



Zoonotic Diseases: Etiology, Impact, and Control

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Absract:

The term "Zoonoses" originates from the Greek words "Zoon," meaning animal, and "nosos," meaning illness. The World Health Organization (WHO) defines zoonoses as diseases or infections that can naturally transmit between vertebrate animals and humans, or vice versa. Approximately 61% of human pathogens are categorized as zoonotic. Zoonoses pose a significant public health concern as they directly threaten human well-being and can even result in fatalities. Globally, the 13 most prevalent zoonoses primarily impact impoverished livestock workers in low- and middle-income countries. These diseases have caused an estimated 2.4 billion cases of illness and 2.7 million human deaths annually, alongside their detrimental effects on human health. Furthermore, zoonoses also negatively affect animal health and lead to decreased livestock production.

Key words: Infection, Pathogen, publichealth, livestock

Introduction:

Zoonotic diseases are the result of various types of pathogens. These diseases can be classified into different categories based on their underlying causes. Bacterial zoonoses encompass diseases like anthrax, salmonellosis, tuberculosis, Lyme disease, brucellosis, and plague. Viral zoonoses include rabies, acquired immune deficiency syndrome (AIDS), Ebola, and avian influenza. Parasitic zoonoses consist of trichinosis, toxoplasmosis, trematodosis, giardiasis, malaria, and echinococcosis. Fungal zoonoses involve diseases like ringworm. Rickettsial zoonoses include Q-fever, while chlamydial zoonoses encompass psittacosis. Mycoplasma zoonoses refer to Mycoplasma pneumoniae infection. Protozoal zoonoses are caused by protozoan parasites. Additionally, there are diseases caused by acellular non-viral pathogenic agents, such as transmissible spongiform encephalopathies and mad cow disease. Major Zoonotic Diseases, their etiological agents, hosts, and the major symptoms in humans.

Toxoplasmosis	<i>Toxoplasma gondii</i>	Pigs, sheep, goats, poultry, and rabbits	Lymphadenopathy, fever, malaise, night sweats, myalgia, sore throat, and maculopapular rash
Balantidiasis	<i>Balantidium coli</i>	Ruminants, pigs, guinea pigs and rats	Chronic diarrhea, occasional dysentery, nausea, foul breath, colitis, abdominal pain, weight loss, and deep intestinal ulcerations
Disease caused by acellular non-viral pathogenic agents			
Mad Cow Disease, also known as BSE (Bovine spongiform encephalopathy). In human known as Creutzfeldt-Jakob disease (CJD)	Prion protein	Cattle, sheep, goats, mink, deer, and elks	Ataxia, jerky movements, seizures, dementia, memory loss, and personality changes

3.Zoonoses of Domestic Animals:

Domestic animals play a crucial role in the transmission of various diseases to humans and often act as amplifiers for pathogens originating from wild animals. The hypothesis that domestic animals have a positive association with humans in influencing pathogen diversity was proposed long ago. Around 60% of human infectious diseases stem from vertebrate animals. Direct contact between humans and animals has increased due to the domestication of various vertebrate species. Zoonotic bacteria, viruses, parasites, and fungi can be transmitted through direct contact, ingestion, inhalation, conjunctiva, or biting.

Cattle, sheep, goats, dogs, cats, horses, pigs, and other domestic animals serve as reservoirs for pathogens causing domestic zoonoses, which can be transmitted to humans. Pathogens can be transmitted through direct contact or consumption of animal-origin foods. Examples of zoonotic diseases transmitted from domestic animals to humans include anthrax, rabies, tuberculosis, brucellosis, campylobacteriosis, leptospirosis, toxoplasmosis, balantidiasis, ancylostomiasis, toxocariasis, listeriosis, bovine pustular stomatitis, rotavirus infection, and Q fever. Among these zoonotic diseases transmitted by domestic animals, anthrax caused by *Bacillus anthracis* is of significant public health importance. *B. anthracis* is a soil-borne bacteria capable of producing spores, allowing them to survive in the environment for extended periods. Anthrax can be transmitted to humans through close contact with infected animals (such as cattle and goats) or their products (such as meat, skin, hides, or bones). Human-to-human transmission is rare.

