

**ZOOZOSIS**

**人畜共通傳染病對屠檢人員的危害**

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**A medical mystery unfolds in Minnesota** *February 5, 2008*

The New York Times




**Is pig-brain 'mist' linked to mystery ailment?** *09 February 2008 NewScientist.com*

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**PIN: a new occupational disease?**  
 Who knew? blowing pigs' brains out is bad for you?

**Investigation of progressive inflammatory neuropathy among swine slaughterhouse workers — Minnesota, 2007–2008**



MMWR February 8, 2008 / Vol. 57 / No. 5

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- As of January 28, 2008, a total of 12 workers at plant A had been identified with confirmed (eight workers), probable (two), or possible (two) progressive inflammatory neuropathy (PIN)
- Symptoms ranged from acute paralysis to gradually progressive symmetric weakness over periods ranging from 8 to 213 days

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- Severity ranged from minor weakness and numbness to paralysis predominantly in the lower extremities affecting mobility
- Eleven patients had evidence of axonal or demyelinating peripheral neuropathy by electrodiagnostic testing

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- Cerebrospinal fluid obtained from all 7 patients had elevated protein levels
- Five patients had evidence of inflammation on spinal magnetic resonance imaging



The Hormel Company, in Austin, Minnesota, developed America's first canned ham in 1925.

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- All 12 patients reported either working at or having regular contact with an area where swine heads were processed (known as the **head table**)
- As of January 30, laboratory investigations had not identified any infectious agent from the blood and throat-swab specimens that would explain the occurrence of PIN

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- Standard PPE used by workers at plant A included **hard hats, laboratory coats (some were shortsleeved), boots, hearing protection, eye protection, and specialized gloves** that varied with the particular task of the worker

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- A compressed air device was used to harvest brain tissue from pig heads at the head table
- The device was placed into the skull of the pig through the foramen magnum



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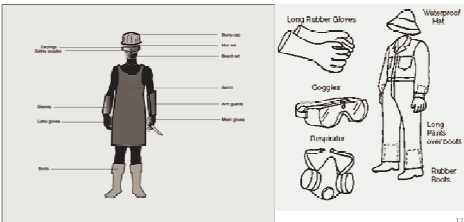
- Only three plants (plant A in Minnesota and plants in Nebraska and Indiana) reported recent use of compressed air to extract pig brains (25 federally inspected swine slaughterhouses with >500 employees)
- To date, no cases of PIN have been identified in association with workers at the Nebraska plant

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- Several workers at the Indiana plant have been preliminarily identified with neurologic illnesses and similar histories of exposure to **head processing activities** at that slaughterhouse
- All three plants have stopped using compressed air to extract brain material

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*After ruling out **toxins and infectious agents**, investigators are now focused on whether the workers' immune systems reacted to **pig protein** they inhaled from bits of brain tissue floating in the air around them*





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## Illness from Unknown Cause



- Turkey processing plant
- 600 employees
- Evisceration line
  - birds sent into super-chlorinated water
  - open trough catches super-chlorinated water
- Workers reporting eye and respiratory irritation




 Presentation for the American Meat Institute  
 April 15, 2008
 


## Findings



- Evisceration workers had more symptoms than dark meat workers
- Detected chloramines, but not chlorine or ammonia in the air
- Cooling fans above line stations caused turbulence in airflow, blowing air opposite to desired direction
- Air was recirculated from high to low-exposed areas


 Presentation for the American Meat Institute  
 April 15, 2008
 

## Conclusions


- Soluble chlorine associated with:
  - Upper airway irritation
  - Asthma symptoms
  - Pulmonary function change
- Trichloramine associated with:
  - Pulmonary function change






 Presentation for the American Meat Institute  
 April 15, 2008
 

## Impact

- NIOSH helped plant modify ventilation system
- After modifications
  - Fewer workers with symptoms
  - Lower levels of soluble chlorine in air







