avoiding raw date palm sap and promptly reporting symptoms. Active community engagement also strengthens surveillance, contact tracing, early detection, and quick patient management.

9.1 RISK COMMUNICATION

Risk communication is an essential component of Nipah virus outbreak management in Bangladesh, where community beliefs, traditional practices, and misinformation can strongly influence disease transmission and response efforts. Timely, transparent, and culturally appropriate communication helps build public trust, reduce fear and stigma, and encourage safe behaviors such as avoiding raw date palm sap and maintaining infection prevention measures. Engaging trusted local figures, such as religious leaders, teachers, and community volunteers ensures that accurate information reaches affected populations through credible sources. Structured risk communication will enhance community cooperation, improve case reporting, counter misinformation, and ultimately strengthen outbreak control and prevention efforts.

For effective risk communication during a Nipah outbreak response, the approved resources (shown in the attached materials) should be distributed among community members. In addition, it is important to establish a clear communication steps (outlined below) to guide discussions and ensure consistency during meetings. Following these guidelines, supplementary communication materials should also be developed with updated information, which can further support community engagement and strengthen the communication process.

9.2 HEALTH MESSAGE

সম্ভাব্য এনকেফালাইটিস রোগীর ক্ষেত্রে করণীয়:
(আইইডিসিআর এবং আইসিডিডিআর,বি)

যদি কোন রোগীর,
জ্বর (তাপমাত্রা) ১০১.৩ ডিগ্রী ফারেনহাইটের অথবা ৩৮.৫ ডিগ্রী সেন্টিগ্রেডের বেশি
এবং
শিউলি অথবা অজ্ঞান অথবা মানসিক অবস্থার পরিবর্তন (আবোল-তাবোল/চুল বলা)
ইত্যাদি থাকে তবে-

চিকিৎসা সংক্রান্ত ব্যবস্থাপনা হাসপাতালের নিয়মানুযায়ী প্রদান করুন এবং এনকেফালাইটিস কেইসের ব্যাপারে (কেইস নোটিফিকেশন) ডাক্তার/নার্স গণ- জরুরী ভিত্তিতে নিম্নলিখিত মোবাইল নাম্বারে অবহিত করুন।

যোগাযোগ এর নাম্বার সমূহ:

১. ০১৯০৭৮০১৮৫৬ (আইইডিসিআর)
২. ০১৩০৪০৬৮৮০০ (আইসিডিডিআর,বি)

Logos for icddr,b, CDC, and CEPI are at the bottom.

9.3 COMMUNITY ENGAGEMENT

Community engagement is crucial for the prevention and control of NIV infections in Bangladesh. As most transmission occurs through community practices such as consuming raw date palm sap and caregiving of patients, active involvement of communities helps promote safer behaviors. Engagement also builds trust, reduces stigma, and ensures timely sharing of accurate information. Sustained community participation beyond outbreak periods strengthens preparedness and makes preventive practices more sustainable.

Type of Engagement	Activities	Responsible Authorities	Purpose
Seasonal (Dec-April)	<ul style="list-style-type: none"> Community meetings considering different occupations and aged groups, including date palm sap harvesters specially Public Service announcement through miking and local channels. Use the digital platform for message and distribution of posters, leaflets before & during winter 	<ul style="list-style-type: none"> Local health authority and administration Community key persons, including Local NGOs and other stakeholders 	<ul style="list-style-type: none"> To reduce risk behaviours during the peak Nipah virus transmission season

Type of Engagement	Activities	Responsible Authorities	Purpose
Year round	<ul style="list-style-type: none"> • School/college health education sessions • Training health workers on risk communication & surveillance • Use of TV, radio & social media for continuous messaging 	<ul style="list-style-type: none"> • Disease control of DGHS/IEDCR • Local health workers (HA, FWA, CHCPs) • Teachers • Media professionals • Local government representatives 	<ul style="list-style-type: none"> • To sustain knowledge, build trust, and maintain preparedness
Outbreak based	<ul style="list-style-type: none"> • Engagement with religious/ community leaders for investigation as well as community sensitization. • Community meetings to counter rumours & stigma • Reinforce safe caregiving and burial practices 	<ul style="list-style-type: none"> • Outbreak response teams from IEDCR, icddr,b • Civil Surgeon's office • Local health officials & CHCPs • Community/ religious leaders Law enforcement & local govt. (if needed) 	<ul style="list-style-type: none"> • To control panic, ensure compliance, and break transmission

INTERSECTORAL COORDINATION AND ONE HEALTH APPROACH

To effectively prevent and control the NiV infections, a multi-sectoral approach involving health, livestock, environment, agriculture, local administration, as well as local & international partners are ongoing. By ensuring joint planning and execution, preparedness and outbreak responses can secure timely case detection, thorough risk assessment, and rapid, coordinated action at human and animal interfaces.

Media sensitization meetings before the Nipah season are conducted regularly to make people aware of potential risk factors. Awareness messages disseminated through social media on avoiding the consumption of raw date palm is an effective way to spread awareness. A coordinated One Health approach built upon continuous collaboration, planning and information sharing is pivotal for a successful outbreak response.

