GOARN and One Health: Nipah virus as a source of lessons learnt

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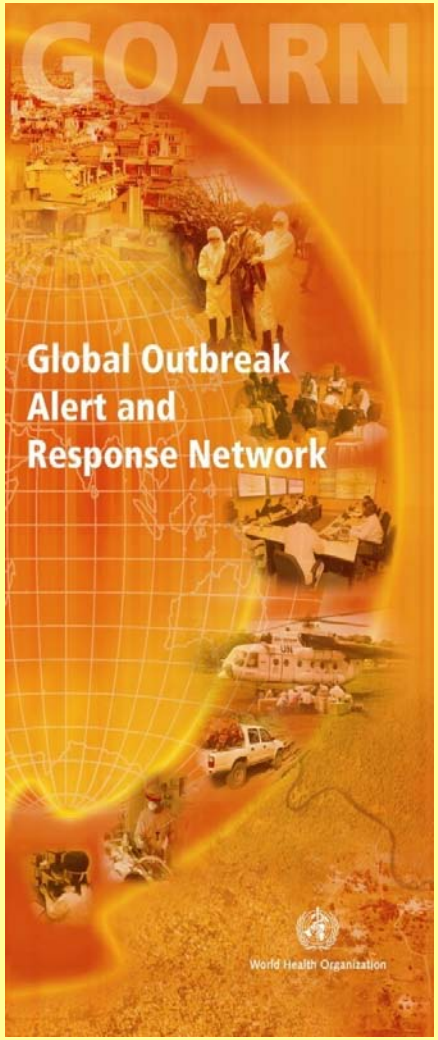
Global Outbreak Response - Rationale

- WHO cannot respond itself to many outbreaks – it has neither the staff nor the resources;
- So, in April 2000 a meeting was called to discuss a new strategy, the establishment of a partnership in which partners would assist with missions in the field through provision of experts and, in many cases, help with resources;
- The suggestion was that the partnership would be an independent entity with WHO as one of the partners, and that WHO would play a coordination role.
- Thus was born the Global Outbreak Alert and Response Network, or GOARN