 Presentation for the American Meat Institute  
 April 15, 2008
 



## 1970: OSH Act Forms NIOSH and OSHA



**Public Law 91-596**  
**91st Congress, S. 2193**  
**December 29, 1970**  
**An Act**

*To assure safe and healthful working conditions for men and women; by authorizing enforcement of the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, education, and training in the field of occupational safety and health; and for other purposes.*

*Be it enacted by the Senate and House of Representatives*

  
 U.S. Department of Health and Human Services  
  
 National Institute for Occupational Safety and Health  




  
 U.S. Department of Labor  
 Occupational Safety and Health Administration  



 Presentation for the American Meat Institute  
 April 15, 2008
 

## Hispanic Injury Trends

Hispanic workers comprised 12% of the U.S. workforce in 2002, but:

- Contributed 15% of the workforce fatalities
  - 891 fatalities in 2001 - 31% in construction
- Work days lost have declined 7.6% from 2001 to 2002 in all other workers, but rose 3.2% among Hispanics.


 Presentation for the American Meat Institute  
 April 15, 2008
 

### Hispanics overrepresented in more hazardous industries

- Agriculture - 20%
- Construction - 16%
- Food processing - 25%
- Apparel mfg. - 25%

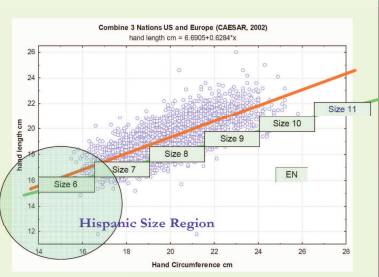


**CDC** Presentation for the American Meat Institute April 15, 2008 **NIOSH**

### Glove Size & Availability for Hispanics

#### EN In-Size Coverage

U.S., Italy & Holland Combined Data Set



Chain Mesh gloves were sized to fit much taller European Workers

**CDC** Presentation for the American Meat Institute April 15, 2008 **NIOSH**


### Types of hazards

Chemical	Physical
Biological	Ergonomic

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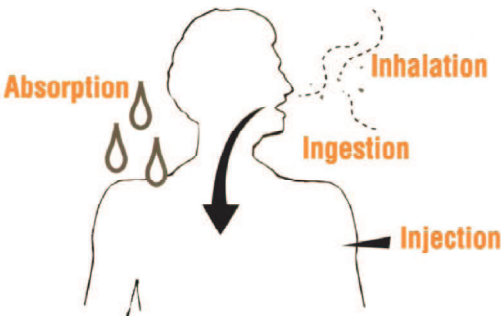
### Examples

- Biological
  - Bacteria
  - Viruses
  - Fungi
  - Anthrax



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### Routes of entry



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### Warning Signs / Symptoms

- Headache
- Nausea
- Dry Skin / Dermatitis
- Tingling / Numbness
- Soreness
- Hearing Loss
- Frostbite

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## Personal Protective Equipment

- Least Effective
- Does Not Eliminate / Change Hazard
- Barrier Between Hazard & Worker
- Last Resort


4/14/08 AMI © National Safety Council, South Louisiana Chapter 59

## Could killer horse virus spread amongst humans?

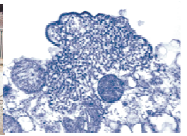
22 July 2008  
NewScientist.com news service





Rachel Nowak



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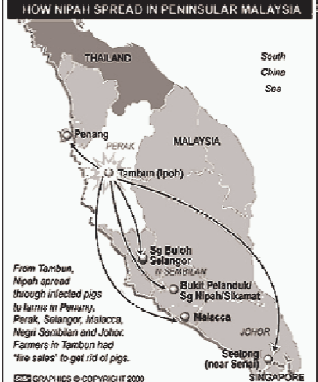



### 從 Nipah virus infection 談起


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#### HOW NIPAH SPREAD IN PENINSULAR MALAYSIA



From Tambun, Nipah spread through infected pigs to farms in Perak, Perak, Selangor, Malacca, Negeri Sembilan and Johor. Farmers in Ipoh had 'one sale' to get rid of pigs.