ANNEXURES

ANNEXE 1A: GLASGOW COMA SCALE (ADULTS)

(source: <https://biologydictionary.net/glasgow-coma-scale/>)

Behaviour	Response
Eye Opening Response 	4. Spontaneously 3. To speech 2. To pain 1. No response
Verbal Response 	5. Oriented to time, person and place 4. Confused 3. Inappropriate words 2. Incomprehensible sounds 1. No response
Motor Response 	6. Obeys command 5. Moves to localised pain 4. Flex to withdraw from pain 3. Abnormal flexion 2. Abnormal extension 1. No response

ANNEXE 1B: MODIFIED GLASGOW COMA SCALE FOR INFANTS AND CHILDREN

Modified Glasgow Coma Scale for Infants and Children

Type of Engagement	Activities	Responsible Authorities	Purpose
Eye opening	Spontaneous	Spontaneous	4
	To speech	To speech	3
	To pain only	To pain only	2
	No response	No response	1
Best verbal response	Oriented, appropriate	Coos and babbles	5
	Confused	Irritable cries	4
	Inappropriate words	Cries to pain	3
	Incomprehensible sounds	Moans to pain	2
	No response	No response	1

Type of Engagement	Activities	Responsible Authorities	Purpose
Best motor response*	Obeys commands	Moves spontaneously and purposefully	6
	Localizes painful stimulus	Withdraws to touch	5
	Withdraws in response to pain	Withdraws to response in pain	4
	Flexion in response to pain	Abnormal flexion posture to pain	3
	Extension in response to pain	Abnormal extension posture to pain	2
	No response	No response	1

*If patient is intubated, unconscious, or preverbal, the most important part of this scale is motor response. Motor response should be carefully evaluated.

Interpretation

- Score ≤ 12 suggests a severe head injury.
- Score ≤ 8 suggests the possible need for intubation and ventilation as well as the need for intracranial pressure monitoring.

** If the patient is intubated, unconscious, or preverbal, the most important part of this scale is motor response. This section should be carefully evaluated.

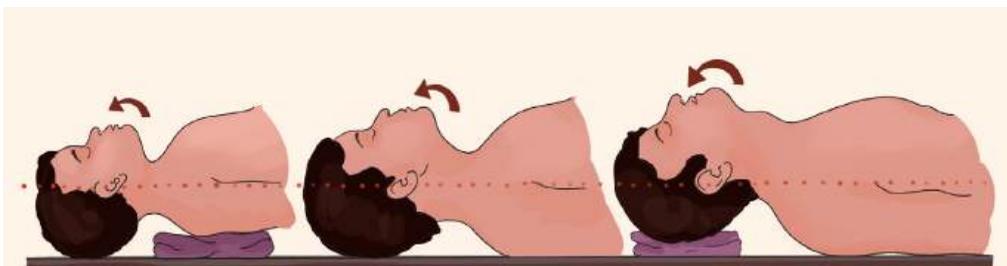
(source: <https://www.msmanuals.com/professional/multimedia/table/modified-glasgow-coma-scale-for-infants-and-children>)

ANNEXE 2: RESUSCITATION THROUGH ABC MANAGEMENT

This protocol is aligned with current international guidelines for resuscitation and emergency support. It uses the ABC sequence: Airway, Breathing, Circulation, to maintain vital functions in acutely unwell patients.

A-Airway (oral cavity, nostrils)

- Open the airway using the Head Tilt–Chin Lift maneuver (head and neck gently extended, chin–jaw line perpendicular to the floor), or insert an appropriate airway adjunct if needed.



- II. Clear the airway of secretions or vomit using a suction device (closed circuit preferred) or a manual suction bulb.
- III. Place the patient in the recovery position, orienting the mouth downward to facilitate fluid drainage and maintain an open airway.

Recovery position



- IV. Endotracheal intubation is performed if the patient is unable to protect the airway or if advanced airway management is otherwise indicated.

B-Breathing

- I. Assess breathing by observing:
 - a. Respiratory rate (Adults >25/min, Children ≥12 months: ≥40/min)
 - b. Oxygen saturation (SpO_2 <90% on room air)
 - c. Signs such as flaring of the nostrils and chest wall movement
- II. Administer oxygen:
 - Via face mask at ≥5 L/min or nasal cannula (1–2 L/min)
- III. In cases of impending respiratory failure, support ventilation with a bag-and-mask or proceed to intubation and mechanical ventilation.

C-Circulation

- I. Assess circulation - pulse rate, blood pressure, capillary refill time, cardiovascular examination
- II. Establish an intravenous (IV) line and infuse crystalloid fluid if required
- III. If the patient is in shock (hypotension and with low capillary refill time, then s/he will be managed with-
 - a. IV Normal saline (20 ml/kg) bolus rapidly, then reassess and if no improvement, repeat
 - b. Norepinephrine (noradrenaline) infusion (0.05–0.1 microgram/kg/min), if hypotension persists despite adequate fluids.
 - c. Dopamine (5–20 microgram/kg/min) may be considered only if norepinephrine is unavailable.

ANNEXE 3: CLUSTER DEFINITION AND IDENTIFICATION

DEFINITION OF CLUSTER

Suspected cluster of Nipah infection

A group of individuals with suspected Nipah infection will be classified as a suspected cluster based on the following criteria:

- May to November (outside Nipah season):
Three or more individuals with suspected Nipah infection who live within a 30-minute walk or 3 km air distance of each other and develop symptoms consistent with Nipah infection within 28 days of each other.
- December to April (during Nipah season):
Two or more individuals with suspected Nipah infection who live within a 30-minute walk or 3 km air distance of each other and develop symptoms consistent with Nipah infection within 28 days of each other.