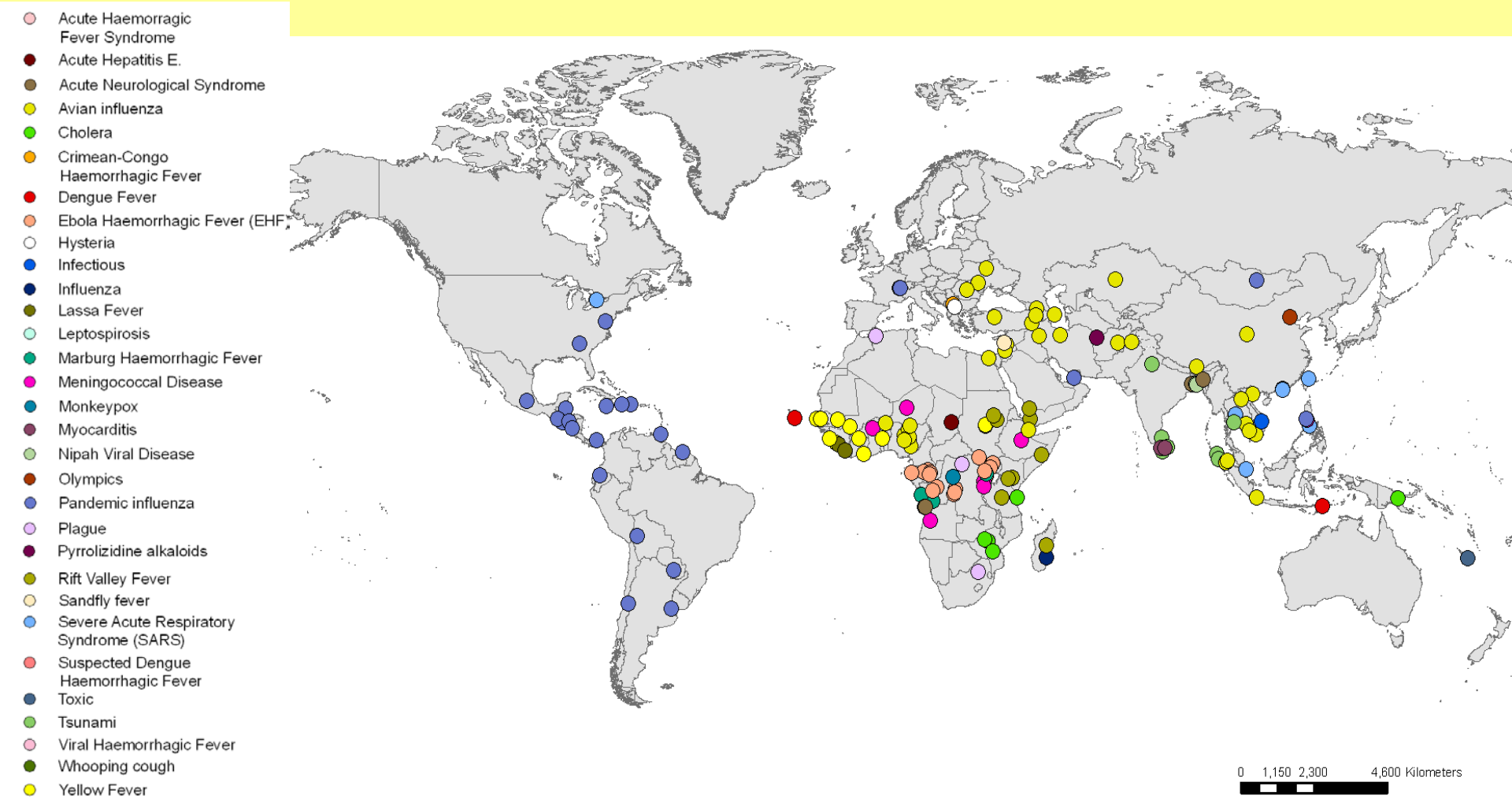
What is GOARN?

- GOARN is a technical partnership of 150+ institutions and other networks who mobilize and pool resources, including personnel, to provide rapid international multi-disciplinary technical support to countries for outbreak response.
- Partners include: government health departments, health institutions, universities, regional networks (eg WHO, CDC, HPA, MSF, Institut Pasteur, IRC, ECDC, PacNet, etc)
- The secretariat and logistics are carried out by WHO, as one of the partners.
- Oversight of the activities is undertaken by a steering committee, and by occasional meetings of the partners.