Cobey/HERG 8/25/2008 [http://www.henipavirus.org/virus\\_and\\_host\\_info/nipah\\_virus\\_natural\\_history.htm](http://www.henipavirus.org/virus_and_host_info/nipah_virus_natural_history.htm) 28



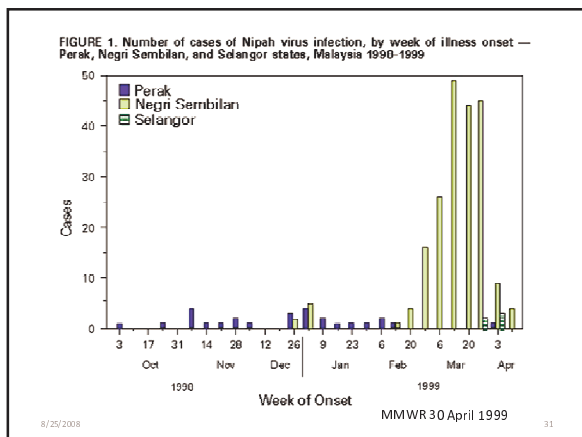
*Nipah* is named after the village --Kampung Baru Sungai Nipah-- in Negeri Sembilan where it was first detected by Universiti Malaya experts on March 18

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## Nipah virus infection

- From September 1998 through May 1999, 265 cases of encephalitis (105 fatal) were reported from 3 states—Perak, Negeri Sembilan, and Selangor—of Malaysia
- Most patients were pig farmers. Concurrently, an illness characterized by respiratory and neurological symptoms was observed in pigs on some farms with ill workers Parashar et al., 2000

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## Clinical Features of Nipah Virus Encephalitis among Pig Farmers

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### Nipah virus infection

- **Ninety-four patients were seen from February to June 1999 (mean age, 37 years; ratio of male to female, 4.5 to 1)**
- **Ninety-three percent had direct contact with pigs, usually in the two weeks before the onset of illness, suggesting that there was direct viral transmission from pigs to humans and a short incubation period** Goh et al., 2000

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### Nipah virus infection

- **The main presenting features were fever, headache, dizziness, and vomiting**
- **Fifty-two patients (55%) had a reduced level of consciousness and prominent brain-stem dysfunction**

Goh et al., 2000 8/25/2008 34

### Nipah virus infection

- **Distinctive clinical signs included segmental myoclonus, areflexia and hypotonia, hypertension, and tachycardia and thus suggest the involvement of the brain stem and the upper cervical spinal cord**

Goh et al., 2000 8/25/2008 35

### Nipah virus infection

- **The initial cerebrospinal fluid findings were abnormal in 75% of patients**
- **Antibodies against Hendra virus were detected in serum or cerebrospinal fluid in 76% of 83 patients tested**

Goh et al., 2000 8/25/2008 36

### Nipah virus infection

- **Thirty patients (32%) died after rapid deterioration in their condition**
- **Fifty patients (53%) recovered fully, and 14 (15%) had persistent neurologic deficits**

Goh et al., 2000

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### Nipah virus infection

- **A severe, rapidly progressive encephalitis with a high mortality rate and features that suggest involvement of the brain stem**
- **The infection is associated with recent contact with pigs**

Goh et al., 2000

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### Risk factors studies



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### Risk factors for human infection Nipah virus, during a 1998–99 outbreak of severe encephalitis in Malaysia

- **From Sep.1998 through May 1999, 265 cases of encephalitis (105 fatal) were reported from 3 states—Perak, Negeri Sembilan, and Selangor**
- **Nipah, a new paramyxovirus, infected pigs, humans, dogs, and cats**
- **Most patients were pig farmers**

