One Health: How Can Human Health Professionals Contribute?

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Swenson land and cattle company
Learning Objectives:

1) List at least 2 roles for human health professionals, including clinicians, in One Health efforts
2) List competencies of human health care providers regarding zoonoses and animals as sentinels
3) Describe the “shared risk” concept.
The One Health Concept

“One Health is the collaborative effort of multiple health science professions, together with their related disciplines and institutions – working locally, nationally, and globally – to attain optimal health for people, domestic animals, wildlife, plants, and our environment.“

“While veterinarians have been the main driver of the One Health initiative, the medical profession does not seem to be fully aware of how veterinary science can contribute to human public health.”

Marcotty T et al 2013. Intersectoral collaboration between the medical and veterinary professions in low-resource societies: The role of research and training institutions. Comp Immunol Microbiol Infect Dis
Number of Licensed Physicians and Veterinarians: US
Number of Schools with One Health Programs (Web search 2014)

- AAMC Med Schools
- AAVMC Vet Schools

- One Health Programs
- No One Health
Case:
The Dog that Wouldn’t Get Up

- 9 year old labrador retriever taken to veterinarian because of 2 days difficulty rising.
- Amoxicillin prescribed
Dog gets worse
Admitted to veterinary hospital
Gets CT Scan, spinal tap
CT scan shows a mass (could be cancer or infection) prognosis poor
Dog euthanized
Vet does necropsy
Tissue sent to CDC
Two Days Later:

Dog’s owner, 69 year old woman, goes to her doctor complaining of 3 days of nausea, vomiting, fatigue, and fever.

Patient reports “my dog died of cancer two days ago, and the dog had some of the same complaints”
Patient diagnosed with gastroenteritis, sent home with fluids.

Next day, patient returns to doctor, feeling worse, with fever and altered mental status

Admitted to hospital: “Fever of unknown origin”

Treated with antibiotics but only partially recovers
CDC Results

Dog’s tissue specimens tested for “spotted fever”

Results: Rocky Mountain Spotted Fever
Rocky Mountain Spotted Fever

- Veterinarian contacts doctor
- Physician prescribes Doxycycline
- Patient’s complaints resolve completely

(Paddock, Childs et al 2002 Am Jl Trop Med Hyg)
Rocky Mountain Spotted Fever

- Severe tickborne rickettsial infection
- Incidence increasing, vectors extending range
- Mortality without antibiotic treatment: 20%, with treatment (Doxycycline): 5%
- Long term sequellae: deafness, neurological damage, amputation
- Often underdiagnosed, at first visit only 3-18% present with triad of fever, rash, history of tickbite
RMSF in Dogs

- Causes severe disease
- Ecchymoses, edema, vasculitis, hemorrhage

Petechia and Ecchymosis
What Was the Connection between the Infections in the Dog and the Owner?

A. Owner became infected when the dog licked her
B. The same tick that bit the dog bit the woman as well
C. The woman removed a tick from the dog and got infected
D. The dog and the owner both got infected from the same tick-infested environment.
Dogs as Sentinels for Rocky Mountain Spotted Fever Risk

- RMSF has patchy geographic distribution

- Cases in dogs can alert human health that disease is present in the community.
Case: Dog Sentinels of Rocky Mountain Spotted Fever

- Dog diagnosed with apparent RMSF
- 8 days later, second dog of same owner dies
- 2 weeks later, owner develops RMSF and dies, diagnosis possibly delayed
  - No communication between human and veterinary medicine

What Could Have Happened Differently?
Case: The Cat as Canary

Woman, 29 weeks pregnant, tells her obstetrician: “my cats are not well”
Midge and Pepsi: 3 year old short hair siblings

Sick for 3 weeks;
   - anorexia, gagging, retching

Cats treated with Ranitidine (ulcer medicine) without improvement
Clinical Evaluation of Cats

- Vomiting, diarrhea, anorexia
- Pepsi had lost 0.7kg
- Both dehydrated, pale mucus membranes
- Midge: swaying gait, fine tremor
- Pepsi: hypersalivation

- Both admitted to veterinary hospital
Lab Testing/Treatment of Cats

- Cats admitted to veterinary hospital
- Cats given IV fluids and IV ranitididine
- Veterinarian sends blood for lead test
Lab Results: Venous Lead

- Midge: 135 mcg/dL
- Pepsi: 87 mcg/dL
  (CDC recommends levels <10 mcg/dL in children)

- Both cats treated with chelation therapy
- Pepsi survived, Midge died

- Veterinarian tells pregnant owner: “call your doctor and tell him the cats have lead poisoning”
Lead Testing: Pregnant Woman

- Venous blood lead 40 mcg/dL
  - (adverse fetal outcomes reported with maternal levels >10mcg/dL)
- She had been stripping old paint with blowtorch while renovating house with husband in preparation for baby

(SK Doumouchtsis et al. “Veterinary diagnosis” of lead poisoning in pregnancy. BMJ 2006)
Cats as “Sentinels” of Lead Poisoning

- Cats at risk because:
  - Low to the ground
  - Licking fur: grooming behavior
  - In the house more than humans
  - More susceptible

- Dogs also reported as sentinels for lead risk in humans
What Could Have Happened Differently?
Case: Returning Traveler

