

Popular Article

Zoonotic Diseases of Global Health Significance

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Abstract

Zoonosis is a very huge global burden due to its effects on economy and human and animal health. The various key drivers responsible for zoonosis are change in land use patterns, close animal and human contact along with intensification of livestock and poultry rearing. There are various diseases of zoonotic nature in domestic and pet animals like rabies, tuberculosis, brucellosis, influenza etc. which affect the human health and animal productivity. The basic approach to control and prevent these diseases is one health approach, which involves collaborative and multidisciplinary approach.

Keywords: Public health; zoonosis, one health, disease

Introduction

Zoonosis is the term, derived from Greek word 'zoon' and 'nosos' which mean animal and illness respectively. According to World health organisation, zoonosis is defined as the infection or diseases which have the tendency to naturally transmit between the humans and animals (Rahman et al., 2020). It acts as a double-edged sword which causes fatality in humans and causes significant economic losses by deteriorating the animal health (Pal, 2005). About 60 % of human pathogens are zoonotic in origin with 72 % originated from wildlife species (Ferriera et al., 2021). COVID-19 pandemic is a recent example of the zoonosis which is believed to be originated from wildlife species to humans. Therefore, zoonosis is considered to be a significant global burden with huge economic agony. One health approach which is at its embryonic stages in India could be a panacea for this global burden.

Drivers of zoonosis

Land use change has been considered to be the leading driver for zoonosis (Loh et al., 2015). Change in the land use and fragmentation increases the natural edge habitat with more chances of animal to human contact (Ferriera et al., 2021). The basis of pathogen transmission due to land use change includes the direct closeness of human and animal contact along with various naturally infected wild hosts (Dobson et al., 2020). Various examples of zoonotic diseases can be cited in this regard as Ebola virus outbreak and deforestation was connected in central and west Africa (Olivero et al., 2017). Nipah virus outbreak in Malaysia, Hendra virus in Australia and probably SARS-CoV 2 can also be cited in this regard with bats as the source of disease (Han et al., 2015).

As human and animal contact is the key driver which causes the spillage of pathogens, this contact can occur in various settings like live animal markets, wildlife farms and within the wildlife trade (Daszak et al., 2020; Ferriera et al., 2021). Intensive livestock and poultry production facilitates the interaction of animal and humans along with increased exposure to pathogenic organisms. Various examples of zoonotic diseases which become global burden in livestock as well as humans through this key driver are avian influenza virus (H₇N₉ and H₅N₁), swine flu variants (H₁N₁, H₁N₂ and H₃N₂), Middle Eastern Respiratory Syndrome (MERS) and various bacterial, viral and parasitic pathogens in cattle. Few other sites where animal and human come in close proximity like recreational caving and wildlife watching could be considered significant (Ferriera et al., 2021).

Zoonosis of domestic animals

The domestication process along with its positive impact on economy has increased the chances of various zoonotic diseases with about 60% human pathogens originated from vertebrate animals (Klaus et al., 2016). The domestic animals like cattle, buffalo, sheep, goat, pigs and horses serve as reservoir of various pathogens and can transmit them to humans (Samad. 2011). Various diseases include anthrax, rabies, brucellosis, tuberculosis, campylobacteriosis, leptospirosis, toxoplasmosis, balantidiasis, ancylostomiasis, toxocariasis, listeriosis, bovine pustular stomatitis, rotavirus infection, and Q fever (Rahman et al., 2020). Among the various diseases, tuberculosis (TB) is one of the most important public health concerns with about 5-10% TB cases in humans are from *Mycobacterium bovis*. The transmission occurs by the contact with unpasteurized milk and via aerosol from coughing by infected animal (Moda et al., 1996). Though most of the developed countries have eliminated TB, but in the developing countries, this disease used to cause outbreak and causes huge economic losses (Rahman et al., 2020). Anthrax is another important zoonotic disease, transmitted via close contact with infected domestic animals (cattle and goat) or their products (meat, hides, skin etc). In anthrax, humans develop various symptoms like gastroenteritis, pneumonitis, pustules of malignant nature and sudden death with mortality rate of 100% in pulmonary form and 25-65% in gastrointestinal form (Kamal et al., 2011). Brucellosis is very important zoonotic disease which is forgotten and neglected nowadays as depicted by World Health Organization (WHO, 2015). Of various species, only *Brucella melitensis*, *B. abortus*, *B. suis* and *B. canis* are of zoonotic nature. Transmission occurs by ingestion of contaminated unpasteurized milk. Humans used to develop various symptoms like influenza like signs with other complications (weakness, joint pain, fever, night sweats and headache) (Rahman et al., 2020).

Zoonosis of pets and companion animals

In the growing world of modernisation and urbanisation, pet keeping is very common and increasing at an exponential rate. About 14-62% pet owners used to keep their pets in bedrooms, which causes an enhanced risk for transmission of various zoonotic diseases (Chomel& Sun, 2011). The zoonotic diseases frequently associated with pets and companion animal include brucellosis, campylobacteriosis, chlamydiosis, catch scratch fever (*Bartonellahenselae*), ehrlichiosis, giardiasis, hantavirus, hookworms, influenza, rabies, Lyme disease, rocky mountain spotted fever, leptospirosis, monkey pox, pasteurellosis, Q fever, plague, roundworms, salmonellosis, staphylococcosis (MRSA), streptococcosis, toxoplasmosis, and tularemia (Belchior et al., 2011). Transmission can occur by direct or indirect contact. The most common zoonotic disease associated with dogs is rabies, which kill various thousands of people every year. Also pet associated methicillin-resistant Staphylococcus aureus (MRSA) is very important for global concerns (Rahman et al. 2020).The most common disease associated with cats is cat scratch disease which is caused by *Bartonella henselae*. The mode of transmission of this disease is horizontal in cats and humans can get this infection through arthropods (Rahman et al., 2020).