Tuberculosis is the most significant zoonotic disease among bovine zoonoses, causing severe economic losses in animal production. It is caused by *Mycobacterium bovis*, *M. tuberculosis*, or rarely *M. caprae*. *Mycobacteria* are acid-fast soil saprophytes characterized by the presence of mycolic acid in their cell wall. They are also facultative intracellular pathogens. While bovine tuberculosis has been largely eliminated in developed countries, other parts of the world still face serious zoonotic effects. Human tuberculosis is the second leading cause of death after AIDS, with 5-10% of all human tuberculosis cases caused by *M. bovis* (25% of which occur in children). Handling or consuming unpasteurized contaminated milk or inhaling aerosols from coughing infected animals are common modes of transmission. *M. bovis* infection can also affect the urogenital system of humans and can be transmitted to animals through respiratory secretions, leading to reverse zoonoses. Direct contact between infected animals and humans, such as farm workers, veterinarians, abattoir workers, or people in rural areas, poses a significant risk. Brucellosis is one of the most prevalent bacterial zoonotic diseases, causing over 500,000 human cases. Rabies, caused by the rabies virus belonging to the *Rhabdoviridae* family, is one of the deadliest zoonotic diseases, resulting in approximately 30,000-70,000 human deaths worldwide each year. While dogs are the primary carriers of the rabies virus, other wild animals like cats and jackals also transmit it. In developing countries, rabies is often transmitted through dog bites due to stray dog populations. In developed countries, bats, foxes, and other wild animals are responsible for rabies transmission. The incubation period of rabies can vary from four days to several years depending on the severity and location of the wound and the viral load.

Impact of Zoonosis:

Zoonoses have diverse effects on the health of both humans and animals. Assessing the impact of zoonoses is challenging, but it can be evaluated through various parameters, including disease prevalence, incidence, morbidity, mortality, and economic losses. Zoonotic diseases have severe consequences for human livelihood and well-being. Affected individuals often face obstacles that hinder their work performance, thereby affecting their ability to support their families. These situations are frequently observed in underdeveloped countries in Africa and Asia. In some cases, affected individuals may experience isolation from their communities, which can increase the risk of developing mental health issues. The emergence of antibiotic resistance poses a global health challenge, further complicating the treatment of bacterial zoonoses. Patients suffering from diseases caused by antibiotic-resistant bacteria require special attention and expensive medications, placing a burden on the healthcare system, particularly in developing countries.

Zoonotic diseases can result in substantial economic losses in the livestock sector of any country, even if animal deaths do not occur. Animal health and productivity can be adversely affected, leading to significant reductions in animal product outputs such as meat, milk, and eggs, sometimes exceeding 70%. This reduction in the supply of high-protein animal-derived food negatively impacts human health and nutrition. Zoonotic diseases such as brucellosis and toxoplasmosis can cause infertility, abortion, and weak offspring in animals, leading to substantial economic losses for farmers and the entire country.

Recommendations:

- **Establishing a system for reporting and notifying diseases.**
1. Prioritizing zoonoses and forming action teams. • Providing accessible diagnostic facilities and skilled personnel.
 2. Promoting cooperation at regional, national, subnational, and international levels.
 3. Ensuring sufficient regular and emergency funding.
 4. Conducting mass campaigns to raise public awareness about zoonoses.
 5. Increasing research efforts on disease epidemiology, risk factors, pathogen virulence, host biology, and vector biology.

6. Monitoring and protecting wildlife populations.
7. Ensuring the safe production of animal-origin food.
8. Safeguarding infectious laboratories to prevent accidental spread of zoonotic infections and bioterrorism.
9. Protecting the environment.

Implementing national and international educational programs to educate people about zoonoses and hygiene.

Conclusion:

A significant portion of infectious diseases affecting humans have their origins in animals. These pathogens not only cause illnesses in animals but also pose a substantial threat to human health. Factors such as changes in dietary habits, climate change, and environmentally harmful human activities contribute to the emergence and reemergence of numerous zoonotic diseases, as they increase the contact between humans and wildlife. The devastating impact of zoonoses on the human population is evident in the current COVID-19 pandemic. Given the interconnectedness of animals, humans, and the environment, research efforts should prioritize the "one health" approach to identify crucial steps for intervention in pathogen transmission. Implementing robust active surveillance that encompasses all aspects of the one health approach is necessary for early and accurate detection of zoonotic diseases, enabling the implementation of effective control measures.

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