Contact of a Nipah case

A contact of a confirmed or probable Nipah case is defined as any individual who, following the symptom onset of the case:

- Reports direct physical contact with the patient without protection, or
- Was in close proximity to the patient without protection, or
- Stayed in the same room, veranda, or vehicle as the Nipah case.

Close contact/high risk contact of a Nipah case

A close contact or high-risk contact of a confirmed or probable Nipah case is defined as any individual who, following the symptom onset of the case:

- Reports direct physical contact with the patient without protection, or
- Was exposed to the bodily fluids (e.g., saliva, respiratory droplets, blood, urine, feces, vomit) of the patient, or
- Was in close proximity to the patient (less than one full-stretched arm distance or 3 feet/1 meter) without protection, or
- Stayed in the same room, veranda, or vehicle as the patient for at least 15 minutes.

Same source exposure

An individual is considered to have same source exposure if they report consuming raw date palm sap from the same source (sap from the same date palm tree) that is suspected to be the origin of infection for the confirmed or probable Nipah case.

ANNEXE 4: DETAILS OF NIPAH INFECTION SURVIVOR

Definition

Trait*	Description
A. Symptomatic evaluation, contact history, or presence in a Nipah virus outbreak area	Known history of fever (>38.5°C) with new onset of altered mental status or new onset of breathing difficulty corresponding to a Nipah virus outbreak or a confirmed NiV case detected by surveillance [47]
	Contact with a known patient infected by NiV
	Presence in an area known to be affected by NiV at time of a known outbreak
B. Laboratory Confirmation	Positive NiV RT-PCR on any patient specimen
	Positive NiV IgM or IgG antibodies to NiV, through ELISA
	CSF testing positive for NiV at CDC, Atlanta

*An individual was considered a Nipah infection survivor only if the individual matched one criterion under trait “A” and one under trait “B” and, if the individual has survived the acute infection

Why follow-up is necessary

- NiV infection leaves a prolonged clinical footprint, with survival often followed by persistent sequelae, underscoring the need for systematic, long-term follow-up of survivors.
- Long-term follow-ups are recommended in viral encephalitis surveillance guidelines from other countries (e.g., CDC protocols for arboviral encephalitis and WHO guidance on Japanese encephalitis, US CDC’s Ebola survivors follow-up). Routine follow-up facilitates early detection of complications and timely intervention, which may reduce long-term outcomes and improve quality of life.
- In Malaysia and Singapore, long-term sequelae have been reported in Nipah survivors, including persistent fatigue, neurological deficits, and relapse encephalitis [48].
- In Bangladesh, findings from a recent publication, involving 52 adult Nipah virus survivors, revealed a substantial burden of long-term sequelae. Survivors reported a wide range of persistent symptoms, including sleep disturbances, gait issues, memory and concentration difficulties, myoclonus, and chronic fatigue. Functional assessments demonstrated high levels of disability, particularly in anxiety, mobility, and cognitive domains, with nearly two-thirds experiencing at least one form of disability and almost half suffering from multiple domain impairments. These outcomes indicate a more severe and prolonged post-infection impact compared to survivors from Malaysia and Singapore, underscoring the urgent need for comprehensive, context-specific survivor care and rehabilitation services in Bangladesh.

Investigation of Suspected Relapse

If a survivor presents with symptoms suggestive of encephalitis, the following evaluations can be conducted:

- Hospital admission for monitoring and management
- Neurological examination by a qualified specialist
- Neuroimaging (MRI brain) to detect inflammatory or structural lesions
- Laboratory testing:
 - Nipah virus IgG titers to assess immune response
 - qRT-PCR testing on relevant specimens to rule out active infection
 - Differential diagnosis to exclude other possible causes such as stroke, hypoglycemia, or meningitis

ANNEXE 5: NIPAH CASE FATALITY IN BANGLADESH

Year	Total case	Alive	Death	Case fatality ratio (%)
2001	13	4	9	69
2003	12	4	8	67
2004	67	17	50	75
2005	12	1	11	92
2007	18	9	9	50
2008	11	4	7	64
2009	4	3	1	25
2010	18	2	16	89
2011	43	6	37	86
2012	18	5	13	72
2013	31	6	25	81
2014	36	21	15	42
2015	15	4	11	73
2017	3	1	2	67
2018	4	2	2	50
2019	8	1	7	88
2020	7	2	5	71
2021	2	2	0	0
2022	3	1	2	67
2023	13	3	10	77
2024	5	0	5	100
2025	4	0	4	100
Grand Total	347	98	249	72

