Journal of Etiology and Animal Health
Received: Nov17, 2015, Accepted: Nov 25, 2015, Published: Nov 28, 2015
J Etiol Anim Health, Volume 1, Issue 1
http://crescopublications.org/jeah/JEAH-1-001.pdf
Article Number: JEAH-1-001

Mini Review Article Open Access

Animal Health and Zoonoses in the Context of "One World, One Health" Concept

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Citation: Rubén Bueno Marí (2015) Animal Health and Zoonoses in the Context of "One World, One Health" concept. J Etiol Anim Health 1: 001.
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Keywords: Zoonoses, Animal health, Vector-borne diseases, Epidemiology, Pest control, Medical and Veterinary entomology

Introduction

The ecosystems interface between animals-humans is the natural niche of zoonoses. Zoonoses can be defined as the diseases and infections which are naturally transmitted between vertebrate animals and humans. Although zoonoses always occurred with devastating effects on human populations along the history, in recent years these diseases and infections have been dramatically increased due to climatic change, globalization, biodiversity loss, massive deforestation and urbanization or exponential demographic increments in humans and animals in short time periods, among other factors related with global change. Approximately 75% of recently emerging infectious diseases affecting humans are diseases of animal origin and approximately 60% of all human pathogens are zoonotic [1]. Obviously these data not only force the international health organizations to adopt corrective measures in endemic and enzootic areas at local level, but also at large scale is mandatory to prevent the possible introduction and dissemination of those pathogens in new territories.

There is a great variability of bacteria, viruses, protozoans and nematodes that are potential causal agents of these zoonoses (Table 1). From the point of view of potential vectors of zoonoses, arthropods are probably those of major significance due to their abundance, high plasticity, adaptability, and coevolution to different kinds of pathogens, high degrees of synanthropism in several groups, and difficulties to apply effective programs of population control [2]. Although ticks, flies, sandflies, cockroaches, bugs, and fleas are excellent vectors capable of transmitting viruses, parasites, and bacteria, undoubtedly mosquitoes are the most important human disease vectors, while ticks are the most important vectors of pathogens in domestic production animals. Mosquito borne diseases like malaria or dengue are zoonoses with increasing incidence in the last years in tropical and temperate countries.The morbidity data of both mosquito borne diseases is especially high worldwide, being estimated in close to 700 millions people that have been infected by malaria or dengue [3, 4].

Table 1.

Main zoonoses according to the American Biological Safety Association (ABSA), with indication of disease name, pathogen identification, genus/species of specific causal agent, host range and mechanism of transmission.

Disease	Pathogen	Genus/species	Host range	Transmission
Brucellosis	Bacteria	*Brucella (B. melitensis, B. abortus, B. suis, B. canis)*	Infected animals (swine, cattle, goats, sheep, dogs)	Skin or mucous membrane contact with infected animals, their blood, tissue, and other body fluids
Salmonellosis	Bacteria	*Salmonella (S. cholera-suis, S. enteriditis, S. typhymurium, S. typhi)*	Domestic (dogs, cats, monkeys, rodents, labor-atory rodents, rep-tiles [especially turtles], chickens and fish) and herd animals (cattle, chickens, pigs)	Direct contact as well as indirect consumption (eggs, food vehicles using eggs, etc.). Human to human transmission also possible
Shigellosis	Bacteria	All *Shigella* species	Captive non-human primates	Oral-fecal route
Leptospirosis	Bacteria	*Leptospira interrogans*	Animal, human urine	Direct contact with urine of infected dogs, mice or rats. Indirect contact with urine contaminated materials. Droplet transmission via aerosols of urine
Relapsing fever	Bacteria	*Borreliae spp. [B. recurrentis (louse-borne), B. hemsii (tick-borne)]*	Animals	Tick-borne, blood transfusion
Tuberculosis	Bacteria	*Mycobacterium tuberculosis*	Primarily humans, cattle, non-human primates, other animals (rodents)	Inhalation of aerosol droplets, contaminated equipment, bites
Melioidosis	Bacteria	*Burkholderia pseudomallei (formerly Pseudomonas pseudomallei)*	Equines, especially horses and mules; humans are accidental hosts	Transmitted by inhaling dust contaminated by the bacteria and when contaminated soil comes in contact with abraded skin
Tularemia	Bacteria	*Francisella tularensis*	Isolated from 100 species of wild animals (e.g., rabbits, skunk), 9 domestic mammals, 25 species of birds, frogs, and reptiles	Arthropods, direct or indirect contact, ingestion of contaminated meats, inhalation of dust, materials contaminated with urine, feces or tissues, bites and scratches