Parashar et al., 2000

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Characteristic	Case patients (n = 48)	Case-farm controls (n = 107)	OR	95% CI
Male	36/48 (75)	55/107 (51)	3.29	1.44–7.53
Occupation				
Pig farm owner/worker	40/48 (83)	71/107 (66)	3.49	1.24–9.81
Housewife	2/48 (4)	10/107 (9)	0.32	0.07–1.42
Student	8/48 (17)	38/107 (36)	0.24	0.10–0.60
Living on farm	39/48 (81)	86/107 (80)	1.31	0.32–5.33
Working on farm	44/48 (92)	76/107 (71)	8.79	2.53–30.6
Contact with pigs on farm <sup>a</sup>	42/44 (95)	70/76 (92)	1.57	0.30–8.18
Contact with sick pigs on farm <sup>a</sup>	30/42 (71)	30/73 (41)	3.69	1.49–9.14
Specific activities on farm <sup>a</sup>				
Cleaning pigpens	42/44 (95)	70/76 (92)	1.48	0.24–9.15
Washing pigs	43/44 (98)	71/76 (93)	1.11	0.17–7.26
Feeding pigs	39/43 (91)	58/74 (78)	3.86	1.16–12.9
Processing baby pigs <sup>b</sup>	23/44 (52)	20/76 (26)	2.95	1.21–7.21
Assisting in breeding of pigs <sup>c</sup>	21/43 (49)	12/75 (16)	3.37	1.34–8.45
Assisting in the birth of pigs	22/44 (50)	13/73 (18)	4.42	1.66–11.8
Injecting or medicating pigs	29/44 (66)	21/75 (28)	3.10	1.47–6.56
Handling dead pigs	29/43 (67)	27/76 (36)	3.89	1.60–9.44

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**Nipah virus infection among military personnel involved in pig culling during an outbreak of encephalitis in Malaysia, 1998–1999**

- An operation to cull the approximately 1 million pigs on farms in the outbreak-affected areas was carried out, primarily by 1,638 military personnel
- Two soldiers involved in culling became ill with Nipah encephalitis

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Ali et al., 2001

43

**Nipah virus infection among military personnel involved in pig culling during an outbreak of encephalitis in Malaysia, 1998–1999**

- Six (0.4%) of the 1,412 personnel studied had detectable antibody against Nipah virus
- All six had IgM antibody, and one also had IgG antibodies
- Two of the six antibody positive persons had been hospitalized with encephalitis during the culling operation

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Ali et al., 2001

44

**Nipah virus infection among military personnel involved in pig culling during an outbreak of encephalitis in Malaysia, 1998–1999**

- All the antibody-positive personnel were involved in culling in Negeri Sembilan state and reported direct physical contact with live pigs
- None reported obvious contact with secretions or body fluids (e.g., blood and urine) of infected pigs

8/25/2008

Ali et al., 2001

45

**Nipah virus infection among military personnel involved in pig culling during an outbreak of encephalitis in Malaysia, 1998–1999**

- Four of the six antibody positive persons also reported direct physical contact with dead pigs
- All six reported wearing gloves, masks, and boots at all times while working, and three reported wearing goggles

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Ali et al., 2001

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**Nipah virus infection among abattoir workers in Malaysia, 1998–1999**

- All 143 registered abattoir workers in 11 of 13 states were invited to participate in this cross-sectional study
- Seven (1.6 %) of 435 abattoir workers who slaughtered pigs versus zero (0%) of 233 workers who slaughtered ruminants showed antibody to Nipah virus ( $P = 0.05$ )

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Sahani et al., 2001

48

### Nipah virus infection among abattoir workers in Malaysia, 1998-1999

- All Nipah-positive workers were from abattoirs in the three states that reported outbreak cases among pig farmers
- Workers in these three states were more likely than those in other states to have Nipah antibody (7/144 [4.86%] versus 0/291 [0%],  $P < 0.001$ )

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Sahani et al., 2001

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### Nipah virus infection among abattoir workers in Malaysia, 1998-1999

- Nipah infection was not widespread among abattoir workers in Malaysia and was linked to exposure to pigs
- Using PPE conducting surveillance for Nipah infection on pig farms which supply abattoirs, and avoiding handling and processing of potentially infected pigs are presently the best strategies to prevent transmission of Nipah virus in abattoirs

