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*Afr. J. Biomed. Res. 14 (May 2011); 81 -88*

*Mini Review*

# The Control of Neglected Zoonotic Diseases in Nigeria through Animal Intervention

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**ABSTRACT:** Zoonoses are a major cause of morbidity and mortality across the world and particularly in Nigeria; however, they are often neglected by primary healthcare managers and policy makers. The neglected zoonotic diseases endemic in Nigeria include Anthrax, brucellosis, Bovine Tuberculosis, Rabies, Lassa Fever, Animal Trypanosomosis and Echinococcosis. With a population of over 140million people, urbanisation, economic development; and the concomitant intensification of animal husbandry coupled with the development of peri-urban livestock production systems, the risk posed by these neglected zoonoses are enormous. Their control in Nigeria is nearly non-existent and their impact on human health is largely unknown. The possible risk factors associated with their occurrences have been identified, and risk-avoidance advocated. These neglected zoonoses are mainly maintained in animal reservoir; hence their control/elimination is possible only through interventions that extensively target animal reservoirs accompanied by public enlightenment and information. This underscores the need for collaborations and partnerships between stakeholders in the Ministries of Agriculture, Health and Information for the enhancement of the health of both human and animal populations.

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**Keywords:** Control, Neglected, Zoonoses, Animal Interventions

## INTRODUCTION

Zoonoses are diseases and infections which can be naturally transmitted between vertebrate animals and humans (WHO, 2006). A zoonotic agent may be a bacterium, a virus or fungus. At least 61% of all human pathogens are zoonotic, and these represent 75% of all emerging pathogens during the last decade (WHO, 2006). Many zoonotic diseases have significant impact on human health as well as livestock productivity, thereby undermining livelihoods both by causing illness in the household and threatening its livestock and their output.

Neglected zoonotic diseases (NZDs) refer to the vast majority of zoonoses that are not prioritized by primary healthcare managers and policy makers at all levels of government (WHO, 2006). Although some zoonotic diseases has been accorded much publicity recently, it is the endemic, and periodically the epidemic zoonoses, which affect the poor people and livestock owners in the rural communities that have somewhat been forgotten or neglected as they have no defined preventive or control programme in the national healthcare scheme in Nigeria. Due to the fact that these NZDs comes from animals, prevention and control strategies must focus on interventions that target animal reservoirs combined with close collaborations and partnerships between veterinarians, physicians and other stakeholders in the government agencies that will lead to effective control/eradication measures for the protection and promotion of human and animal health.

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Received: March 2011; Accepted: May 2011

**Some Endemic Neglected Zoonotic Diseases in Nigeria**

***Anthrax***

Anthrax, caused by the spore-forming bacterium *Bacillus anthracis*, is primarily a disease of herbivores. The reservoir of the disease is soil contaminated by spores of *B. anthracis*. Humans generally get infected either by direct or indirect contact with infected animals or via occupational exposure to contaminated animal products. Report shows that nearly 60% of anthrax cases were from developing countries (WHO, 2006). The disease is almost always rapid and fatal in animals. In humans, the disease takes three forms. Cutaneous anthrax accounts for >95% of human cases worldwide; Inhalation (Pulmonary) anthrax is an occupational disease reported only in industrialized countries and contracted by breathing in spores and the gastro-intestinal anthrax is acquired from the consumption of infected meat from an animal that died of the disease. Although anthrax is feared for its bio-terrorist potential, its role in causing illness and sudden death in livestock and the threat to public health is largely ignored. In Nigeria, anthrax has been reported in food animals and persons whose occupation necessitates contact with animals or handling animal products (Okolo, 1985; Okolo, 1988).

***Rabies***

Rabies is a viral zoonosis which causes encephalomyelitis, and is caused by the viruses of the Rhabdoviridae family of the genus Lyssavirus, consisting of seven genotypes, and is usually maintained in reservoir animals, mainly carnivores (dogs) and bats (Arai et al., 2003; Amengual et al., 1997; Bourhy et al., 1993; Gould et al., 2002). It is estimated that worldwide about 40,000-70,000 people die annually due to rabies. More than 99% of all human death from rabies occurs in the developing world, including Nigeria, with domestic dogs as the source of the vast majority of human cases (WHO, 2006). Average records of age stratified incidence rates of human cases of rabies (and therefore rabies deaths) shows that between 30% and 50% occur in children under 15years of age (WHO, 2006). In some areas, its economic importance is related to its occurrence in domestic animals (especially cattle) which are source of food. The epizootiology of rabies has been previously described in Nigeria (Boulger and Hardy 1960; Umoh and Belino, 1979; Nawathe, 1980; Ogunkoya, 1986; Aghomo *et al.,* 1986; Okoh, 1982; Ehizibolo *et al.,* 2008), with dogs incriminated as the predominant reservoir of the disease; however, information on rabies deaths is sparse in Nigeria due to misdiagnoses in the hospitals and underreporting. Rabies is a vaccine-preventable disease, and it is a significant public health problem in Nigeria (Ehizibolo *et al.,* 2008). Due to the high cost and sometimes unavailability of post exposure treatment in many urban and rural areas in Nigeria, most rabies victims die in a horrific nature.

