Nipah Virus Outbreak Investigation in Kerala, India
Introduction

- Nipah virus infection was first identified in Sept, 1998 in Ipoh, Malaysia
- In Malaysia & Singapore, most cases were in individuals handling pigs
- Outbreaks in Bangladesh reported in 2001, 2003, 2004 and 2007-15 (every year)
- In India: Siliguri, West Bengal (in Jan-Feb’2001); Nadia, West Bengal (in Jan-Apr’2007)
- Outbreaks in India & Bangladesh were not associated with disease in pigs
### Situation for Nipah Virus Infection-India

<table>
<thead>
<tr>
<th>Month /Year</th>
<th>Location</th>
<th>No. of Cases</th>
<th>No. of Deaths</th>
<th>Case Fatality Rate</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb 2001</td>
<td>Siliguri</td>
<td>66</td>
<td>45</td>
<td>68%</td>
<td>WHO</td>
</tr>
<tr>
<td>April 2007</td>
<td>Nadia</td>
<td>5</td>
<td>5</td>
<td>100%</td>
<td>WHO</td>
</tr>
<tr>
<td>May* 2018</td>
<td>Kerala</td>
<td>19</td>
<td>17</td>
<td>89.5%</td>
<td>NCDC, MoHFW</td>
</tr>
</tbody>
</table>

*As on 29.07.2018 (Last case reported on 31<sup>st</sup> May, 2018)

Index case/death not lab confirmed
Nipah virus infection in Kerala: Initial report

• On May 19-20, outbreak of NiV reported in Kozhikode district of Kerala
• State/district administration activated
• Case suspected in Baby Hospital, diagnosed as NiV by Manipal lab and confirmed by NIV, Pune
• State action initiated:
  – suspect linked to Index case
  – Epidemiological and lab investigation initiated
  – active case search in the area
Action Taken - MoHFW

- Hon’ble HFM deputed two central teams to the affected area
- 1st team reached on 21st May, 2018
  - started epidemiological investigation.
  - reviewed the situation in affected areas and public health measures with the Health Minister of Kerala, Addl. CS, DHS & SSO
- 2nd team reached on 22nd May, 2018
  - reviewed triage, isolation, sample collection and clinical management in the district hospital.
  - hospital visit and review with hospital staff
- Regular reviews by Hon’ble HFM and Hon’ble MoS- in addition to Sec.(H), AS(H), JS(PH) and DGHS
Action Taken - MoHFW

- Epidemiological investigation initiated
- Line list creation and Contact tracing (n=2600)
- Case definitions, Guidelines on contact tracing issued
- Advisories issued for Health care workers and General public
- Strategic Health Operation Centre activated at NCDC for monitoring Nipah virus outbreak, coordination with field teams/other states
- Alert for AES cases: possible history of travel/contact
- Rumour recording & management
- Activities review by Director, field teams and experts on daily basis
Epidemiological investigation

- Document/previous report review
  - Literature review - WHO/CDC
  - Report and guidelines of Bangladesh
  - Report of Siliguri & Nadia outbreaks
  - Discussion with members of earlier teams

- Field visit
  - to PHC Chengaroth (Perambra Block)
  - house of index case (Sabith)
  - affected area and block hospitals in both the districts
Field observations

• Index case: Muhammad Sabith, 26 year old male from Kozhikode
• *Date of onset:* 3 May, 2018
• *Date of death:* 5 May 2018
• Died in Govt. Medical College Kozhikode, was earlier admitted to Perambara Taluka Hospital and Baby Memorial Hospital
• Possible date of infection: ? 11-27 April, 2018- based on documented incubation period of disease (4 to 21 days)
## Distribution of Cases and Death- Nipah Outbreak Kerala

<table>
<thead>
<tr>
<th>Total cases (including index case)</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total deaths (including index case)</td>
<td>17</td>
</tr>
<tr>
<td>Total lab confirmed cases</td>
<td>18 (10 males, 8 females)</td>
</tr>
<tr>
<td>Total deaths amongst lab confirmed cases</td>
<td>16 (9 males, 7 females)</td>
</tr>
</tbody>
</table>

*No cases & deaths reported since 1st June 2018*

<table>
<thead>
<tr>
<th>Total number of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tested</td>
</tr>
<tr>
<td>337</td>
</tr>
</tbody>
</table>
# Descriptive Analysis of Nipah cases (n=19)