Herpesvirus	Virus	*Herpesvirus Type 1 (fever blister, cold sore) and Type 2 (genital herpes), Herpesvirus hominis, Herpes simiae (Herpes B)*	Human, non-human primates	Produce latent infections in host and frequently shed without overt lesions
Poxvirus	Virus	*Monkeypox, vaccinia, cowpox, buffalopox, cantagalo, and aracatuba viruses*	Non-human primates, swine, cattle, horses, birds	Direct skin contact with lesions on infected animals
Rabies Virus	Virus	*Rhabdoviridae, genus Lyssavirus*	Natural reservoir: bats. All mammals: wild animals (raccoons, rodents, foxes, etc.) domestic animals (dogs, cats) and humans	Animal bite, contact with infected saliva or tissue
Viral Hemorrhagic Fever	Virus	*Multiple species: Filoviridae ; Ebola virus, Lassa virus, Marburg virus*	Humans, non-human primates (Cynomolgous monkeys)	Contact with blood and body fluids of infected animals
Arboviral infections	Virus	*Multiple species: Togaviridae, Flaviviridae, Bunyaviridae, Arenaviridae*	Ticks, insects, infected animals (deer, birds, rodents, etc.)	Ticks, insects, blood transfusion
Viral Hepatitis	Virus	*Hepatitis A, B, C, D (delta), E, F, G*	Humans, non-human primates (chimpanzee, wooly monkey, gorilla, Celebes ape, some marmosets	Close contact with infected animals or materials
Lymphocytic Choriomeningitis (LCM)	Virus	*Multiple arenaviruses*	Rodents (hamsters, mice, guinea pigs), monkeys and humans	Infected mice excrete virus in saliva, urine and feces; man infected through inhalation of aerosolized particles of (urine, feces or saliva) contaminated with virus
Vesicular Stomatitis	Virus	*Multiple strains of Vesicular Stomatitis Virus (VSV) Rhabdoviridiae*	Bovine, equine, porcine animals.	Probably arthropod-borne via the bite of an infected sandfly, mosquito or blackfly; by direct contact with infected animals (vesicular fluid, saliva)
Sub-viral Agents and Related Diseases (i.e., Scrapie)	Virus	*non-RNA/DNA Infectious Protein Virus- like particle*	Transmissable Spongiform Encephalopathies (TSE): BSE and vCJD (vCreutzfeld- Jacob Disease)	Adult sheep goats, and cows can infect humans

Amoebic Dysentery	Parasite (protozoa)	*Entamoeba histolytica*	Monkeys can readily transmit the agent to humans	Food, water, fomites, insects. Fecal-oral route. Cyst is resistant to drying
Giardiasis	Parasite (protozoa)	*Giardia lamblia*	Dogs, monkeys	Drinking contaminated water, person-to-person contact, eating contaminated food, and direct contact with infected animals
Balantadidiasis	Parasite (protozoa)	*Balantidium coli*	Monkeys, pigs, and other nonhuman primates readily transmitted to humans	Direct contact with feces, person-to-person transmission
Malaria	Parasite (protozoa)	*Plasmodium species: P. falciparum* *P. vivax* *P. ovale* *P. malariae*	Anopheles mosquito	Mosquito bite
Toxoplasmosis	Parasite (protozoa)	Toxoplasma gondii	Amazing lack of host specificity. Primates, carnivores (felines), rodents, birds, undulates	Consuming under-cooked infected meats; ingestion of oocysts in milk, food or water; inhalation of oocysts;-contact with soil containing contaminated cat feces;
Ascariasis (Roundworm)	Nematode	*Multiple Ascaris species (A. lumbricoides, A. suum)*	Pigs; Humans are the definitive host	Ingestion of contaminated food or water
Visceral Larval Migrans (VLM)	Nematode	*Nematodes of the Toxocara genus (T. canis, T. felis)*	Dogs, cats	Ingestion of eggs through direct contact with feces or contaminated materials
Strongyloidiasis	Nematode	*Strongyloides stercoralis*	Dogs, cats, monkeys	Careless handling of contaminated fecal materials
Trichinosis	Nematode	*Trichinella spiralis*	Generally pigs or cattle	Eating undercooked flesh of animals infected with the larvae