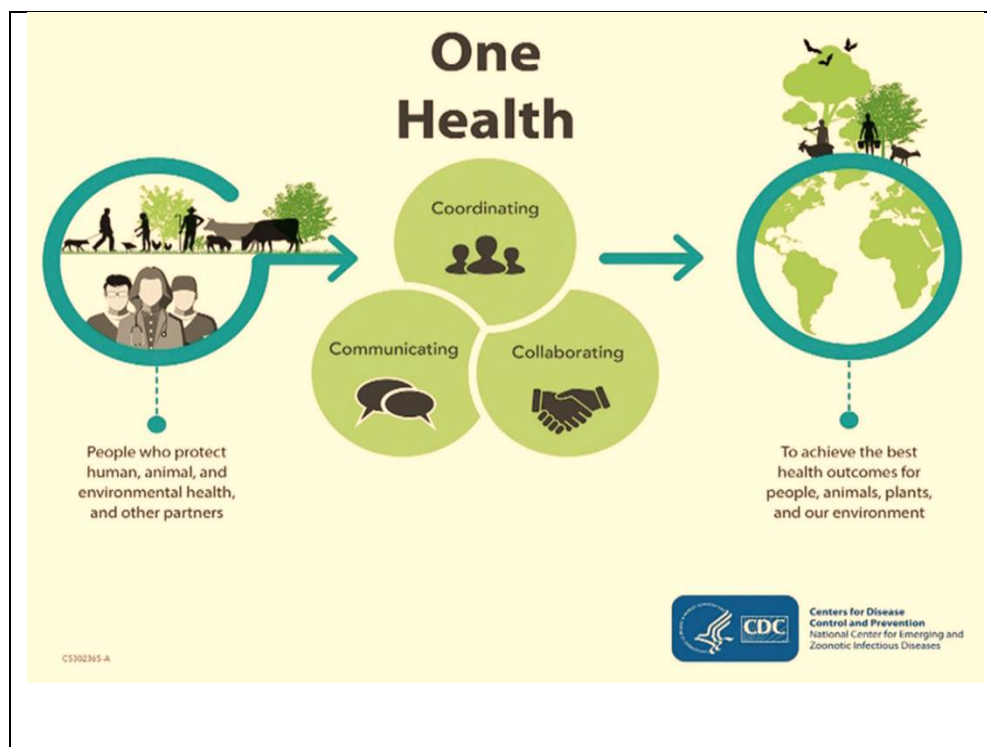
Food-born zoonosis

Common food-borne zoonotic pathogens include *Salmonella* spp. (*Salmonella entericaserovar* Enteritidis), *Campylobacter* spp., Shiga toxin-producing *Escherichia coli* (STEC), and hepatitis E virus. Approximately 90% of the food-borne zoonosis is caused by *Salmonella*spp and *Campylobacter* spp. Also, *Brucella*spp., *Listeria* spp., *Clostridium* spp., BSE, norovirus, calicivirus, and other hepatitis viruses, mainly reside in intestines of animals that can be transmitted through contaminated food. Various factors like reduced immunocompetence of people, globalization of farm animals and their meat, consumption of uncooked meat and lack of proper awareness among the people are the reasons behind this type of zoonosis (Rahman et al. 2020).

Control of zoonosis

Zoonotic diseases are the global burden with huge economic losses, productivity and health of humans and animals. Human health is deteriorated due to lack of proper food supply and animal health and productivity is affected due to morbidity and mortality (Rahman et al., 2020). Diseases like BSE, avian influenza and anthrax can devastate the global international trade of animals and their products. Therefore control measures to limit the zoonotic diseases needs to be taken. One health concept needs to be adopted for the control and prevention. This approach involves

collaboration from many disciplines including health professionals, veterinarians, policy makers and researchers. One health approach is at its initial embryonic stages in India with some of the steps taken by the Indian government regarding antimicrobial resistance, zoonotic diseases, and food safety using one health approach. But there needs to be a legal framework to implement the one health approach along with good coordination among various private and government agencies, good surveillance measures and data sharing mechanism across various sectors with availability of good budget (Aggarwal & Ramachandran, 2020). According to Pieracci et al. (2016), various recommendations provided by one health approach to prevent and control zoonoses are (1) developing “Zoonotic Disease Unit” for betterment of the human and animal health agencies; (2) developing national strategy for “Zoonotic Disease Unit”; (3) engaging leadership among multi-sectoral researchers and relevant personnel to prioritize zoonotic disease research; (4) adopting veterinary public health policies with collaborators from other countries; and (5) reviewing the zoonotic diseases on a regular basis (2–5 years) to address the emerging and re-emerging diseases through regular surveillance, epidemiological implementations, and laboratory diagnosis.



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