- 23 year old graduate student seen by her physician for illness after travel
- Was doing a “One Health” project with cattle in Kenya.
- Complaining of fever, malaise, knee pain
Evaluation

On further history taking, patient reports not taking antimalarial prophylaxis
Physical examination unremarkable except low grade fever
Bloodwork normal except for slightly low platelets
Malaria smear negative
Management

- Patient informed she probably has a viral syndrome
- She requests a blood test
Test Results

- Patient’s IgG is positive for Brucella abortus
- Patient started on Doxycycline and Rifampin for 6 week course
Follow-up

6 months later, patient reports occasional fever, malaise, and depression
Questions

What are long term consequences of Brucella infection?
How could this case have been prevented?
"Stealth Pathogens"

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<thead>
<tr>
<th>Feature</th>
<th>Frontal</th>
<th>Stealth</th>
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<tbody>
<tr>
<td>Incubation</td>
<td>Short (hours to days)</td>
<td>Long (months to years)</td>
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<td>Symptoms</td>
<td>Acute</td>
<td>Chronic</td>
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<td>Non-sterilizing</td>
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<tr>
<td>Transmission</td>
<td>Direct</td>
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<td>Rapid</td>
<td>Slow</td>
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<td>Carrier state</td>
<td>Uncommon</td>
<td>Common</td>
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Adapted from Merrell and Falkow (2004).
One Health-How Can Human Health Professionals Contribute?

- Zoonotic diseases
- Animals as sentinels of human environmental health risks
Competencies for Human Health

- Zoonoses:
  - Diagnosis and treatment, prevention
  - Surveillance: including occupational surveillance of at-risk animal workers.
World Population, Chicken Production, Cattle Production (1000)

Data Source: FAO
Intensification of Agriculture
Trends in hog operations in the United States.

Occupational High Risk Groups

- Farm workers with animal contact
- Hunters
- Butchers, Abattoirs workers
- Veterinary care workers
- Workers with wildlife contact
  - Extractive industry workers
  - Loggers, etc.
Pandemic (H1N1) 2009,
Number of laboratory confirmed cases as reported to WHO

Status as of 06 July 2009
09:00 GMT

Cumulative deaths
- 1 - 10
- 11 - 50
- 51 - 100
- 101 and more

Cumulative cases
- 1 - 10
- 11 - 50
- 51 - 500
- 501 and more

Total: 94,512 cases
429 deaths

Chinese Taipei has reported 61 confirmed cases of pandemic (H1N1) 2009 with 0 deaths. Cases from Chinese Taipei are included in the cumulative totals.

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Public Health Information and Geographic Information Systems (GIS)
World Health Organization

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Map produced: 06 July 2009 09:00 GMT
pH1N1 2009 Flu:
a Triple Recombinant Virus

- Avian, swine, human components
La Gloria, Mexico: Index Cases
Swine Production in La Gloria
Risk of Transmission to Swine
Transmission Questions

- How much exposure is occurring
- Species-specific binding and pathogenesis
- Role of host immunity
Assessing Environmental/Occupational Exposure to Swine Influenza
Movement of influenza virus particles through several state-transitions in Markov chain model for swine barn.
Physician Survey re: Zoonoses in Farming Patients

“over 50% of physicians were either mostly uncomfortable or strongly uncomfortable with their knowledge of zoonoses, and in their ability to diagnose and make recommendations on how to prevent zoonotic infections.”

Kersting AL et al 2009. Zoonoses and the physicians’ role in educating farming patients. JI Agromedicine
Competencies for Human Health

Animals as Sentinels

- Awareness of importance of animal sentinels
  - Infections
  - Toxicants
- Communication with animal health and environmental health to recognize and report sentinel cases
“Us vs. Them”:
animals cause scary zoonotic disease
Solutions: vaccination, isolation, elimination

“Shared Risk”:
animals and humans share exposures
Animals can be “sentinels” for humans
Competencies for Human Health

Zoonoses:
– Diagnosis and Treatment, Prevention
– Surveillance
Competencies for Human Health

**Zoonoses:**
- Diagnosis and Treatment, Prevention
- Surveillance

**Animals as Sentinels**
- Awareness of Shared Risks
  - Infections
  - Toxicants
- Communication
Strategies

- Physician training
  - Zoonoses
  - Animal sentinels
- Development of clinical protocols for communication with animal health
- Integration of medical records systems
- Involvement of human health in interdisciplinary teams: integrated assessment and interventions
Assess burden of zoonotic disease

Research on the impact of many zoonotic diseases on chronic disease status: in both immunocompromised and immunocompetent patients

- Toxoplasmosis
- Bartonellosis
- Coxiella
- Lyme
- Others
Gates Grand Challenge: One Health One Household
Occupational Health of Animal Workers

Zoonotic disease transmission risks in:
- Veterinary and animal care workers
- Wildlife workers- PREDICT project
- Farm workers
- Market workers
One Health Metrics

Human Health
- GBD/DALYs
- Nutritional status
- Urbanization
- Wellbeing

Animal Health
- Nutritional status
- Diseases
- Welfare
- Wildlife populations

Environmental Health
- Air
- Water
- CO2 levels
- Climate change
- Biodiversity
Thank You!

http://deohs.washington.edu/cohr/