



Public Health Concern Due To Emerging and Re-Emerging Zoonoses Mahendra Pal

Department of Microbiology, Immunology and Public Health, Faculty of Veterinary Medicine,
Addis Ababa University P.O. Box No. 34, Debre Zeit, Ethiopia.

Abstract

Zoonoses which include emerging and re-emerging zoonoses are still remain a leading cause of high morbidity and mortality in many countries of the world .These diseases constitute the major threats to human health; and are caused by a large number of organisms. Zoonoses act as a double edged weapon, one by causing serious and fatal diseases in human beings and other by undermining animal health and productivity and thus producing great financial losses to the animal industries .The knowledge of the zoonoses is the fundamental for the veterinarians ,as they are the first on the line of duty. Re-emerging zoonoses have now appeared in more virulent form or in a new epidemiological setting after a period of decline or disappearance. The new megacities have overcrowding, poverty, poor sanitation and water supply and inadequate infrastructure that amplify the transmission of these zoonoses .The emergence and re-emergence of several zoonotic diseases in the past require a systematic surveillance and evaluation of disease control programme. I am of the strong opinion that the involvement of the Public Health Veterinarian in the process of global health programme is highly imperative.

Key Words: Emerging zoonoses, Human health, Public health veterinarian, Re-emerging zoonoses, Surveillance

Introduction:

Emerging and re-emerging zoonoses are infectious diseases that are newly recognized, or newly evolved, or that have occurred previously but have recently shown an increase in incidence or expansion into a new geographic, host or vector. In the last 25 years, 38 new pathogens have emerged, of which 75 per cent originated as animal disease producing agent. It is reported that 80 per cent of bioterrorist agents are zoonotic and could be used as biological weapons. Moreover, zoonotic diseases account for the majority of infectious diseases. The concept of emerging infectious disease appeared in the last 1980's when major outbreaks occurred around the globe. Disease emergence often follows ecological change caused by human activities such as agricultural changes, urbanization, migration, deforestation and dam building (Pal, 2007). In addition, international travel and commerce, industrialization of food product, break down of public health measures and microbial adaptation also led to the emergence of the zoonotic diseases (Dasseberger, 2000; Chug, 2008). There is no way to predict when or where the next new zoonotic pathogen will emerge or what its ultimate importance might be. The effective surveillance and control of zoonotic diseases pose a significant challenge (Pal, 2005).

A wide variety of animal species, both domestic and wild, act as reservoir for the new emerging and re-emerging diseases of humans. They are caused by pathogens such as viruses, bacteria, fungi, Rickettsia,



and parasites which originated from animal or products of animal origin (Pal, 2005). Many of these diseases were either unknown because we were not able to isolate the infectious agent or to distinguish them from other clinical syndromes of discovered accidentally. Much of the recent identification of new pathogens have been based on new molecular biology tools or epidemiological studies. The role of veterinary profession is very important in public health and on the rise again in the USA, as it should be in many countries of the world. Veterinarian, therefore, must use all the available resources to meet the challenge of new emerging zoonoses. The present communication is an attempt to high light the public health concern due to emerging emerging and re-emerging zoonoses.

Concern due to emerging and re-emerging zoonotic diseases:

The brucellosis has continuously been a re-emerging zoonosis. In 1961, several outbreaks of human hepatitis involving prior contact with chimpanzees and other animals were first reported. High case fatality occurred in people affected with Argentine haemorrhagic fever (1958), Bolivian haemorrhagic fever (1959), Marburg disease (1967), Lassa fever (1976) and Korean haemorrhagic fever 1978 (Hung-Jones et al; 1995). Cowpox virus was isolated from the pox lesions in a cat. In 1989, cat pox was observed in a person at the site of cat scratch. Hitherto, the actual reservoir of cat pox/cowpox virus is uncertain. Plague and yellow fever are two zoonoses well known for their historic pandemic, spreading from seaport to seaport. Epidemics of yellow fever continue to occur between 1986-1991 in South Africa affecting over 20,000 people. Recently, few viral zoonoses such as avian influenza (H5N1) and swine flu (H1N1) occurred in pandemic form affecting many people in many countries of the world. People with acquired immunodeficiency syndrome (AIDS) are much more susceptible to several zoonotic diseases, including candidosis, cryptococcosis, tuberculosis, toxoplasmosis and cryptosporidiosis (Pal, 2006, Pal and Basu, 2008). It is possible that other zoonotic diseases may emerge in individual affected by AIDS.