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cases</td>
<td>19 (18 Laboratory confirmed)</td>
</tr>
<tr>
<td>Male (%)</td>
<td>11 (58)</td>
</tr>
<tr>
<td>Female (%)</td>
<td>8 (42)</td>
</tr>
<tr>
<td>Deaths (Case fatality rate)</td>
<td>17 (89.5%) (16 Laboratory confirmed: 89%)</td>
</tr>
<tr>
<td>Median age (range)</td>
<td>32 years (19-75 years)</td>
</tr>
<tr>
<td>Median Incubation period (range)</td>
<td>11 days (8-14 days)</td>
</tr>
<tr>
<td>Median duration between onset and admission (n=19) (range)</td>
<td>3 days (1-8 days)</td>
</tr>
<tr>
<td>Median duration between admission and death (n=17) (range)</td>
<td>2 days (1-12 days)</td>
</tr>
<tr>
<td>Median duration between onset and death (n=17) (range)</td>
<td>7 days (2-14 days)</td>
</tr>
</tbody>
</table>
Distribution of Nipah cases by date of death (n=19)
Distribution of Nipah cases by residence
Contact Tracing of Cases (n=19)

Asokan
Sijitha
Sijitha
Salih
Kalyani
Sindhu
Mariyam
Moosa
Velayudan
Janaki
Lini
Ismail
Rajan
Abin
Madhusoodan
Ajanya
Ubeesh
Rasin

May 2018
Date of Illness Onset

Index Case
Family Contacts
Hospital Contacts
Community Contacts
Field observations

• Possible transmission route to index case
  – Fruit Bats (flying fox)/other animals (rabbits, pigs, pigeons), contaminated Fruits/articles
  – Human to human: Siliguri / Bangladesh workers/travel of index case

• Transmission dynamics of outbreak
  – Family
  – Health facility
  – Community contacts

• Gaps in enlisting contacts, period of infectivity, active case search, contact tracing, home quarantine, PPEs use (HCWs), duration of contact tracing, risk communication (to general public and HCW), Disinfection SOPs
Team 2: Health facility observations

• All areas identified for Nipah treatment visited by the Central Team.
• Protocol followed for treatment including ventilator management assessed through the case sheets of the victims who died/ those undergoing treatment.
• The hospital infection control practices were reviewed.
• The hospital logistics to support Nipah outbreak reviewed
• The information management system at the hospital/ district IDSP reviewed.
Observations

• The risk reduction measures instituted by the GMC, Kozhikode need substantial strengthening. Risk communication to internal stakeholders lagging.
• The infrastructure support inappropriate: fever triage and treatment of Nipah suspect and confirmed cases (patients kept at 4 different locations in MC, Kozhikode and in 2 private hospitals).
• The treatment protocol especially the ventilator management protocol was found to be inapt.
• Sample testing reports did not mention date of sample collection: delay in reports from Manipal Institute of Virological Research, Manipal (on an average the samples were reported with 3-4 days delay) (whereas it takes only 6 hours for performing an RT/ PCR).
• The hospital infection control practices were found lagging and had major gaps. The knowledge and skills for HICP was found deficient.
• The hospital was found short of required logistics for undertaking standard precautions.
Actions taken by the Central Team

- The physical facility for managing suspect & confirmed Nipah cases identified and layout planning discussed with engineering Department.
- The ground floor of the Pay Ward was found appropriate and recommended appropriate modification to provide optimal standard, contact, droplet and airborne precautions for a Nipah Treatment.
- Detailed clinical case management protocol prepared and handed over to Principal, GMC, Kozhikode.
- Arrangements were made to train 5 specialists on ventilator management protocol at Safdarjung Hospital, New Delhi from 28th May - 2nd June, 2018.
- NIV Branch at Alleppy was activated with full complement of trained staff drawn from NIV, Pune.
- Two skill based training workshops each of 4 hours duration were held at GMC, Kozhikode on infection prevention control practices. About 300 participants drawn from the relevant departments attended.
Actions taken by the Central Team

- Dedicated staff trained for sample collection and transportation in the procedure for sample collection.
- Interacted with the PSM Department for their meaningful participation in event based surveillance and data management.
- Two meetings were held with HODs of the hospital departments to clear their queries on clinical management/ infection prevention.
- The micro-plan for event based surveillance prepared.
- ASHAs/ Anganwadi Workers of the epicenter sensitized on the disease, infection control practices and their role in implementation of the micro-plan
- Meetings with community leaders and IMA doctors to clear their queries
- Provision of logistic support
Actions taken by the Central Team

