**ZOO NOSES**

**Definition:** Diseases and infections which are naturally transmitted between vertebrate animals and man (W.H.O., 1951, Expert Committee on Zoonoses, WHO tech rep. Ser No 40).

**Comments:**
- Excludes toxins transmitted by vertebrate animals and diseases experimentally transmitted.
- Excludes diseases transmitted by animals or food as vehicles of human pathogens (hepatitis A & ice-cream).
- Excludes diseases transmitted only from human to human via an arthropod (i.e., malaria).
- Usually excludes diseases common to animals and humans (i.e., Clostridial infection).


Zoonoses

That's not a zoonosis...
even if it hurts...

• Definitions:
  Anthropozoonoses: Diseases in animals that can be transmitted to man (i.e., rabies).
  Zooanthroponoses: Diseases in humans that can be transmitted to animals (i.e., tuberculosis in cats, monkeys).

Amphixenoses: Diseases affecting humans and animals that can be occasionally transmitted from one to another (i.e., staphylococcal infection).
Euzoonoses: Diseases in which humans are an obligatory host of the agent (i.e., Taenia solium or T. saginata)
Zoonoses

• Emerging and re-emerging zoonoses:

“Zoonotic diseases caused either by totally new or partially new agents, or by micro-organisms previously known, but now occurring in places or in species where the disease was previously unknown.”

(Meslin, WHO, 1992)
Emerging Infectious Diseases:
Major resources are lost

- U.K., 1990-98: BSE
  - US$ 9 billion
- USA, 2001: Anthrax
  - US$ 250 million
- Peru, 1991: Cholera
  - US$ 770 million
- Malaysia, 1999: Nipah Virus
  - Swine slaughtering
    - US$ 540 million
- Tanzania, 1998: Cholera
  - US$ 36 million
- India, 1994: Plague
  - US$ 2 billion
- China, 2003: SARS
  - US$ 25 billion
- Hong Kong, 1997: Influenza A (H5N1)
  - Poultry slaughtering
    - US$ 22 million

Emerging Zoonoses

- Some Major Bacterial Etiologic Agents of New Zoonoses Identified Since 1976
  - 1976: Capnocytophaga canimorsus
  - 1977: Campylobacter spp.
  - 1982: E. coli O157:H7
  - 1982: Borrelia burgdorferi (Lyme disease)
  - 1983: Helicobacter pylori and other spp.
  - 1986: Ehrlichia chaffeensis (HME)
  - 1992: Bartonella henselae (Cat scratch Disease)
  - 1994: Rickettsia felis (Murine typhus like)
  - 1994: E. Equi/A. phagocytophila (HGE)
Emerging Zoonoses

- Some Major Viral Etiologic Agents of New Zoonoses Identified Since 1990
  - 1991 Guanarito virus (Venezuelan hemor. fever)
  - 1993 Sin nombre virus (Hantavirus Pulm. Syndr.)
  - 1994 Sabia virus (Brazilian hemorrhagic fever)
  - 1994 Hendra virus (Equine morbillivirus)
  - 1996 Australian bat Lyssavirus (Rhabdovirus)
  - 1997 Menangle virus (paramyxovirus)
  - 1997 Influenza virus H5N1 (Hong Kong)
  - 1998 Nipah virus (Paramyxovirus)
  - 1999 Influenza virus H9N2 (Hong Kong)
  - 2003 SARS (Coronavirus)

Speed of Global Travel in Relation to World Population Growth

Spread of a new Infectious agent through international flights.

In 2000, 27 million Americans travelled abroad
9% visited a National Park,
5% camped or hiked,
5% visited sites of ecological interest, and
2% (540,000) traveled to Africa.

Incidence of Rickettsial Spotted fever was
14 cases per million for travelers to Africa.
By comparison, incidence of Rocky Mountain Spotted Fever in the USA is only
2 cases/million population

Emerging Zoonoses

- Estimated Global Mobile Population
  - International Travelers 698 million (WTO, 2000)
  - Migrant Workers 70-80 million (ILO, 2001)
  - Refugees/Uprooted People 22 million (UNHCR, 2002)
  - Migrant Victims of Trafficking 0.7 million (IOM, 2001)
Leptospirosis outbreak among 312 participants, Eco Challenge 2000*, Malaysia

Reasons for emergence or re-emergence of zoonoses

Human population increase leading to an increased number of contacts between humans and infected animals.
Increased International Trade of Agricultural Products.

