One Health: A Concept for the 21st Century

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The One Health Concept:

- Human health is inextricably linked with animal and environmental health.
- One Health seeks to increase communication and collaboration between human, animal, environmental health professionals.

www.onehealthinitiative.com
Why One Health?

- Zoonotic disease risks from wildlife, livestock, and pets.
- Over 75% of emerging infectious diseases are zoonotic.
- 60% of human pathogens are zoonotic.
- Most agents of bioterrorism are zoonotic.
- Beyond zoonoses: Disease processes across species are shared.
The Price of Agriculture and Domestication of Animals

- Agriculture about 10,000 years ago.
- Agriculture allowed civilization to develop. Towns and cities grew.

http://www.nature.com/nature/journal/v447/n7142/full/nature05775.html
Price of Agriculture

- Measles (Rinderpest)  Cattle
- Brucellosis           Goats/Sheep
- Q fever              Goats/Sheep
- Tularemia            Rabbit/Squirrels
- BSE                  Cattle

http://www.nhbs.com/beasts_of_the_earth_tefno_141345.html
Mycobacterium tuberculosis appeared about 40,000 years ago, coincided with human migration out of Africa.

Two main lineages 20-30,000 years ago: 2\textsuperscript{nd} lineage associated with animals.

Humans probably infected livestock.

http://www.plospathogens.org/article/info%3Adoi%2F10.1371%2Fjournal.ppat.1000160
Without Agriculture

- People eat wild animals (i.e. bushmeat)
- Danger of zoonotic disease transmission
  - HIV/AIDS
  - SARS
  - Ebola
- What’s next?
Hippocrates (ca. 460 BCE--ca. 370 BCE)

Recognized the link between human health and the environment.

Malaria=“mal” + “aria.”
Middle Ages (14\textsuperscript{th} Century): Black Death

Bacteria: \textit{Yersinia pestis}

Spread by fleas carried by rats
Beginning in the 18th century...

Some of the greatest discoveries in the history of medicine and public health were made at the intersection between human and animal health.
18th Century: Vaccination against smallpox

“Vacca” is Latin word for cow.

Dr. Edward Jenner vaccinating 8 yr old boy
Opposition to Vaccination
19th Century: Germ Theory of Disease

- Louis Pasteur, French chemist studied chicken cholera
- Robert Koch, German physician studied anthrax
Rudolf Virchow (1821-1902), a German physician and pathologist said, “between animal and human medicine there are no dividing lines--nor should there be.”

Coined term “zoonosis”
Early Meat Inspection Programs
Improved Food Safety

- Virchow’s father was a butcher.
- Animal experiments on life cycle of Trichinella spiralis in porcine muscular tissue.
- Studied cysticercosis and tuberculosis in cattle.
19th Century Developments

- Sir William Osler received his medical degree from McGill University, Canada.
- Went to Berlin to work with Virchow.
- Returned to Canada in 1874.
- Est. veterinary pathology as an academic discipline in North America.
19th Century Discovery: Diseases can be transmitted by arthropods

- Theobald Smith, MD (pictured) and F.L. Kilbourne, DVM discovered cause of cattle fever
- *Babesia bigemina* transmitted by the cattle tick.
- Set the stage for Walter Reed and colleagues’ discovery that mosquitoes transmit yellow fever.
20th Century Developments

- Scientific knowledge exploded
- Medicine became increasingly specialized
- Medicine and veterinary medicine diverged
Emergence of new infectious diseases in 20th century

Figure 1 Examples of Emerging and Re-emerging Infectious Diseases Throughout the World.

Why are these diseases emerging?

- Increasing global population pressures
- Deforestation and environmental destruction
- Intensive agriculture
- Global trade and travel
- Possibly climate change
1999 West Nile Virus Outbreak in NYC
Two Simultaneous Outbreaks

WNV TRANSMISSION CYCLE

Bird to Mosquito

Reservoir Host:
Birds

Mosquito to Bird

Insect Vector

Mosquitoes

Accidental Hosts:
People and Animals

(Not spread by person to person or by animal to human contact)
Solving the Mystery

Dr. Tracey McNamara, Chief Veterinary Pathologist, Bronx Zoo

Birds native to North America
Challenges of the 21st century

- Requires a new paradigm, One Health:
  - Zoonotic diseases
  - Cancer
  - Cardiovascular Diseases
  - Metabolic Diseases
  - Neurological Diseases
  - Degenerative Diseases and Injuries
  - And others...
Humans and Animals Get the Same Diseases: New Therapeutic Discoveries Can Benefit All Species
Zoonotic diseases and pets

- Some people are at greater risk:
  - Chronically immunosuppressed
    - HIV/AIDS
    - Organ transplant recipients
    - People with autoimmune diseases
  - Pregnant women
  - Infants and very young children

http://www.cdc.gov/healthypets/extra_risk.htm
Risks of Pet Ownership: Microbes are shared
New York Times, September 21, 2009

- Dr. Elizabeth A. Scott et al.
- swabbed household surfaces
- at 35 randomly selected addresses. Nearly half of homes had MRSA on surfaces.

- Cat owners were 8 times more likely than others to have MRSA at home.

“Tie to pets has germ jumping to and fro”
Methicillin Resistant Staph aureus (MRSA) is infecting both humans and animals.
Grant and Olsen Study, 1999

- Grant and Olsen, EID, “Preventing zoonotic diseases in immunocompromised persons.”
- Surveyed MDs and DVMs in Wisconsin
- MDs generally not comfortable discussing role of animals in zoonotic disease transmission.
- DVMs typically didn’t know pet owner’s health status.
- Found nearly a complete lack of communication between MDs and DVMs.
- Result: Zoonotic disease risk communication to patients falls through the cracks.

Grant and Olsen Study, 1999

- MDs and DVMs asked to rank animals posing greatest risk to immunocompromised patients.
  - DVMS: ranked reptiles (*Salmonella*) and puppies (*Campylobacter*)
  - MDs: ranked cats and kittens
  - Both groups ranked *Salmonella* and *Toxoplasma gondii* as microbes of greatest risk.
Risks of Pet Ownership for Immunosuppressed

- Reptiles carry *Salmonella* in their guts.
- In U.S., exposure to these animals leads to 100,000 cases of reptile-associated salmonellosis each year.
- Reptiles are popular pets: In 2001, estimated households with reptiles—1.7 million

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5249a3.htm
Some animals simply shouldn’t be pets

More tigers are now kept as pets in the U.S. than living in the wild.

15,000 big cats and 15,000 primates in private hands in U.S. according to Humane Society of US.

400 tigers left in Sumatra.

Only 18 states have outright bans on exotic animals as pets. NYTimes Jan. 10, 2012.
How can clinicians engage in One Health?

- Human and animal health professionals have much to learn and benefit from each other.
- Continue inter-disciplinary, inter-species conferences such as this one.
- Develop collegial relationships with animal (human) health professionals.
- Educate policy makers and the public about the importance of One Health.
Take Home Messages

- Human, animal, and environmental health are linked.
- One Health concept provides an important strategy to improve the lives of all species.
- Animals suffer from many of the same diseases as people: new therapies would benefit all species.
- One Health is a strategy to prevent zoonotic disease transmission, especially in high risk patient groups.
The One Health Umbrella
One Health Endorsements

- American Medical Association
- American Veterinary Medical Association
- American Nurses Association
- American Association of Medical Colleges
- American Association of Veterinary Medical Colleges
- American Society for Microbiology
- American Society of Tropical Medicine and Hygiene
- Council of State and Territorial Epidemiologists
- Association of Schools of Public Health
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http://www.onehealthinitiative.com
Thank you!