The human health dimensions of ONE HEALTH

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Disclaimer:  
I have no conflict of interest in topics relevant to this talk.
The vulnerability of humans to infectious diseases
The vulnerability of humans to emerging infectious diseases

- Translocation
  - Wildlife EID
    - Encroachment
    - Introduction
    - "Spill-over" and "spill-back"
  - Domestic animal EID
  - Agricultural intensification
- Human EID
  - Human encroachment
  - Ex situ contact
  - Ecological manipulation
- Technology and industry
- Global travel
  - Urbanization
  - Biomedical manipulation
Portals of Entry of Infectious Diseases

- Ear
- Conjunctiva of eye
- Nose
- Mouth
- Placenta
- Vagina
  - In males: Penis
- Anus
- Urethra
- Broken skin
- Insect bite
The transmission cycle of infectious diseases in humans

ANTHROPONOSES

Direct Transmission
- Humans
- Humans

Indirect Transmission
- Humans
- Vector
- Humans
- Vector

ZOONOSES

- Animals
- Animals

- Vector

- Humans
- Humans

Climate, Ecosystems and Infectious Diseases, 2001
Emerging Infectious Diseases

- infections that have newly appeared in a population or have previously existed but are rapidly increasing and expanding in geographic range (Moore, 1995)
## Selected Emerging Infectious Diseases of Humans and Wildlife

<table>
<thead>
<tr>
<th>Disease and class of EID†</th>
<th>Pathogen</th>
<th>Hosts‡</th>
<th>Geography of emergence</th>
<th>Impact on wildlife populations</th>
<th>Factors associated with emergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hendra virus disease 1</td>
<td>Hendra virus (paramyxovirus)</td>
<td>Humans, horses, fruit bat reservoir</td>
<td>Australia, Papua New Guinea, Malaysia and Singapore, Europe, USA</td>
<td>Unknown</td>
<td>Unknown</td>
</tr>
<tr>
<td>Nipah virus disease 1</td>
<td>Nipah virus (paramyxovirus)</td>
<td>Humans, domestic pigs and dogs, fruit bats</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Farming practices, emergence of HIV, cross-species transfer</td>
</tr>
<tr>
<td>Cryptosporidiosis 4</td>
<td><em>Cryptosporidium parvum</em> (protozoan parasite)</td>
<td>Humans, cattle, wild rodents and other mammals</td>
<td>Unknown</td>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td>Hantavirus pulmonary syndrome 1</td>
<td>Sin Nombre and other strains of hantavirus (bunyaviruses)</td>
<td>Humans, <em>Peromyscus spp.</em>, and other rodents</td>
<td>Americas, esp. SW USA</td>
<td>Probably little impact</td>
<td>ENSO event and human encroachment Marburg: translocation of infected monkeys for lab research; Ebola: contact with infected human or nonhuman carcasses or patients</td>
</tr>
<tr>
<td>Marburg virus and Ebola virus hemorrhagic fever 1</td>
<td>Marburg and Ebola virus (filoviruses)</td>
<td>Humans and nonhuman primates, insectivorous or fruit bat reservoir suspected</td>
<td>Sub-Saharan Africa, Indonesia, Philippines</td>
<td>High mortality in captive and wild nonhuman primates</td>
<td></td>
</tr>
</tbody>
</table>
Outbreak of Henipavirus Infection, Philippines, 2014

<table>
<thead>
<tr>
<th>Clinical presentation</th>
<th>Slaughter and meat consumption</th>
<th>Meat consumption alone</th>
<th>Exposure to probably infected human</th>
<th>Uncertain exposure</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute encephalitis syndrome</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. patients</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Sex, M:F</td>
<td>3:0</td>
<td>3:0</td>
<td>4:0</td>
<td>1:0</td>
<td>11:0</td>
</tr>
<tr>
<td>Age, y</td>
<td>21, 32, 60</td>
<td>30, 51, 54</td>
<td>24, 29, 35, and 46</td>
<td>28</td>
<td>32 (median)</td>
</tr>
<tr>
<td>Incubation period</td>
<td>6, 8, 8</td>
<td>7, 10, 20</td>
<td>3–8, 6, 7, 8</td>
<td>Unknown</td>
<td>3–20</td>
</tr>
<tr>
<td>No. deaths</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Influenza-like illness (n = 5) or meningitis (n = 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. patients</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Sex, M:F</td>
<td>4:0</td>
<td>NA</td>
<td>1:0</td>
<td>0:1</td>
<td>5:1</td>
</tr>
<tr>
<td>Age, y</td>
<td>21, 23, 26, 39</td>
<td>NA</td>
<td>46</td>
<td>26</td>
<td>26 (median)</td>
</tr>
<tr>
<td>Incubation period, d</td>
<td>7, 9, 15, 15</td>
<td>NA</td>
<td>4</td>
<td>Unknown</td>
<td>4–15</td>
</tr>
<tr>
<td>No. deaths</td>
<td>0</td>
<td>NA</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*NA, not applicable.
Dynamics of Infectious Disease Spillover to Domestic Animals & Humans