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Sahani et al., 2001

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### Nipah virus infection among abattoir workers in Malaysia, 1998-1999

- Transmissibility of Nipah virus to military personnel involved in pig culling was low
- All six Nipah positive persons reported wearing gloves, masks, and boots while culling, three did not report wearing goggles
- Exposure may have occurred through inoculation of the conjunctiva with infectious secretions of pigs

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Sahani et al., 2001

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### Risk factors for Nipah virus infection among abattoir workers in Singapore

- Eleven workers in 1 of 2 Singaporean abattoirs developed Nipahvirus associated encephalitis or pneumonia, resulting in 1 fatality (10-19 March 1999)
- Case patients were abattoir A workers who had anti-Nipah IgM abs; control subjects were randomly selected abattoir A workers who had no anti-Nipah IgM

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Chew et al., 2000

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### Risk factors for Nipah virus infection among workers at abattoir A, Singapore

Exposure	Case patients, <sup>a</sup> no. (%)	Control subjects, no. (%)	$P^b$
Job involved			
Chasing pigs	8 (62)	11 (27)	.04
Exposure to live pigs <sup>c</sup>	13 (100)	26 (63)	.01
Smoked while working	2 (15)	8 (20)	1.0
Ate while working	4 (31)	9 (22)	.71
Any contact with pig bodily fluid or substance	13 (100)	31 (76)	.10
Mucous-membrane exposure			
to pig bodily fluid	2 (11)	11 (27)	.48
Contact with pig blood	8 (62)	23 (56)	.73
In the slaughterhouse	8 (100)	18 (86)	.54
In the auction house	3 (38)	6 (27)	.67
Fecal contact	9 (75)	23 (56)	.32
In the slaughterhouse	4 (57)	15 (71)	.64
In the auction house	7 (100)	9 (41)	.01
Urine contact	9 (75)	20 (50)	.13
In the slaughterhouse	5 (71)	13 (65)	1.0
In the auction house	6 (86)	8 (36)	.035

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Chew et al., 2000

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### Risk factors for Nipah virus infection among abattoir workers in Singapore

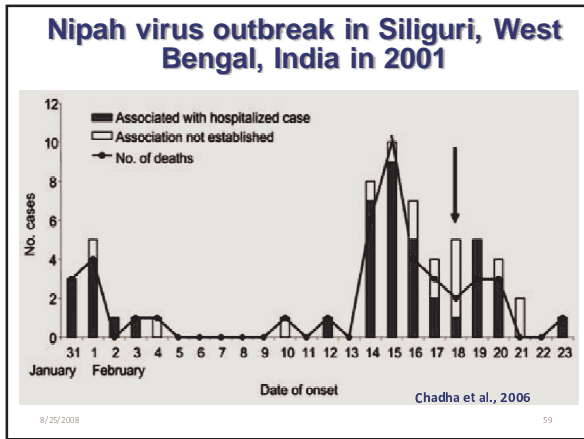
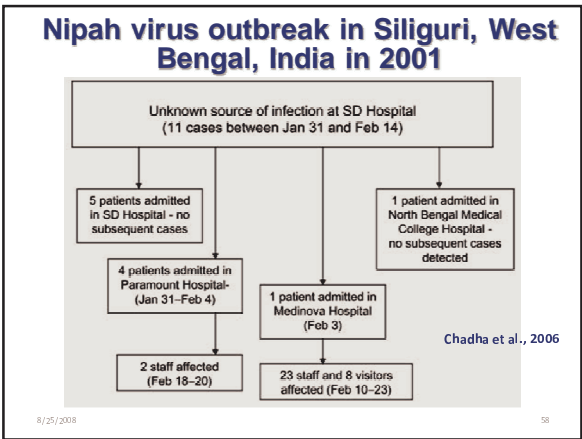
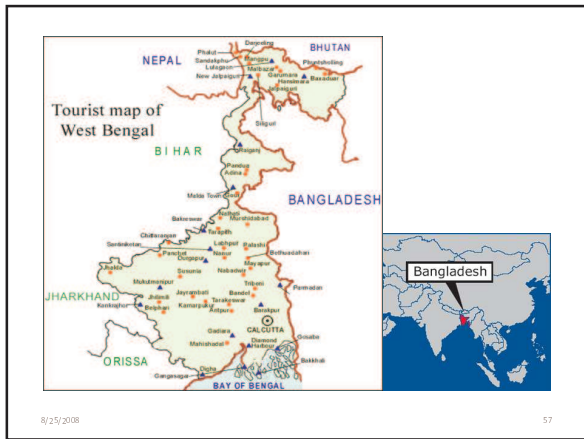
- Overall, use of personal protective equipment (PPE) was low, and no differences between case patients and control subjects
- Only 10% of study participants reported wearing plastic face shields, and 36% reported always wearing gloves