*** (There were no detected cases in 2002, 2006 and 2016)

ANNEXE 6: TOTAL NIPAH CASES IN BANGLADESH

Districts	2001	2003	2004	2005	2007	2008	2009	2010	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022	2023	2024	2025	Grand Total
Bhola																						1	1
Bogura									1						2								3
Chapainawabgonj												1										1	1
Chuadanga												1										1	2
Cumilla									1														1
Dhaka			1																				1
Dinejpur				1					6	1		1											9
Faridpur			37		1	1	12			1	1	8	3	2	1		5						71
Gaibandha										1													1
Gopalganj			1				2			1	1	1	1				1						8
Jhalakathi																	1						1
Jhenaidah											1	1											2
Joypurhat			4							6													10
Khulna												1									1		2
Kurigram							1				1		1										3
Kushtia					8		1				2	1									1		12
Lalmonirhat									23	1													24
Madaripur							1					3	2										6
Magura											1	4	1										6
Manikganj			6								7										2		19
Meherpur	13																						13
Mymensingh											2												2
Naogaon		12	2		1						3	1	4			1		1	2	5	1	1	34
Narsingdi																							1
Natore			1		1					1	2	1	1			1							9
Nilphamari							1		1		3	1											6
Narail												1											1
Pabna											2											1	6
Panchagarh												1											1
Rajbari			14		6	1	1	1	3	1	2	1	1					1	1	4			35
Rajshahi										4	2	3	1			1							13
Rangpur			1			1			9	1	4												16
Shariatpur												2									1		3
Tangail				12																			12
Thakurgaon					7																		12
Grand Total	13	12	67	12	18	11	4	18	43	18	31	36	15	3	4	8	7	2	3	13	5	4	347

ANNEXE 7: SAMPLE COLLECTION PROTOCOL

1. General Principles

- All procedures must be performed by trained personnel using full PPE (gloves, impermeable gown/coverall, N95 respirator or higher, face shield/goggles, boots).
- Limit the number of staff involved in specimen collection and handling.
- Maintain a log of all specimens collected, including date, time, collector's name, and patient identifiers.

2. Specimen Types

Type of specimen	Processing	Storage
Blood	Centrifuge	In the form of raw serum (ELISA) and in lysis buffer (RT-PCR)
Oral or Oropharyngeal Swab	No processing	In Lysis buffer (RT-PCR) and in VTM
CSF	No processing	Raw
Breast Milk	No processing	In Lysis buffer, Raw and VTM
Urine	No processing	In Lysis buffer, Raw and VTM

3. Frequency of Specimen Collection:

- For suspected NiV cases specimen will be collected at the time of enrollment. If the 1st specimen is negative for NiV, No further specimens will be collected.
- For confirmed NiV cases, specimens will be collected daily until 2 consecutive oral swab specimens are negative for Nipah virus. However, the frequency of specimen collection will depend on resource availability, patient condition and physician recommendation.

4. Infection Prevention and Control (IPC) Measures

- Perform hand hygiene before donning and after doffing PPE.
- Use disposable equipment where possible. If reusable, decontaminate immediately after use (0.5% sodium hypochlorite or autoclaving).
- Avoid sharps whenever possible. If sharps are used, dispose immediately in puncture-proof sharps containers.
- Decontaminate spills immediately with 1% sodium hypochlorite, leave for 30 minutes, then clean.

5. Packaging and Labelling

- Apply the triple packaging system:
- Primary container: Leak-proof tube/vial with secure cap, disinfected externally with 1% sodium hypochlorite.

- Secondary container: Sealed, durable, leak-proof container with absorbent material.
- Outer container: Rigid transport box.
- Clearly label with patient ID, type of specimen, date/time of collection, and “Suspected/ Confirmed Nipah virus”.
- Include a completed laboratory request form in a waterproof pouch, separate from specimens.

6. Transport

- Transport specimens to designated reference laboratory as soon as possible.
- Porters must be trained in handling infectious substances and wear appropriate PPE when loading/unloading.
- If delay is unavoidable, store specimens at 2–8 °C in a secured, access-controlled refrigerator

7. Residual Samples and Waste Disposal

- After any diagnostic use, residual samples must be discarded after disinfection with 1% sodium hypochlorite or autoclaving.
- Specimens must not be stored outside designated high-containment laboratories.

All waste generated during collection and packaging must be treated as infectious and decontaminated before disposal.

ANNEXE 8: HAND WASHING PICTOGRAM

How to Handwash?

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

 Duration of the entire procedure: 40-60 seconds



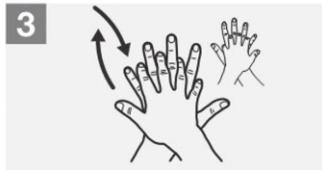
Wet hands with water;



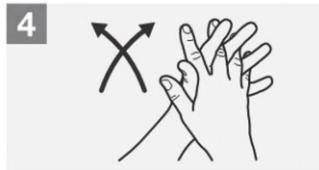
Apply enough soap to cover all hand surface;



Rub hands palm to palm;



Right palm over left dorsum with interlaced fingers and vice versa;



Palm to palm with fingers interlaced;



Backs of fingers to opposing palms with fingers interlocked;



Rotational rubbing of left thumb clasped in right palm and vice versa;



Rotational rubbing, backwards and forwards with clasped fingers or right hand in left palm and vice versa;



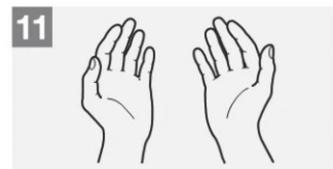
Rinse hands with water;



Dry hands thoroughly with a single use towel;



Use towel to turn off faucet;



Your hands are now safe;