International trade of agricultural products multiplied by 5 since 1950

Source: WTO, 2000

BSE and nvCJD: Potential Exposure through International Trade in the early 1990s

- Live cattle
- Cattle feed and Beef meat for human consumption
- Pharmaceutical and Cosmetic products
- Blood and derivated blood products
- Meat and Bones
- Human and Bovine Products used in Biology
**Zoonoses**

- Epidemiological cycle/Modes of transmission:

**Orthozoonoses:** Disease transmission cycle can be completed with only one vertebrate reservoir (i.e., rabies).

**Cyclozoonoses:** Diseases whose maintenance cycle requires more than one vertebrate species, but no invertebrate host (i.e., hydatid disease, taeniasis).

Echinococcosis
**ZOONOSES**

• Epidemiological cycle/Modes of transmission:

**Pherozoonoses (= Metazoonoses):** Diseases whose maintenance cycle requires both vertebrates and invertebrates to complete their transmission cycle (i.e. arboviruses).

(Sample diagram showing transmission cycle)

**Saprozoonoses:** Diseases that depend upon inanimate reservoirs or development sites, as well as upon vertebrate hosts.

(i.e. listeriosis: *Listeria monocytogenes* is the infectious agent responsible for the food borne illness Listeriosis. In the United States, an estimated 2,500 persons become seriously ill with listeriosis each year. Of these, 500 die).
ZOONOSES

Clinical manifestations:

Phanerozoonoses: Zoonoses for which symptoms are observed in animals and humans.
  - Iso-symptomatic: Symptoms are the same in humans and animals: Rabies, tuberculosis
  - Aniso-symptomatic: Symptoms are different in humans and animals: Q fever, anthrax

Cryptozoonoses: Zoonoses for which there is only infection without symptoms in animals and/or humans.
  - Infection in animals/disease in humans: ornithosis
  - Infection in humans/disease in animals: Ebola/Reston

Dynamics of zoonotic epidemics:

- Often, epidemics will start in animals and spread to human populations: rabies, Rift Valley fever, Equine Viral Encephalitides, Plague..
- Sometimes, epidemics are simultaneous in humans and animals when exposed to a same source (anademic): Anthrax, salmonellosis, listeriosis, coccidioidomycosis.
- In rare occasions, epidemics are first observed in humans and then in animals: i.e. West Nile virus in USA in humans and then horses; measles in primate colonies.
  - If a zoonosis does not spread from human to human, it is called “self-limited” man is usually an epidemiological cul-de-sac
  - If a zoonosis can be transmitted back to the animals, it is called reversible.
Zoonoses are important to Public Health:

- Public Health Aspect: Zoonoses are important to Public Health, because of their number, their frequency and the severity of human diseases.
  - Number: more than 150 zoonoses (Schwabe counted 183 diseases)
  - Frequency: Some zoonoses very ubiquitous and common (Salmonellosis), some restricted geographically (plague, yellow fever), some very limited (Ebola).
  - Severity: Very severe: herpes B, Ebola, rabies
    Severe: Plague, Hantavirus
    Mild: cowpox, Cat scratch disease

In 1998, W.H.O. indicated that among the 54 million people who died that year, 25% of the deaths were caused by infectious diseases.

- Millions of cases of salmonellosis worldwide,
  - In 2001, WHO reported 2,671 cases (including 175 deaths) of plague recorded in 14 countries.
- Serosurvey of zoonoses in rural population in UK (1991-1996): Chlamydia (79.6%), Q fever (27.3%), Toxoplasma (50.2%), Hantavirus (4.7%), Bartonella (2%)…
Zoonoses

• Importance:
Zoonoses have an important economic impact:

- Food borne diseases, USA: $1.5 – 2.7 billion
- Human toxoplasmosis, USA: > $400 million/year
- Cat Scratch disease, USA: 22,000 cases, $12 M

Latin America: porcine cysticercosis: US$ 164 million
Bovine TB worldwide: estimated losses > $1.5 billion.

Animal bites and rabies: 1-3 million bites, $90-$270 million in medical bills. About 18,000 rabies post-exposure treatment annually in the USA for an estimated cost of > $9 million!

Zoonoses

• Importance:
Zoonoses have an important LEGAL impact for professionals, including veterinarians!!!

- Insurance companies paid a record $1 billion for dog bite liability claims in 1996.
- In 1997, State Farm Insurance reported than more than 11,000 dog bite claims and more than $80 million were paid out in liability claims.

- Veterinary sued for a child acquiring psittacosis from a recently acquired cockatiel ($150,000). Vet. sued for exposure to a rabid adopted stray kitten that had problem walking ($100,000).
Knowledge of Zoonoses is fundamental for vets, as they are the first ones on the line of duty.

One of the most famous pioneer in zoonosis’ prevention, Louis Pasteur, when asked which profession he would embrace if he had to start his professional life again, indicated that he would have chosen to be a veterinarian.