GOARN is a Multidisciplinary Network

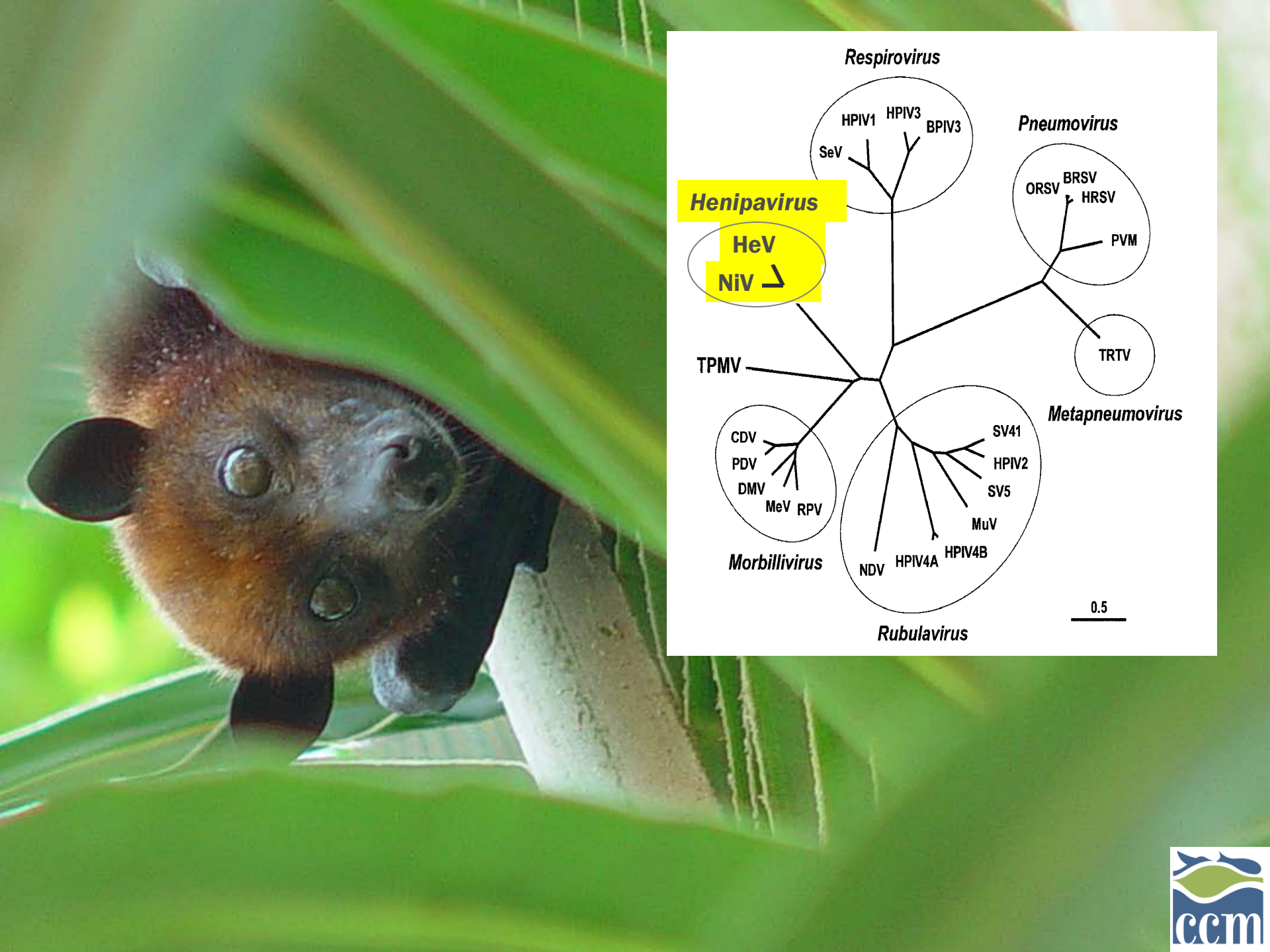
- **Epidemiology**
- **Laboratory science**
- **Clinical Management**
- **Infection Control**
- **Environmental health**
- **Health education**
- **Veterinary public health**
- **Medical anthropology**
- **Risk communication**
- **Logistics**
- **Others…**

GOARN partners have provided experts for over **104** operations in 75 countries, from a total of 197 ARO missions.



GOARN and zoonoses investigations

- Many GOARN missions have been to outbreaks which are zoonoses – including Rift Valley fever, SARS-CoV,various vector-borne diseases, avian influenza, Nipah virus, etc
- GOARN has also been involved with OIE and FAO in investigations of the origin of novel zoonotic viruses, such as SARS.
- These and other investigations have had a major affect on the thinking and planning for future GOARN missions, and on SOPs.
- Major lessons were learnt from outbreaks of Nipah virus infection in Malaysia, India and Bangladesh.


Respirovirus
HPIV1
HPIV3
BPIV3
SeV
Pneumovirus
ORSV
BRSV
HRSV
PVM
Henipavirus
HeV
NiV
TRTV
TPMV
Metapneumovirus
CDV
PDV
DMV
MeV
RPV
Morbillivirus
SV41
HPIV2
SV5
MuV
HPIV4B
HPIV4A
NDV
Rubulavirus
0.5

Henipaviruses

- Henipaviruses represent an novel genus in the Paramyxovirus family;
- Hendra virus first emerged in 1994 in Brisbane, Queensland, as a severe acute respiratory disease of race horses and humans, with a high case fatality rate. Some cases were later shown to be neurological.
- Nipah virus emerged in Malaysia in 1999 as a severe disease of pigs and humans with both respiratory and neurological syndromes, and also with a high fatality rate.
- Since 2001, a number of outbreaks of Nipah virus infection have occurred in Bangladesh and India's West Bengal.
- The natural reservoirs of both viruses are fruit bats (flying foxes) in the family *Pteropididae* and genus *Pteropus*.