ANNEXE 9: HOW TO PREPARE 0.5% HYPOCHLORITE SOLUTION

জীবানুনাশক দ্রবণ (Antiseptic Solution) তৈরির নিয়ম

ব্লিচ ব্যবহার করে

ব্লিচ বাজারে ক্লোটেক (Chlotech), ক্লোরক্স ও ক্লোরেক্স ইত্যাদি নামে পাওয়া যায়। ব্লিচ ব্যবহার করে জীবানুনাশক দ্রবণ তৈরির পদ্ধতি হলোঃ

অধিক মাত্রার সংক্রামক জীবানুনাশক দ্রবণঃ (হাসপাতাল বর্জ্য বা আক্রান্ত মৃতদেহ)



স্বল্প মাত্রার সংক্রামক জীবানুনাশক দ্রবণঃ (সাধারণ গৃহস্থালি পরিষ্কারের কাজে)



ব্লিচিং পাউডার ব্যবহার

ব্লিচিং পাউডার বাজারে পাউডার বা গুঁড়া হিসেবে পাওয়া যায়। ব্লিচিং পাউডার দিয়ে দুইরকমের জীবানুনাশক দ্রবণ তৈরি করা যায়। একটি বেশী ঘনত্বের ১:১০ ঘনত্বের যা দ্বারা অধিক সংক্রামক বর্জ্য, হাসপাতালের বর্জ্য, আক্রান্ত মৃতদেহ ইত্যাদি জীবানুমুক্ত করা হয়। আরেকটি ১:১০০ ঘনত্বের দ্রবণ যা সাধারণ পরিষ্কারের কাজ যেমন আসবাবপত্র, যন্ত্রাংশ, ফ্লোর, গাড়ী ইত্যাদি জীবানুমুক্ত করতে ব্যবহৃত হয়।

১:১০ ঘনত্বের দ্রবণ তৈরিঃ



১:১০০ ঘনত্বের দ্রবণ তৈরিঃ



*এই মিশ্রণটি দৈনন্দিন পরিচ্ছন্নতার কাজে ব্যবহারযোগ্য। পানযোগ্য নহে। রান্না বা সংশ্লিষ্ট কাজে অব্যবহারযোগ্য। শিশুদের হাতের নাগালের বাইরে রাখুন।

ANNEXE 10: HOW TO WASH THE BODY OF DECEASED (IN BENGALI)

দাফন/সৎকার কাজ ব্যবস্থাপনা করার দল

১. চার সদস্য বিশিষ্ট একটি দল সম্পূর্ণ সুরক্ষা পোশাক পরিধানপূর্বক [১ জোড়া ডিজপোজেবল হাতের গ্লাভস, ১ জোড়া হেভি ডিউটি গ্লাভস, ডিজপোজেবল কাভার অল সুট, অভেদ্য প্লাস্টিক অ্যাপ্রোন, ফেস প্রোটেকশন (গগলস এবং মাস্ক), রাবারের তৈরী জুতা যা পানি ও ছিদ্র প্রতিরোধী এবং ওভারসুজ] মৃতদেহকে সৎকার/ দাফনের জন্য প্রস্তুত এবং বহন করবে।
২. সম্পূর্ণ সুরক্ষা পোশাক পরিধানপূর্বক ১ জন সদস্য জীবাণুনাশক কার্যক্রমে যুক্ত থাকবে।
৩. সংক্রমণ নিয়ন্ত্রণ প্রক্রিয়াটি একজন কারিগরী পরিদর্শক তত্ত্বাবধায়ন করবে। তার সম্পূর্ণ সুরক্ষা পোশাক পরিধান করার প্রয়োজন নেই।
৪. একজন সদস্য যোগাযোগকারী হিসেবে মৃতব্যক্তির পরিবারের সাথে যোগাযোগ করবে। পৃথক যোগাযোগকারীর অভাব থাকলে কারিগরী পরিদর্শক পরিবারের সাথে যোগাযোগ করার দায়িত্ব পালন করবে।
৫. একজন ধর্মীয় প্রতিনিধি থাকবেন যার সম্পূর্ণ সুরক্ষা পোশাক পরিধানের প্রয়োজন নেই। দলে নির্দিষ্ট ধর্মীয় প্রতিনিধি না থাকলে স্থানীয় পর্যায়ে একজনকে এই কাজের জন্য নির্বাচিত করতে হবে।

৬. সৎকার/দাফন কাজ ব্যবস্থাপনা করার দলের সকল সদস্যকে (কারিগরী পরিদর্শকসহ) তাদের নিজ দায়িত্ব ও কর্তব্য সম্পর্কে পরিষ্কার ধারণা থাকতে হবে।
৭. মহিলা রোগীর মৃতদেহের দাফন/সৎকারের ক্ষেত্রে দলে একজন মহিলা অবশ্যই অন্তর্ভুক্ত থাকতে হবে।