• Guidelines/reference materials to the state during NiV outbreak:
  – Information about Nipah Virus
  – Case definition of Nipah Virus Disease
  – Hospital Infection Control for Nipah Virus
  – Guidelines for Sample collection and Transportation for Nipah Virus
  – Clinical management guidelines for suspected and Confirmed case of Nipah Virus
  – Guidelines for safe disposal of dead bodies of confirmed Nipah Patients
  – Information for General Public and Advisory for Health care personnel
# Animal Sample results

<table>
<thead>
<tr>
<th>Species</th>
<th>Number tested</th>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bat</td>
<td>55</td>
<td>Conventional nested RT-PCR and real time RT-PCR</td>
<td>10 Bat Samples positive for Nipah viral genome by NIV Pune</td>
</tr>
<tr>
<td>Porcine</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bovine</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caprine</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Samples collected from in and around Changaroth village, Kozhikode, Kerala
Other Activities

• Nipah alert issued to other states
• VCs carried out with all States through IDSP Network- 
  – clarify doubts on Nipah virus diseases
  – States advised to remain vigilant and to be prepared for any suspected event of Nipah virus diseases
• Daily Media scanning (print/electronic and social media)
• Advisories uploaded on NCDC website and shared with all the States
  – Brief on Nipah Virus disease including case definition (suspect & confirm), contact tracing, treatment and clinical management protocol
  – Advisory for General Public
  – Advisory for Health Care Personnel
  – Guidelines and SoPs for sample collection for Nipah Virus
  – Hospital infection control guidelines
  – Laboratory Biosafety guidelines
  – Guidelines for disposal of human remains.
## Suspected AES cases tested for Nipah virus infection in NIV Pune (n=15)

<table>
<thead>
<tr>
<th>State</th>
<th>District</th>
<th>No of suspect cases</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telangana</td>
<td>Hyderabad</td>
<td>2</td>
<td>Negative, RT-PCR</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>Sholapur</td>
<td>1</td>
<td>Negative, RT-PCR &amp; Negative for Nipah Ig M ELISA</td>
</tr>
<tr>
<td></td>
<td>Mumbai</td>
<td>1</td>
<td>Negative, RT-PCR &amp; Negative for Nipah Ig M ELISA</td>
</tr>
<tr>
<td></td>
<td>Pune</td>
<td>1</td>
<td>Negative, RT-PCR &amp; Negative for Nipah Ig M ELISA</td>
</tr>
<tr>
<td>Goa</td>
<td>Panaji</td>
<td>1</td>
<td>Negative, RT-PCR</td>
</tr>
<tr>
<td>Karnataka</td>
<td>Tumkur</td>
<td>1</td>
<td>Negative, RT-PCR</td>
</tr>
<tr>
<td>Himachal Pradesh</td>
<td>Solan</td>
<td>6</td>
<td>Negative, RT-PCR</td>
</tr>
<tr>
<td>West Bengal</td>
<td>Kolkata</td>
<td>2</td>
<td>Negative for Nipah</td>
</tr>
</tbody>
</table>
Actions under IHR

• NFP-IHR immediately notified the event to WHO under IHR
• WHO in its Disease Outbreak News (31 May, 2018) not recommended any travel and trade restrictions against India and shared the same with all countries
• However, there were unwarranted trade restrictions by some middle east countries (EMRO)
• As per Art 43 of IHR (2005), WHO contacted all the countries requesting rationale and relevant scientific information for the public health measures and requested for its reconsideration.
• Some countries lifted the ban and the matter is being followed with other countries.
• WHO has now been informed that both the districts are now free from Human Nipah Virus infection among humans.
GAPS/Challenges – research priorities

• Route of infection transmission: route from animals to humans, high risk behaviour (jungle walk, bat disturbance in well, coconut sap/fruit eating, contact with pigs/contaminated articles (grass/fruits/??), travel ??, contact with workers from Siliguri/B.Desh in the area, Travel of infected bats (from affected areas – flight range), seasonality of virus shedding etc.

• Burden of disease in animals population (bats/pigs/others?)

• How long virus survives in environment? (grass/partially eaten fruits etc., sap)
Long Term Measures

• Detailed survey among animals/wild life (on the basis of infection detected) for risk mapping
• Study of High risk behavior: for IEC, PPE use etc.
• Strengthening hospitals: Resilient health facilities with triage area, isolation and quarantine facilities, ICP, bio-medical waste disposal, stockpile of PPEs, disinfectants, logistics, finances.
• Private sector surveillance and response: big pvt. Hospitals, IAP/IMA, laboratories, ICP etc.
• Research: drugs, vaccines etc.
• Development of a National Framework for prevention, control and management of Zoonotic public health threats
Thanks