History of Nipah Virus Outbreaks

- **1998-1999**: first outbreak of fatal encephalitis among pig farmers in Kampung Sungai Nipah, Perak State, in Peninsular Malaysia with 40% fatality . [Initially confused as Japanese encephalitis (JE), but JE does not kill pigs, and JE vaccine did not protect people from disease.] The outbreak was controlled by culling 1.1 million pigs, and cost Malaysia 625 million USD in direct and indirect costs.
- **1999**: small outbreak in Singapore following importation of sick pigs from Malaysia, with one fatal case
- **Since 2001**, 11 outbreaks occurred in India and Bangladesh

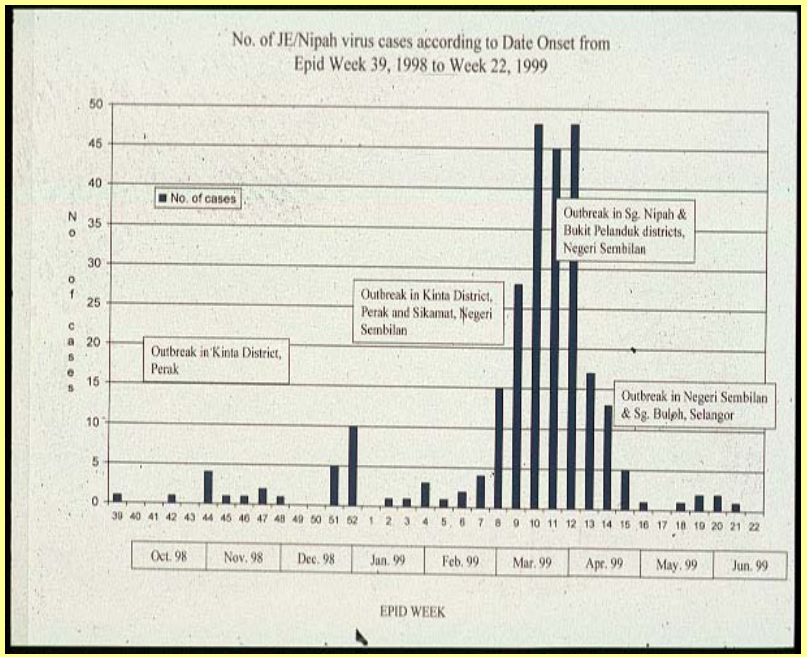
  - Nine in Bangladesh (Kushtia, Faridpur, Manikgonj, Meherpur, Naogaon, Rajbari, Tangail and Thakurgaon districts)

  - Two in West Bengal of India (Siliguri and Nadia)
- **Since Nipah discovery**, 477 human cases including 248 deaths

Lessons/Comments

Sporadic cases and small clusters of encephalitis had been reported in the Perak area for a number of months prior to the outbreak in Malaysia, but they were thought to be due to Japanese encephalitis virus and vaccine was administered. At the same time, pigs were dying. Unfortunately there was little communication between medical and veterinary authorities.

This demonstrates the importance of communication between medical and veterinary health, and of the One Health approach. JE vaccine did not protect people from disease, and pigs do not die from JEV – so with communication, this outbreak could possibly have been averted!