মৃতদেহের ব্যবস্থা প্রক্রিয়া

১. মৃতদেহের সাথে সংযুক্ত সকল টিউব (intravenous lines, endotracheal tubes), ক্যাথেটার ইত্যাদি যদি থাকে সেগুলো সরিয়ে ফেলতে হবে।
২. সংক্রমন নিয়ন্ত্রণের সকল প্রক্রিয়া পালন করে সংযুক্ত দ্রব্যাদির নিষ্পত্তি করতে হবে।
৩. অনিয়ন্ত্রিতভাবে মৃতদেহ পরিষ্কার বা ধোয়া যাবে না।
৪. মৃতদেহের সৎকারের জন্য মৃতদেহের সকল ছিদ্রপথ (যেমনঃ নাক, কান, পায়ুপথ ইত্যাদি) তুলা দিয়ে ভাল করে বন্ধ করে দিতে হবে যেন কোনো তরল গড়িয়ে বের হতে না পারে। মৃত্যুর স্থানেই মৃতদেহটিকে প্লাস্টিকের কভার দিয়ে মুড়িয়ে রাখতে হবে। মুসলমানদের জন্য সাদা মৃতদেহবহনকারী ব্যাগ ব্যবহার করতে হবে।
৫. মৃতদেহটিকে প্লাস্টিকের কভার দিয়ে এমনভাবে মুড়িয়ে রাখতে হবে যেন তা কভারের বাইরের সংস্পর্শে না আসে।
৬. যদি সুরক্ষা পোশাক এবং গ্লাভস রোগীর বডি ফুইড দ্বারা সংক্রমিত হয় তা পরিবর্তন করে ফেলতে হবে।
৭. কাফনের কাপড়ের জন্য অনুরোধ থাকলে একটি সেলাইবিহীন সাদা সুতির কাপড় কাফনের কাপড় হিসেবে ব্যবহার করতে হবে। একটি সেলাইবিহীন সাদা সুতির কাপড়টি একটি খোলা প্লাস্টিকের বডি ব্যাগের উপরে রাখতে হবে। প্লাস্টিকটি ১৫০ মাইক্রোমিটার এর কম হওয়া যাবে না। সম্পূর্ণ সুরক্ষা পোশাক পরিধানপূর্বক মৃতদেহটি উঠু করে কাফনের কাপড়ের উপরে রাখতে হবে। একই কাপড় থেকে তিনটি ছোট অংশ কেটে কাফনটি বেধে দিতে হবে-প্রথমটি মাথার উপরে, ১টি পায়ের নিচে এবং আরেকটি শরীরের মাঝামাঝি অংশে বেধে দিতে হবে।
৮. কাফনের পরে, যত দ্রুত সম্ভব মৃতদেহটি জিপার/চেইন যুক্ত ব্যাগ-এ ভরে বন্ধ করতে হবে।
৯. অত্যাধিক সংক্রামক পদার্থের ইঙ্গিতসহ সিল এবং লেবেল করতে হবে।
১০. মৃতদেহ মোড়ানো শেষ করে এবং সমাধিস্থলে যাওয়ার পূর্বে সংশ্লিষ্ট ধর্মীয় রীতিঅনুসারে জানায়া/অন্ত্যষ্টিক্রিয়া সম্পন্ন করুন।
১১. যত দ্রুত সম্ভব মৃতদেহের ব্যাগটি পূর্ব নির্ধারিত সমাধিস্থলে সরিয়ে ফেলুন।

দাফনকালীন প্রক্রিয়া

১. দাফনের প্রক্রিয়া যত তাড়াতাড়ি সম্ভব সম্পন্ন করা উচিত।
২. মৃতদেহ বহনকারী ব্যাগটি কখনো খুলবেন না।
৩. মৃতদেহ বহনকারী ব্যাগ থেকে অবশিষ্টাংশ অপসারণ করবেন না। ব্যাগবন্দি মৃতদেহগুলি সরাসরি অভেদ্য এবং বন্ধ প্রকোষ্ঠে (hermetically sealed casket) বা কবরে রাখুন।
 - ৩.১ মনোনীত সমাধিস্থল উপযুক্ত প্রসারের (যেমন ২ মিটার বা প্রায় ৭ ফুট) এবং ১-১.৫ মিটার গভীরতার বা ৫ ফুটের একটি কবর তৈরি করুন।
 - ৩.২ মৃতদেহ আগমনের পূর্বেই কবরটির খনন কাজ নিশ্চিত করুন।
৪. অবিলম্বে মৃতদেহকে সমাধিস্থ বা দাফন করুন (স্বতন্ত্র সাংস্কৃতিক ও ধর্মীয় আচার অনুযায়ী)।
৫. দাফনের পরে কবর/স্থানটি ১০ থেকে ১৫ সেগমিঃ গভীর মাটির স্তর দিয়ে ঢেকে দিন। আবদ্ধ অবস্থানে মৃতদেহ দাহ করা উত্তম (সনাতন ধর্মাবলম্বীদের জন্য)।
৬. দাফনকৃত স্থানের আশপাশ উপযুক্ত জীবাণুনাশক (১০,০০০ পিপিএম সোডিয়াম হাইপোক্লোরাইট দ্রবণ) যেমন ১:৪ অনুপাতে মিশ্রিত ব্লিচ (১ ভাগ ৫.২৫% ব্লিচ এর সাথে চার ভাগ পানির মিশ্রণ) দিয়ে পরিষ্কার করে নিন এবং বাতাসে শুকিয়ে নিন।

