Zoonoses:
Convergence of Animal and
Public Health

Zoonotic disease overview

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Implications for foodborne illness prevention

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What is a zoonosis?

“What those diseases and infections which are naturally transmitted between vertebrate animals and man” (WHO)

An old concept with new dimensions:
- New emerging diseases
- Growing populations and increased movement
- Changing agriculture and husbandry practices
- Climate and environmental change
- Bioterrorism threats
- Cultural and social change

Common misconceptions:
- Causes disease in animals
- Animal host is natural reservoir
- Transmission route to humans is simple and direct

Transmission Modes for Zoonotic Diseases
II. Background & Trends

- 75% of emerging diseases are zoonotic
- Zoonotic agents comprise more than 80% of the CDC-listed biothreat agents of concern:

<table>
<thead>
<tr>
<th>Zoonotic Agent</th>
<th>Pathogen</th>
</tr>
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<tbody>
<tr>
<td>Anthrax</td>
<td>Bacillus anthracis</td>
</tr>
<tr>
<td>Avian influenza</td>
<td>Influenza virus</td>
</tr>
<tr>
<td>Botulism</td>
<td>Clostridium botulinum</td>
</tr>
<tr>
<td>Brucella species</td>
<td>Brucella abortus</td>
</tr>
<tr>
<td>Choleraz (Wilde boar)</td>
<td></td>
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<tr>
<td>Ebola virus hemorrhagic fever</td>
<td>Ebola virus</td>
</tr>
<tr>
<td>E. coli O157:H7</td>
<td>Escherichia coli</td>
</tr>
<tr>
<td>Emerging infections (SARS, Rift Valley Fever)</td>
<td></td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td></td>
</tr>
<tr>
<td>Rabies (Canine)</td>
<td>Virus</td>
</tr>
<tr>
<td>Rinderpest</td>
<td></td>
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<tr>
<td>Taenia solium</td>
<td></td>
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<tr>
<td>Typhoid fever</td>
<td>Salmonella Typhi</td>
</tr>
<tr>
<td>Typhus fever</td>
<td></td>
</tr>
<tr>
<td>Uluru disease</td>
<td>cholera</td>
</tr>
<tr>
<td>Viral gastroenteritis</td>
<td></td>
</tr>
<tr>
<td>Viral hemorrhagic fever</td>
<td>Filoviruses (e.g. Ebola, Marburg)</td>
</tr>
<tr>
<td>Water safety threats</td>
<td>Cryptosporidium parvum</td>
</tr>
</tbody>
</table>

Out of these, 868 (61%) are zoonotic, that is, they can be transmitted between humans and animals, and 175 pathogenic species are associated with diseases considered to be 'emerging'.

Out of the emerging pathogens, 132 (75%) are zoonotic, and overall, zoonotic pathogens are twice as likely to be associated with emerging diseases than non-zoonotic pathogens.

Emerging Disease: A new infection resulting from the evolution or change of an existing pathogenic agent, a known infection spreading to a new geographic area or population, or a previously unrecognized pathogenic agent or disease diagnosed for the first time and which has a significant impact on animal or public health.
Classic ‘Old’ Zoonoses

- Rabies
- Trichinosis
- Tuberculosis
- Brucellosis
- Salmonellosis
- Anthrax
- Plague
- Tularemia
- Leptospirosis
- Psittacosis
- Q fever
- Toxoplasmosis
- Ringworm
- Influenza

Emerging ‘New’ Zoonoses

H1N1 ‘Swine’ Flu:
- 2009 pandemic flu
- Re-assortment of viruses with swine and avian hosts

H5N1 ‘Bird’ Flu:

Monkey Pox:
- 2003 U.S. - Prairie Dogs
- Imported Gambian Rats

BSE (Mad Cow Disease):
- Transmissible Spongiform Encephalopathy
- Variant CJD

Multidrug Resistant Salmonella

MRSA (Methicillin Resistant Staph Aureus)

Hendra Viruses:
- Nipah virus swine (1998 Malaysia)
- Morbilliviruses equine (1994 Australia)
- Fruit bat reservoir

West Nile Virus

Lyme Disease

Cryptosporidia
There will be no calm because the forces that create the perfect storm will continue to collide and the storm itself will be a recurring event.