Chew et al., 2000

### Risk factors for Nipah virus infection among abattoir workers in Singapore

- Contact with live pigs appeared to be the most important risk factor for human Nipah virus infection

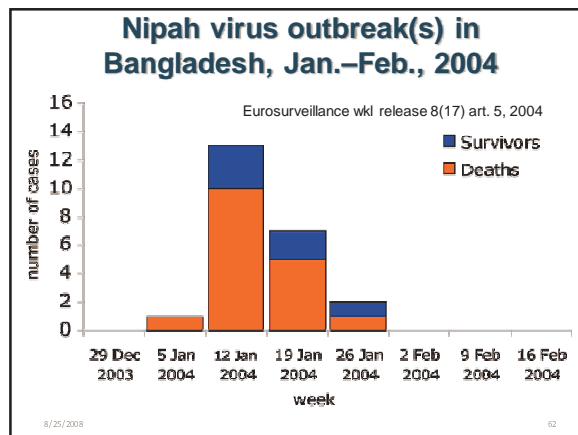
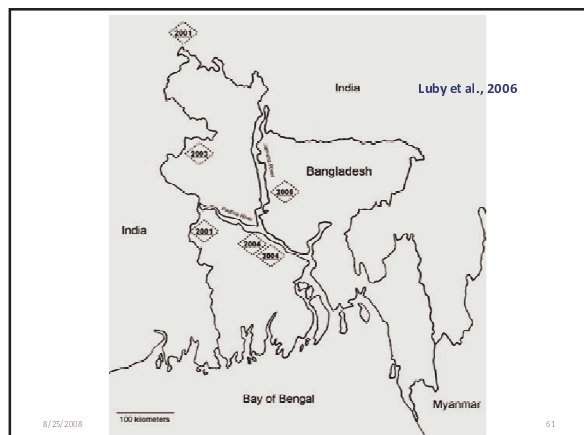
Chew et al., 2000



### Nipah virus outbreak in Siliguri, West Bengal, India in 2001

- NiV-specific IgM and IgG antibodies were detected in 9 of 18 patients
- RT-PCR assays detected RNA from NiV in urine samples from 5 patients
- NiV from Siliguri was more closely related to NiV isolates from Bangladesh than to NiV isolates from Malaysia

Chadha et al., 2006



### Nipah virus infection

- In Bangladesh, 4 outbreaks were identified during the period 2001–2004
- Among 92 patients, 67 (73%) of whom died
- Although all age groups were affected, 2 outbreaks principally affected young persons (median age, 12 years); 62% of the affected persons were male

Hossain et al., 2008

### Nipah virus infection

- Fever, altered mental status, headache, cough, respiratory difficulty, vomiting, and convulsions were the most common signs and symptoms
- Clinical and radiographic features of acute respiratory distress syndrome were identified during the fourth outbreak