৭. মৃতদেহ বহনকারী ব্যাগ থেকে তরল পদার্থ নিঃসৃত হলে, উপযুক্ত জীবাণুনাশক দ্বারা (লেবেলের নির্দেশাবলী অনুসারে) এলাকাটি সম্পূর্ণরূপে পরিষ্কার এবং জীবাণুমুক্ত করণ যাতে প্রায় সব ধরনের ভাইরাস ধ্বংস বা বিনাশ নিশ্চিত হয়।
৮. স্ট্যান্ডার্ড বা আদর্শ পদ্ধতি অনুসারে পুনরায় ব্যবহারযোগ্য সরঞ্জামগুলি পরিষ্কার এবং জীবাণুমুক্তকরণ।
৯. মৃতদেহ দাফনের পর ভালোভাবে ঘিরে রাখতে হবে যাতে কোনো বন্যপ্রাণী মৃতদেহ ভক্ষণ করতে না পারে।
১০. অন্যান্য ইস্যু:
- দাফন/সৎকার প্রক্রিয়া যার যার ধর্মের নির্দেশনা অনুযায়ী পালন করা উচিত।
 - ভক্ষিত দেহাবশেষ বা ছাই হতে নিপাহ ভাইরাস ছড়ায় না।

ANNEX 11: CLINICAL PRIORITIZATION OF THERAPEUTIC CANDIDATES AGAINST NIV INFECTION [49]

Monoclonal antibodies

Sl No	Name	Efficacy	Safety	Feasibility	Clinical prioritisation and proposed further evaluation
01	m102.4 (anti-HeV-G)	Protected monkeys from death and pathology when administered as two doses 48 h apart, starting on day 1 or 3 after NiV-B27 (n=6) challenge or on day 1, 3, or 5 after NiV-M28 (n=12) and HeV29 (n=12) challenge. Also protected ferrets from death when administered 10 h after NiV-M30 (n=3) challenge	No serious adverse events, similar rate of mild treatment emergent adverse events between treatment and placebo groups, and no anti-m102.4 antibodies in phase 1 RCT in healthy adults (n=30 treated) ²⁶	High cost of goods, ²⁰ low drug supply, parenteral route only	High priority. Phase 2a post-exposure prophylaxis or early treatment RCT, or both, dur-ing NiV or HeV disease outbreak. Shorter treatment window for NiV-B than for NiV-M. Dose optimisation for cost recommended.
02	1F5 (anti-NiV-F)	Protected monkeys from death and alleviated symptoms and viraemia when administered at doses of 25 mg/kg (n=6) and 10 mg/kg (n=3) on day 5 after NiV-B challenge, as compared with m102.4, which provided only partial protection at a dose of 25 mg/kg (1 of 6) ³²	No human studies to date. No safety data reported in animal studies	High cost of goods, ²⁰ low drug supply, parenteral route only	High priority. Phase 1 first-in-human RCT for safety and pharmacokinetics. Longer treatment window than that for m102.4 in animals with NiV-B. Dose optimisation for cost recommended.

Sl No	Name	Efficacy	Safety	Feasibility	Clinical prioritisation and proposed further evaluation
03	h5B.3 (anti-NiV-F)	Protected ferrets from death but not minor clinical signs when administered at a dose of 20 mg/kg in two doses 48 h apart, starting on day 1 or 3 after NiV-M (n=6) or HeV (n=3) challenge ³³	No human studies to date. No safety data reported in animal studies.	High cost of goods, ²⁰ low drug supply, parenteral route only	Intermediate priority. Monkey studies with NiV-B challenge. Dose optimisation for cost necessary
04	NiV41-6 (anti-NiV-RBP)	Protected hamsters from death when administered at a dose of 10 mg/kg (n=6) 24 h before NiV-M challenge ³⁴			
05	HENV-26 (anti-HeV RBP)	Protected ferrets (n=5) from death, symptoms, and viraemia when administered at a dose of 15 mg/kg on days 3 and 5 after NiV-B challenge ³⁶			
06	HENV-103 plus HENV-117 (anti-HeV RBP)	HENV-103 plus HENV-117 cocktail (5 mg/kg each) protected hamsters (n=5) from death when administered a day after NiV-B challenge ³⁵			

Small molecules

Sl No	Name	Efficacy	Safety	Feasibility	Clinical prioritisation and proposed further evaluation
01	Remdesivir (nucleoside analogue)	Protected monkeys (n=4) from death at a dose of 10 mg/kg when administered from day 1 after NiV-B challenge for 12 days, ⁵⁰ but provided only partial protection when administered from day 3 after challenge, with fewer monkeys protected at a dose of 3 mg/kg (2 of 6) than that of 10 mg/kg (4 of 6); ⁴⁹ in-vitro EC ₅₀ values=0.029–0.066 µM ⁶¹	Sinus bradycardia and hepa-toxicity observed in humans ⁶⁵	Approved globally for COVID-19. Less affordable, ²⁰ parenteral route with oral formulation in development ⁶²	High priority. Phase 2a postexposure prophylaxis or early treatment RCT, or both, during NiV or HeV outbreak. Short treatment window for NiV-B. Dose optimisation for efficacy recommended.