In Australia, a new disease has seen reported in horses that also affects man; the cause is a Morbilivirus- a measles like virus that is related to canine distemper and rinderpest viruses. Many emerging viral diseases that have a rodent or unknown animal host have caused devastating fatal disease in Africa and South America. The outbreak of plague occurred in India (Pal, 1995), Uganda and Congo. Globally, W.H.O. reports about 1000-3000 plague cases each with most in last five years seeing in Africa. The plague, the bacterial disease that devastated medieval Europe, is emerging worldwide and poses a growing but an overlooked threat. The death of veterinarian in Western USA from plague and reports of serious illness in veterinary technicians and cat owners have focused attention on the domestic and feral cats as carriers of this ancient disease. The involvement of cats since 1970s is evidence of the dynamics of zoonotic disease in a changing environment. The plague bacterium, *Yersinia pestis* is seeking new hosts or new foci, as



seen in other emerging diseases. It is reported that 61 per cent of all human pathogens are zoonotic. In India, anthrax, plague, leptospirosis, melioidosis, listeriosis, Escherichia coli, dengue fever, chikungunya fever, Japanese encephalitis, Nipah virus disease buffalo pox etc; are some of the examples of emerging and re-emerging zoonoses (Pal, 1995; John, 1996; Pal, 1996^a; Pal 1996^b; Pal, 2001; Chug, 2008; Pal and Abdo,2012). In 2006, 1.39 million cases of Chikungunya fever were reported from India. Travelers returning to Europe from Indian Ocean Region in 2006 developed Chikunguna fever. In Asia, the incidence of Japanese encephalitis, which causes almost 30,000 human cases and 7000 deaths annually, is closely associated with rice field irrigation. Major outbreaks of vampire bat rabies occurred in Peru and Brazil following settlement of new agricultural communities in the remote jungle (Chomel, 1998). Hantann virus complex was first reported in Korea but subsequently the infection was recorded in Asia and Europe. The first identified outbreaks of Ebola virus fever in humans were noticed in Sudan and Zaire with mortality rate of 67 per cent. A massive epidemic of Rift Valley fever involving thousands of livestock cases and 18,000 human cases with 600 deaths occurred for the first time in Egypt in 1977(Elakkad, 1978).Another major epidemics of Rift Valley fever which occurred in Kenya, Somalia and Tanzania in 1997-1998 caused deaths of many thousands of sheep, goats and camel besides affected over 90,000 human cases with 500 deaths (Woods et al., 2002). Later in the fall of 2000, outbreaks occurred simultaneously in Yemen and Saudi Arabia. The virus was introduced in Saudi Arabia through the sheep trade. Rift Valley fever is considered as an occupational viral zoonosis of veterinarians, livestock handlers, abattoir workers and dairy farmers (Pal et al., 2012). **Global travel around the world is faster than the incubation period of zoonotic diseases.** The distance and speed of travel increased 1000 fold since 1800. Global trade of food, animals and plants, antibiotic resistance, changing ecosystems, breakdown of public health measures, international travel, microbial adaptation and change, host susceptibility to infection, growth in human and animal populations, war, famine, etc; are the contributing factors for the emergence and re-emergence of several zoonoses (Chomel,1998; Desselberger,2000; Chug, 2008; Venkatesan *et al*; 2010). Severe acute respiratory syndrome (SARS) a viral zoonosis, stemmed from the wildlife trade animal in the market place at high density affected people in close contact with those animals. The global response by veterinarians, physians, and public health practitioners from various organizations to the SARS outbreaks was used as an example of the type of collaboration that is needed to battle emerging zoonotic diseases. At a recent WHO, FAO and OIE meeting on the subject, the scientists brought with them many perspectives. They all agreed on one thing that there are going to be more emerging zoonoses on a global level. Concern was shown over the growing list of new emerging and re-emerging zoonotic diseases which pose a global threat to mankind (Table-1).

**Table -1. Etiological agents of some emerging zoonoses identified since 1972**

S. No	Year	Zoonotic pathogen
1.	1972	Streptococcus iniae
2.	1976	Cryptosporidium parvum
3.	1976	Yersinia enterocolitica
4.	1977	Campylobacter jejuni
5.	1977	Ebola Virus
6.	1977	Hanttan virus
7.	1978	Korean haemorrhagic fever
8.	1982	Borrelia burgdorferi
9.	1983	Escherichia coli O157:H7
10.	1983	Helicobacter pylori
11.	1984	Rickettsia japonica
12.	1991	Guanartio virus
13.	1992	Bartonella henselae
14.	1993	Sin Nombre Virus
15.	1994	Hendra Virus
16.	1994	Rickettsia felis
17.	1994	Sabia Virus
18.	1996	Australian bat Lyssa virus
19.	1996	Prion
20.	1997	Influenza A virus (H5N1)
21.	1998	Nipah Virus
22.	1999	Ehrlichia ewingii
23.	1999	Influenza A Virus (H9N2)
24.	1999	West Nile-like virus
25.	2003	SARS (Coronavirus)
26.	2004	Trichinella papuae
27.	2009	Swine flu (H1N1)

The emphasis was given on the importance of collaboration and team work in identifying emerging zoonotic diseases. The emergence and re-emergence of zoonoses resulted into huge financial losses in many countries of the world including India (Table- 2).