Hossain et al., 2008

### Nipah virus infection

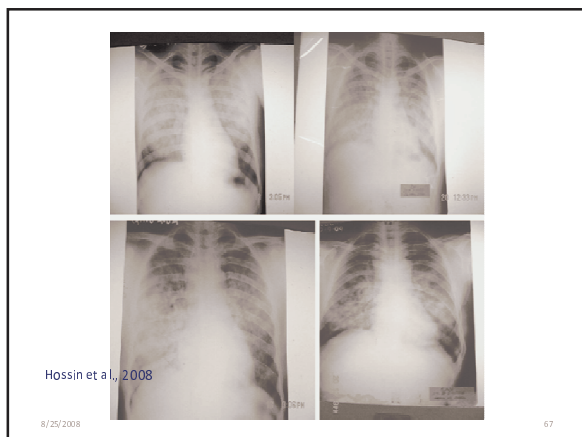
- Death occurred a median of 6 days (range, 2–36 days) after the onset of illness
- Patients who died were more likely than survivors to have a temperature > 37.8 °C, altered mental status, difficulty breathing, and abnormal plantar reflexes

Hossain et al., 2008

### Nipah virus infection

- The median incubation period was 9 days (range, 6–11 days)
- A rapidly progressive severe illness affecting the central nervous and respiratory systems

Hossain et al., 2008

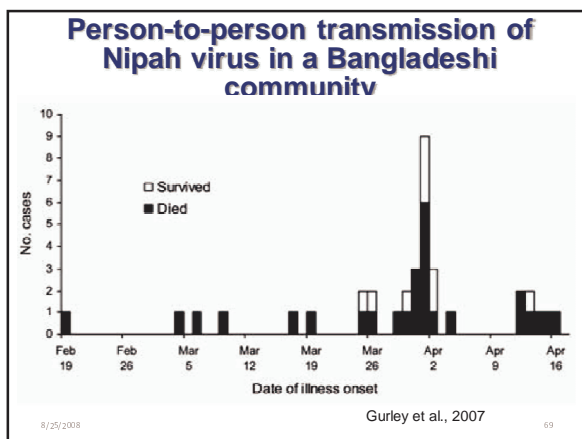


### Foodborne transmission of Nipah Virus, Bangladesh

Luby et al., 2006

**Nipah virus was transmitted from *P. giganteus* to persons through drinking fresh date palm sap (potentially contaminated with pteropid bat saliva)**

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### Person-to-person transmission of Nipah virus in a Bangladeshi community

- An encephalitis outbreak was investigated in Faridpur district, Bangladesh, in April–May 2004
- Thirty-six cases of Nipah virus illness were identified; 75% of case-patients died
- Thirty-three case-patients had close contact with another Nipah virus patient before their illness

Gurley et al., 2007

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### Person-to-person transmission of Nipah virus in a Bangladeshi community

- RT-PCR testing of environmental samples confirmed Nipah virus contamination of hospital surfaces
- Capacity for person-to-person transmission increases the potential for wider spread of this highly lethal pathogen

Gurley et al., 2007

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### Risk of nosocomial transmission of Nipah virus in a Bangladesh hospital

- A total of 105 healthcare workers (26 physicians, 68 nurses [including nursing students], and 11 cleaners or other patient attendants) were enrolled in the study from March 24–30, 2004,
- The most commonly reported type of contact with a patient with Nipah virus infection (50%) was washing or changing bed sheets

Gurley et al., 2007 (pp. 740–2)

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### Risk of nosocomial transmission of Nipah virus in a Bangladesh hospital

- Thirty-four participants (32%) reported having had unprotected exposures to potentially infectious bodily secretions
- None had IgM antibody against Nipah virus, 2 nursing students who reported changing bed sheets for patients had IgG antibodies (titer: 1 : 400), suggesting previous infection

Gurley et al., 2007 (pp. 740-2)