reservoir hosts

HeV
NiV-M

spillover hosts

HeV
NiV-M

dead-end host

HeV
NiV-M

reservoir hosts

NiV-B

spillover host

NiV-B
Dynamics of Spillover to Domestic Animals & Humans

Ebola viruses:
- Ebola virus (formerly Zaire virus)
- Sudan virus
- Tai Forest virus
- Bundibugyo virus
- Reston virus (non-human)

Following initial human infection through contact with an infected bat or other wild animal, human-to-human transmission often occurs.

Human-to-human transmission is a predominant feature of epidemics.
Human interaction with long-tailed macaque in New Israel, The Philippines
Sylvatic and human dengue virus transmission cycle
The scourge of dengue virus infections in the Philippines

Alera et al., 2016
Crossing the species barrier for avian influenza
Crossing the species barrier for avian influenza

Human Infections with Bird Flu Viruses Rare But Possible

1. Direct Contact
   (Most Common)
   - Touching virus and then touching the eyes, nose or mouth

2. Contaminated Surfaces
   - Healthy looking birds can still spread bird flu

Infection can occur without touching poultry.
More testing and monitoring to detect illnesses in animals and people...

...and farms following standards to protect animals, the people who work there, and the farm environment...

...could help prevent an influenza pandemic.
Emergence of Parasitic Infections in Human Populations

Emerging Infectious Diseases

Intestinal Capillariasis, Western Mindanao, the Philippines

Vicente Y. Belizario, Jr., Francis Isidore G. Totañes, Winifreda U. de Leon, Julius R. Migriño, Jr, and Lino Y. Macasaet

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Spread of human malaria in the Philippines, 2017

DOH, 2017
The evolution of monkey malaria in human populations

Galinski, Meyer & Barnwell
Advances in Parasitology, 2013
Massive spread of anti-malarial drug resistance across endemic countries.
Emergence of zoonotic malaria in human populations in the Philippines

Map of Palawan Island, The Philippines showing *P. knowlesi* infections (Luchavez et al. 2008)
MONKEYBAR

Capacity development
Clinical trials & studies
Drug development & resistance
Epidemiology
Immunology & vaccination
Parasite biology
Social & economic studies
Vector control
Research Groups and Consortia

“MONKEYBAR”: Defining the biomedical, environmental and social risk factors for human infection with Plasmodium knowlesi; opportunities for prevention and control of an emerging zoonotic infection

LSHTM Investigators: Chris Drakeley, Jonathan Cox and Kimberly Fornace

External collaborators: Benoit Goossens, Senthivel Nathan, Milena Salgado-Lynn (Danau Girang Field Centre / Sabah Wildlife Department, Malaysia); Timothy William (Infectious Disease Society Kota Kinabalu Sabah, Malaysia); Steve Torr (Liverpool School of Tropical Medicine, UK); Malaysian Ministry of Health; Nick Anstey (Menzies School of Health Research, Australia); Fe Espino, Ferdinand Salazar (Research Institute for Tropical Medicine, Philippines); Royal Veterinary College, UK; Indra Vythilingam (University of Malaya, Malaysia); Chua Tock Hing, Khataya Mariappan, Paul Porodong (Universiti Malaysia Sabah, Malaysia); Heather Ferguson, Rowland Kao (University of Glasgow, UK); Judeline Dimalibot (University of the Philippines Los Baños); Martha Betson (University of Surrey, UK)

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One Health

People who protect human, animal, and environmental health, and other partners

Communicating

Collaborating

Coordinating

To achieve the best health outcomes for people, animals, plants, and our environment

Centers for Disease Control and Prevention
National Center for Emerging and Zoonotic Infectious Diseases
The End