Sl No	Name	Efficacy	Safety	Feasibility	Clinical prioritisation and proposed further evaluation
02	Favipiravir (nucleoside analogue)	Fully protected hamsters (n=10) from death and alleviated symptoms and pathology when administered daily from time of NiV-M challenge; in-vitro EC ₅₀ values=11–44 µM ⁵²	Lethal toxicity in dogs and monkeys (>1 g/kg), ⁶⁶ teratogenicity across four animal species, ⁶⁶ transient hyperu-ricaemia in humans ^{66,67}	Approved in Japan for novel influenza. ⁶⁶ Affordable, ²⁰ oral route, but non-linear pharmacokinetics complicates dosing. ⁶⁸	Intermediate priority. Monkey study with NiV-B challenge. Dose optimisation for efficacy necessary.
03	Ribavirin (nucleoside analogue)	Delayed but did not prevent death when administered before or within 12 h to monkeys (n=6) after HeV ⁴⁵ challenge and to hamsters (n=17) after NiV-M ^{46,47} challenge; in-vitro IC ₅₀ values=4.2–5.0 µM ⁴⁷	Dose-dependent toxicity in hamsters (>100 mg/kg) ⁴⁷ and humans ⁴¹ restricts safety and tolerability	Approved globally for chronic hepatitis C Affordable ²⁰ but equivocal risk-to- benefit ratio.	Intermediate priority. Monkey study with NiV-B challenge. Dose optimisation for safety and efficacy crucial. Time-to-event outcome measure when in phase 2a RCT.
04	Chloroquine (4-amino-quinoline)	Did not protect ferrets ⁴⁸ (n=6) and hamsters ⁴⁷ (n=19) from death when administered as monotherapy before or within 12 h after NiV-M or HeV challenge	Dose-dependent lethal toxicity in hamsters (>100 mg/kg) ⁴⁷ and humans (>3 µM plasma) ⁶⁹	Approved globally for malaria. Affordable ²⁰ but unfavourable risk-to-benefit ratio.	Low priority. Should not be used for the prophylaxis or treatment of NiV or HeV infection.

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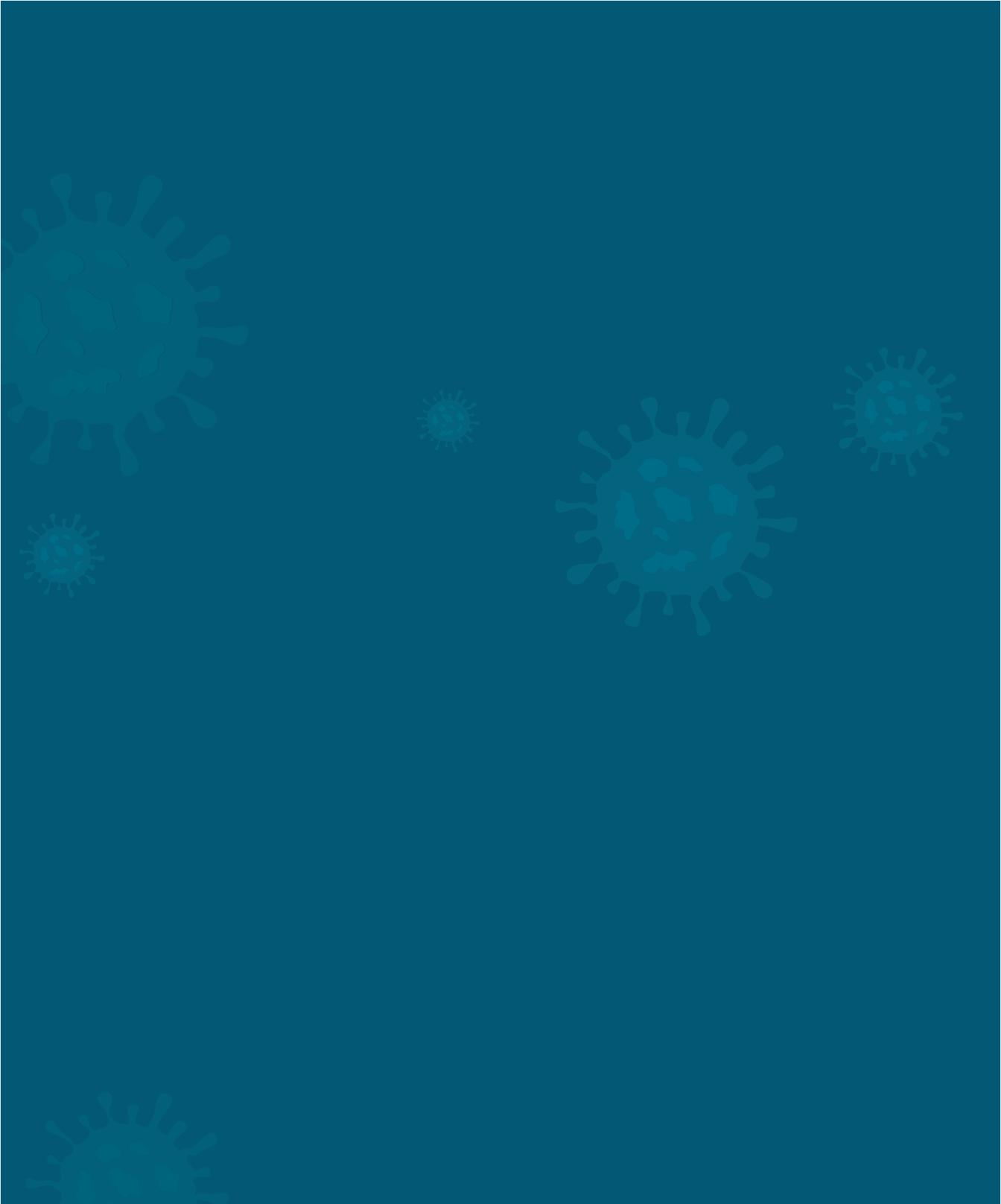
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