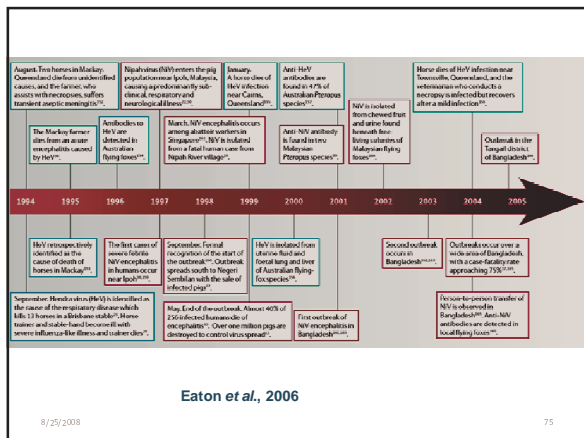
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### Risk of nosocomial transmission of Nipah virus in a Bangladesh hospital

- Thirty-four participants (32%) reported having had unprotected exposures to potentially infectious bodily secretions while providing care for patients, including receipt of a splash in the eye, mouth, or nose with a bodily secretion or a needlestick injury
- No evidence of recent Nipah virus infection was detected despite substantial exposures and minimal use of PPE

Gurley et al., 2007 (pp. 740-2)

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Pteropodidae

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Eaton et al., 2006

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### Henipavirus and Tioman virus antibodies in Pteropodid bats, Madagascar

Species and location	No. tested	Seropositive samples			Total (%)
		Nipah virus	Hendra virus	Tioman virus	
<i>Eidolon alpinum</i>					14/73 (19.2)
Marozevo (Moramanga)	53	10	10	0	10
Miandrivazo	2	0	0	0	0
Ankarana	18	4	1	0	4
<i>Pteropus rufus</i>					6/348 (2.3)
Marovitsika (Moramanga)	33	2	2	0	2
Miandrivazo	112	4	0	1	5
Maroveay	140	0	0	1	1
Bercloka	27	0	0	0	0
Vangaindrano	37	0	0	0	0
<i>Rousettus madagascariensis</i>					1/5 (20.0)
Ankarana	5	0	0	1	1
Total	427	20	13	3	23/427 (5.4)

Lehle et al., 2007

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### Henipavirus and Tioman virus antibodies in Pteropodid bats, Madagascar



*Roussettus madagascariensis*

Madagascar fruit bat (*Eidolon dupreanum*)

Madagascar flying fox (*Pteropus rufus*)

Lehle et al., 2007<sup>79</sup>

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### Evidence of Henipavirus infection in West African fruit bats

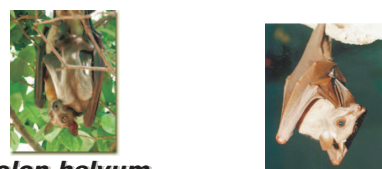
Species	Habitat where caught	Number tested	Number positive (seroprevalence (%), 95% CI)	
			Hendra	Nipah
<i>Epomophorus gambianus</i>	Open woodland*	89	0	1 (1, 0-3)
<i>Eidolon helvum</i>	City colony**	59	13 (22, 11-33)	23 (39, 27-51)
<i>Epomops franqueti</i>	Forest**	29	0	0
<i>Epomops buettikoferi</i>	Forest**	7	0	0
<i>Hypsignathus monstrosus</i>	Forest**	18	0	1 (6, 0-16)
<i>Nanonycterus veldkampii</i>	Forest**	4	0	0

Hayman et al., 2008

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### Evidence of Henipavirus infection in West African fruit bats

#### Luminex multiplexed microsphere assay




*Eidolon helvum*

*Hypsignathus monstrosus*

Hayman et al., 2008

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### Henipavirus Infection in Fruit Bats (*Pteropus giganteus*), India



Characteristic	ELISA		SNT
	No. NIV reactive/ no. tested	No. HeV reactive/ no. tested	No. NIV positive/total (%) [median titer, range]
Total	26/41	5/41	20/39‡ (51) [80; 5-640]
Male	10/12	3/12	8/12 (67) [60; 20-640]
Female	16/29	2/29	12/27‡ (44) [80; 5-640]
Lactating	12/20	2/20	8/19‡ (42) [80; 20-640]
Nonlactating	4/9	0/9	4/8‡ (50) [80; 5-80]

Epstein et al., 2008

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