The fight against these global zoonoses obviously need a holistic and integrative and should be guided by the "One Health" strategy. The "One Health" concept is a worldwide strategy for expanding interdisciplinary collaborations and communications in all aspects of health care for humans, animals and the environment [5]. The factors affecting the zoonotic infections (including human intervention actions like hosts/vector control or vaccination/therapeutic activities) is closely related with translational medicine, and both are modulated by an unique umbrella which is the result of a conjugation of heterogeneous disciplines (like environmental health, ecology, veterinary, public health, human medicine and microbiology) that provokes the equilibrium and changes between individual, population and ecosystem health [6] (Figure 1).

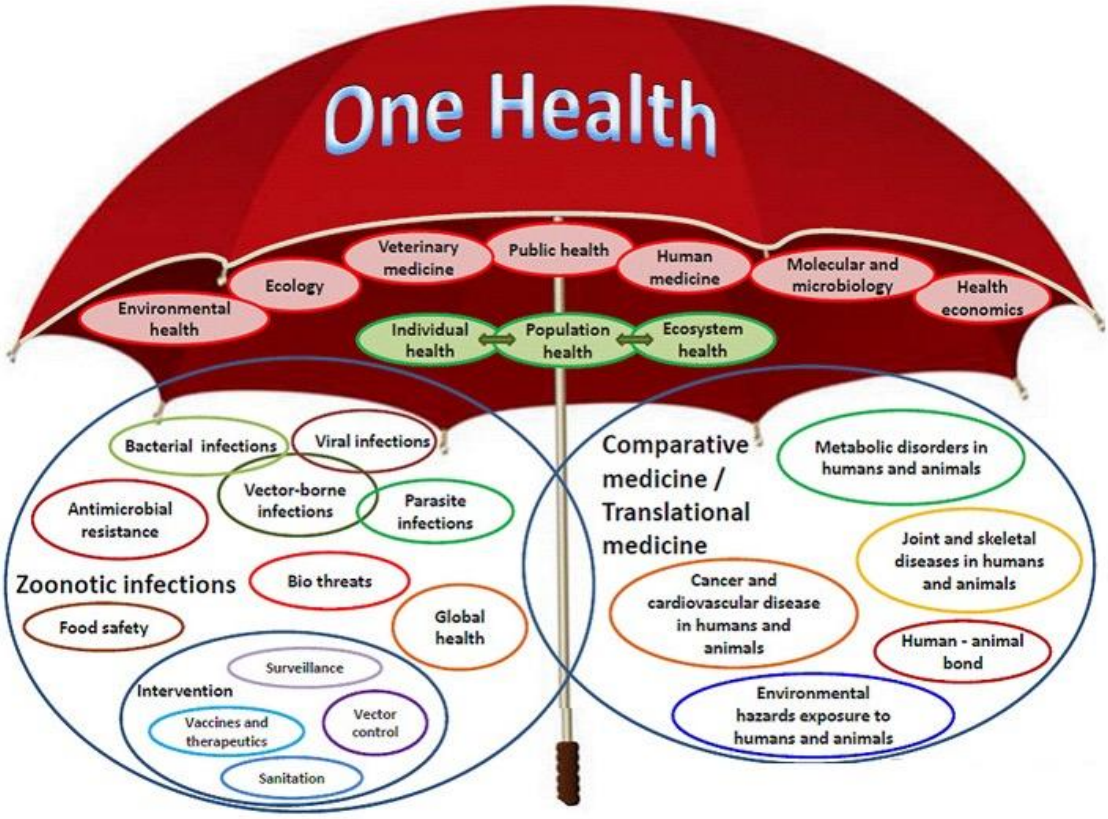

Figure 1. Explanatory diagram of "One Health" concept (directly extracted from "One Health Initiative" website).

In that context of priority collaborations between zoologists, veterinarians, ecologists, microbiologists and epidemiologists, the Journal of Etiology and Animal Health borns with the aim to be an interactive forum of scientific discussion where research articles, reviews or short commentaries that can contribute to advance in the fields of animal health and their implications on humans populations and ecosystems functioning.

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