Nipah Virus Outbreaks: Malaysia, Singapore, Bangladesh and India

Dates	Location	No. cases	No. deaths	CFR(%)
Sep1998-Apr 1999	Malaysia; Singapore	265 11	105 1	40 9
Feb 2001	Siliguri, W. Bengal, India	*66*	*45*	*68*
Apr–May 2001	Meherpur, Bangladesh	13	9	69
Jan 2003	Naogaon, Bangladesh	12	8	67
Jan-Apr 2004	Goalando, Bangladesh Faridpur, Bangladesh	29 36	22 27	76 75
Jan-Mar 2005	Tangail, Bangladesh	12	11	92
Mar-Apr 2007	Kushtia, Bangladesh Nadia, W. Bengal, India	19 5	5 5	26 100
Feb-Mar 2008	Manikganj and Rajbari, Bangladesh	18	8	44

Nipah in Bangladesh and India

Of particular concern:

- **The CFR of Nipah infection in India and Bangladesh is higher than in Malaysia.**
- **Good evidence of human-to-human transmission in Bangladesh and India, with at least 8 cycles of transmission reported from Bangladesh, and nosocomial infections in a hospital setting in Siliguri, West Bengal.**
- **The mechanism of transmission remains to be determined.**
- **No evidence of pigs as intermediate hosts, and little direct evidence of bats in Siliguri or in Bangladesh in 2007 – thus source of virus remains to be determined in many instances.**

➢ *These issues indicate that Nipah virus is a major potential pandemic threat.*

Nipah virus: transmission

(a) **Ingestion of fruits or fruit products (e.g. raw date palm juice) - Bangaldesh**

- **date palm sap contaminated with urine from infected fruit bats**
- **fruit contaminated with saliva from infected fruit bats**

(b) **Human-to-human transmission – Bangladesh and India**

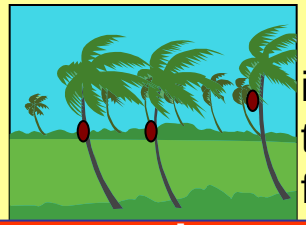
- **direct contact with ill patients**
- **exposure to body fluids (secretions, excretions)**
- **one outbreak in hospital setting, Siliguri, India (hospital staffs or visitors)**

NB There was no human-to-human transmission in Malaysia

(c) **Pig-to-human transmission**

- **initial outbreaks only (Malaysia &Singapore)**
- **direct contact with ill, dying, dead pig**
- **exposure to contaminated tissues & body fluids**
- **droplets respiratory particles or urinary secretions**
- **occasional transmission from other domestic animals (goat, sheep, cow,…)**

Nipah virus: transmission



indirect transmission from bats

Date palm sap, fruit

Fruit bats (*Pteropus* spp.)

Secondary Transmission

Food Chain ?

Human

Pigs: Amplification

Healthcare workers

Lessons learnt

- Nipah virus outbreaks demonstrate a number of lessons.
- In the 1999 outbreak in Malaysia, transmission was from bats to pigs as spillover hosts, and then from pigs to humans – but there were no cases of human-to-human transmission.
- In subsequent outbreaks in Bangladesh and India, there were no spillover hosts – transmission was by human-to-human for the first time (EG nosocomial in Siliguri) but the route remains to be elucidated, or from bats (through contamination of palm sap or fruit contaminated by infected bat saliva)
- Thus transmission from bats to humans is indirect and environmental issues become important, unlike the Malaysian experience..

Lessons….(2)

- There is a major need in many countries for improved communication between human and animal health;
- Transmission from animals to humans is not always obvious, and can be due to many different routes, some of which have strong environmental parameters.
- Thus planning for zoonotic investigations needs to be broadly based and flexible, and SOPs need to reflect these issues.

Lessons…..(3)

- There was a considerable delay in reporting the first West Bengal Nipah virus outbreak in 2001, despite its importance in demonstrating the occurrence of nosocomial transmission. This serves to remind us that transparency, especially through rapid and shared surveillance, is essential if we are to detect novel emergent agents quickly.

Could we have predicted Henipavirus emergence?

- For Hendra virus, answer is probably not – there had been no previous indication of diseases associated with fruit bats.
- For Nipah virus – the answer really has to be ‘yes’ - but in hindsight. Pteropid bats were known to occur as overlapping populations from Australia, PNG and Indonesia throughout South, South-east and East Asia, so this ‘open conduit’ should have raised alarm bells as a possible avenue for virus movement/virus evolution.