Table-2: Major resources lost due to emerging and re-emerging zoonotic diseases

S.N	Country	Disease	Financial loss
1.	China	SARS	US 25.0 Billion
2.	Hong Kong	Influenza A	US 22.0 Billion
3.	India	Plague	US 2.0 Billion
4.	Malaysia	Nipah Virus	US 540.0 Billion
5.	United Kingdom	B.S.E	US 9.0 Billion
6.	USA	Anthrax	US 250.0 Billion

Monkey pox outbreak which started with importation in infected Gambian rats and other African rodents and spread to Prairie dogs through exotic pet trade was a great example of the important role the



veterinarian plays in combating these diseases. Veterinarians were the first to see the source of this zoonotic disease. There are long lasting and persistent zoonoses such as rabies, brucellosis, anthrax, leishmaniasis, tuberculosis, echinococcosis and cysticercosis which continue to occur in many countries especially in developing world where they mostly affect the poorest segment of the human population. West Nile virus, SARS and monkey pox have been recently introduced into areas far from their region of their origin. The greatest risk of new diseases comes from zoonotic pathogens that circulate among wild animals and are occasionally transferred to humans by intermediate invertebrate hosts or vectors that are sensitive to climatic condition (Rogers and Randolph, 2003). The greatest animal populations are the principal reservoir of the pathogens which produce disease in humans (Pal, 2007). Approximately, 75% of the diseases that have emerged over the past decades have a wildlife source. The HIV-1 and HIV 2 viruses have evolved from a chimpanzee strain and a sooty mangabey strain, respectively. The initial transmission in Africa appears to be linked to the hunting apes and using them for food. From these events, virus strains which were both highly adapted to humans and evolved as HIV-1 and HIV-2. Unfortunately, HIV-1 and HIV-2 are now maintained and spread in human populations independent of their simian origin. Bird migration was responsible for the emergence of many zoonotic pathogens which caused a great threat to human health.

There is a worldwide upsurge of multidrug resistant in *Staphylococcus aureus*, *Mycobacterium tuberculosis*, *Pseudomonas aeruginosa*, *Shigella* spp. and non typhoidal *Salmonella* spp. Antimicrobial resistance in hospitals and community poses a public health problem throughout the world (Desselberger, 2000). It is estimated that two-thirds of the global antibiotic production is used in animal husbandry for growth promotion non-therapeutic purposes. The overuse of antibiotics select the drug-resistant zoonotic pathogens. Humans get exposed to the antibiotics through meat, vegetables and water contaminated by animal waste (Chug, 2008). Emergence of ciprofloxacin resistance in *Salmonella* Typhimurium and *S. Heidelberg*, methicillin and vancomycin resistance in *Staphylococcus aureus* and azithromycin and ceftriaxone in *Shigella* spp. is a cause of worrying to the public health authorities of the developed as well as developing nations. The promotion of rational use of antibacterials, active surveillance and developing of rapid diagnostics are some of the strategies to contain the problem of the emergence of old infectious diseases due to development of antimicrobial resistance.

The early cooperation of veterinarians and public health physicians gave impetus to the eradication of bovine tuberculosis first in Denmark, Finland, Sweden and Norway and then in other countries. Intra-dermal tuberculin testing and slaughter of the positive animal helped in the control of tuberculosis which is an international health problem affecting about one third world population and causes two million



deaths each year. About 95 per cent of cases are in developing countries. New Zealand has successful in *Echinococcus granulosus* eradication programme based on test and treatment of dogs. Immunization is very successful in few zoonotic diseases such as yellow fever, plague, etc.

The emergence and re-emergence of zoonotic diseases are challenges to all professionals concerned with public health. Some of the emerging and re-emerging zoonoses such as Nipah virus, West Nile fever, monkey pox, avian influenza, SARS and swine flu (Brown, 1997;Chomel, 1998; Hubalek and Halouzka, 1999; Giulio and Eckburg 2004; Caceres and Otle,2009; Pal and Abdo,2012) drew experts on veterinary medicine, public health, microbiology, ecology, conservation, disease modelling and forecasting from around the world. The impact of global warming and changes in food chain will continue to create opportunities for the emergence of new diseases and re-emergence of old diseases. Forecasts of likely future pathogen threats included several organisms such as *Arcobacter butzleri*, *Bartonella alsatica*, *Brucella ceti*, *Citrobacter freundii*, *Mycobacterium marinum*, *Streptococcus iniae*, *Roseomas gilardii*, *Vibrio vulnificus* etc.

Conclusions

Now it is a well established fact that zoonoses are important from public health as well as economic point of view. It is, therefore, pertinent to mention that a network of excellence for the integration of medical, veterinary and food scientists to develop food safety measures and to improve research on the prevention and control of food-borne diseases and zoonoses should be established throughout the world. Moreover, continuous health education to the public about the source of infection, mode of transmission, severity of disease, personal and environmental hygiene and preventive measures should be imparted. These measures will certainly help to reduce the incidence and prevalence of zoonotic diseases which have emerged as global health problem. Since zoonoses are primarily animal diseases, the involvement of public health veterinarian in the diagnosis and control of these diseases is of paramount importance.

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