Emerging and Re-emerging Zoonoses 1996-2004 (Source: WHO)

- Ebola
- West Nile Virus
- Nipah virus
- Hendra virus
- Multidrug resistant Salmonella
- Lyme Borreliosis
- Reston virus
- Lassa fever
- Multidrug resistant E.coli O157
- West Nile
- Brucellosis
- E.coli non-O157
- Influenza A(H5N1)
- Reston Virus
- Nipah virus
- Equine morbillivirus
- Ross River virus
- BSE
- Hantavirus pulmonary syndrome
- Leptospirosis
- Venezuelan Equine Encephalitis
- Cryptosporidiosis
- Yellow fever
- Monkeypox
- Rift valley fever
- Ebola
- E.coli O157
- BSE
- Influenza A(H5N1)
- Reston Virus
- Nipah virus
- Equine morbillivirus
- Ross River virus
- BSE
Other Impacts of Zoonotic Disease

- **Agricultural Products**
  - Vegetables contaminated with E. coli 0157:H7

- **Food Safety**
  - Trade restrictions may be placed on products like eggs and milk

- **Conservation Issues**
  - Endangered wildlife populations may be at risk for extinction (gorillas and measles)

- **Economic Impact**
  - Typically, the animal reservoirs of many zoonotic diseases are of economic importance (livestock) or provide social well being (companionship)

- **Livestock productivity**
  - Zoonotic pathogens may result in control costs or production losses

David Chico, VMD, MPH, DACVPM
Director Emergency Programs
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ESF #11 (USDA/APHIS) provides for an integrated Federal, State, tribal, and local response to an outbreak of a highly contagious or economically devastating animal/zoonotic disease …
Animal Disease Response

Area Level
- Surveillance
- Investigation
- Diagnosis
- Quarantine
- Appraisal
- Depopulation
- Disposal
- C&D
- Compensation
- Repopulation

Farm Level
- Reporting
- Investigation
- Diagnosis
- Quarantine
- Vaccination
- Treatment
- Release

USDA APHIS VS Resources
- National Veterinary Stockpile
- Incident Management Teams (4)
- NVSL/FADDL Laboratories
- NAHLN Laboratory Network
- NAHERC Veterinary Reserve Corps

National Animal Health Laboratory Network (NAHLN)
M. Bovis

- **Surveillance**
  - Slaughter Surveillance
  - Herd Testing

- **Response**
  - Quarantine, Indemnity and Depopulation
  - Quarantine, Test and Remove

- **Zoonotic Issues**
  - Migrant Laborers and Reverse Zoonosis (M. Tb)
  - Raw milk consumption

**Case Scenario: August 14, 2007**

- A severe storm with high winds damaged a dairy farm used as a teaching facility by the University of Minnesota college of Veterinary Medicine.
- A call for help went out to any available veterinary student to assist with the clean up.
Friday August 31, several reports of illness among students.
- 2 students reported diarrhea, one student was sick enough to be admitted to the ER and placed on IV fluids.
- **Cryptosporidiosis** diagnosed
- 26/36 (72 %) ‘responders’ responded to survey
- 10/26 respondents reported illness
- Case definition; “persons who have been sick with vomiting or diarrhea since August 14, 2007.”

**Summary of significant risk factors:**

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Odds ratio</th>
<th>P-value</th>
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<tbody>
<tr>
<td>Assigned to public health rotation during visit to TMF</td>
<td>16.67</td>
<td></td>
</tr>
<tr>
<td>Clinical track small animal</td>
<td>24.5</td>
<td>0.003</td>
</tr>
<tr>
<td>Wear coveralls while at the TMF (protective)</td>
<td>0.25</td>
<td>0.137</td>
</tr>
<tr>
<td>Were you raised on farm</td>
<td>0.32</td>
<td>0.17</td>
</tr>
</tbody>
</table>
# State Veterinarian Offices

<table>
<thead>
<tr>
<th>State</th>
<th>Location</th>
<th>Contact Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>Illinois Department of Agriculture</td>
<td>217-782-4944</td>
</tr>
<tr>
<td>Indiana</td>
<td>Indiana State Board of Animal Health</td>
<td>317-544-2400</td>
</tr>
<tr>
<td>Michigan</td>
<td>Michigan Department of Agriculture</td>
<td>517-373-8200</td>
</tr>
<tr>
<td>Minnesota</td>
<td>Minnesota Board of Animal Health</td>
<td>651-201-6825</td>
</tr>
<tr>
<td>New York</td>
<td>New York State Department of Agriculture &amp; Markets: Division of Animal Industry</td>
<td>518-457-3502</td>
</tr>
<tr>
<td>Ohio</td>
<td>Ohio Department of Agriculture: Division of Animal Industry</td>
<td>614-728-6220</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>Pennsylvania Department of Agriculture: Bureau of Animal Health and Diagnostic Services</td>
<td>717-772-2852</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>Wisconsin Department of Agriculture, Trade and Consumer Protection: Animal Health Division</td>
<td>608-224-4880</td>
</tr>
</tbody>
</table>

# USDA, APHIS, VS

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<tr>
<th>State</th>
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<tr>
<td>Illinois</td>
<td>217-547-6030</td>
</tr>
<tr>
<td>Indiana</td>
<td>317-347-3100</td>
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<tr>
<td>Michigan</td>
<td>517-324-5290</td>
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<tr>
<td>Minnesota</td>
<td>651-290-3691</td>
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<tr>
<td>New York</td>
<td>518-218-7540</td>
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<td>Ohio</td>
<td>614-856-4735</td>
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<tr>
<td>Pennsylvania</td>
<td>717-237-7440</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>608-662-0600</td>
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