***Brucellosis***

Brucellosis is a zoonosis transmitted to humans from infected animals. It is one of the world's most widespread zoonoses caused by various bacteria in the genus brucella which affect domestic livestock and wild animals leading to abortion, reduced fertility and chronically lowered milk yields in affected animals (WHO, 2006). The disease is almost invariably transmitted to man from infected domestic animals, however, the possibility of human to human transmission of the organism through bone marrow transplantation, blood transfusion, transmammary and sexually has also been documented (Palanduz *et al.,* 2000). Transmission to humans can be via direct contact with infected livestock or through consumption of animal products such as unpasteurized milk and undercooked meat. Other dairy products prepared from unpasteurized milk such as soft cheese, yoghurts and ice-creams may serve as an important cause of brucellosis (Bikas *et al.,* 2003). In addition, brucellosis have been recognised a common major health hazard for laboratory workers handling the cultures of the virulent or attenuated strains of the organism due to accidental ingestion, inhalation and mucosal or skin contact and has been reported to occur in clinical, research and production laboratories (Ciftci *et al.,* 2003; Almuneef *et al.,* 2004). Skin abrasions and inhalation of airborne animal manure particles are other means of infection (Omer *et al.,* 2002; Mantur *et al.,* 2004). In humans, brucellosis usually manifests as an acute or subacute febrile illness, which may persist and progress to a chronically incapacitating disease with severe complications. The first evidence of brucellosis in humans in Nigeria was reported by Collard in 1962, which was followed by other several reports (Falade, 1974; Alausa, 1977; Alausa and Osoba, 1977; Falade, 2002). Epidemiological evidence shows that brucellosis is present in different species of domestic livestock and pet animals in Nigeria including cattle, sheep and goats, carmel, horses and dogs (Esuruoso, 1974; Adamu and Ajogi, 1999; Osinubi *et al.,* 2004 Ocholi *et al.,* 2005; Bertu *et al.,* 2010; Ehizibolo *et al.,* 2011). Unfortunately, there is no control policy in Nigeria for this disease with a potential for huge economic and medical impact.

***Bovine Tuberculosis***

The vast majority of cases of tuberculosis in humans are caused by *Mycobacterium tuberculosis*. However, *Mycobacterium bovis* is the causative agent of zoonotic tuberculosis.

The public health importance of animal tuberculosis was recognized early by WHO (WHO, 1951). In its 1950 report of the expert committee on tuberculosis, WHO stated: "The committee recognizes the seriousness of human infection with bovine TB in countries where the disease in cattle is prevalent. There is the danger of transmission of infection by direct contact between diseased cattle and farm workers and their families, as well as from infected food products." Since then, efforts to control and eliminate TB in animals have gained prominence particularly in developed countries.

Humans contract bovine TB via consumption of raw and infected animal products. There is possibility of aerial spread, especially in situations where infected livestock and people share small and enclosed shelters (Moda *et al.,* 1996). Human infection (hunters and butchers) via contact with infected carcases is another possible route of transmission (Etter *et al.,* 2006; Wilkins, 2008). TB caused by *M. bovis* often occur in organs other than the lungs (extra-pulmonary), but in many cases, it is clinically indistinguishable from TB caused by *M. tuberculosis*, and *M. bovis* may be misdiagnosed as those of *M. tuberculosis* (Cosivi *et al.,* 1998; Theon *et al.,* 2006). In addition to the threat posed to humans, *M. bovis* is also resistant to drugs commonly used for the treatment of TB (Van Helden *et al.,* 2006). Information on human disease due to *M. bovis* across the globe is scarce and little is known of the relative frequency with which *M. bovis* causes non-pulmonary TB in developing countries due to limited diagnostic facilities for the culture and typing of tubercle bacilli. In Nigeria, the prevalence of *M. bovis* ranges from 2.5%-14% (Alhaji, 1976; Abubakar, 2007). *M. bovis* have been isolated from fresh raw and sour milk sold in the local markets (Alhaji, 1976; Shehu, 1988; Abubakar, 2007), and from sputum and tissue samples in apparently healthy and clinically ill persons (Cadmus, 2006; Mawaket al., 2006; Abubakar, 2007).

***Human African Trypanosomiasis (Sleeping Sickness)***

Human African Trypanosomiasis (HAT) otherwise known as sleeping sickness is a complex and debilitating disease in man still ravaging in several countries of Sub-Saharan Africa despite decades of efforts to control it (WHO, 1998). It is limited in Africa where its insect vector, the tsetse fly is found. There are two forms of sleeping sickness. The chronic form found in Central and West Africa caused by *Trypanosoma brucei gambiense* which constitute a major problem arising from the controversial role of animal reservoir hosts, the disease is maintained by transmission between the tsetse fly (vector) and humans. The animal reservoir is important in the acute form found in Eastern and Southern Africa caused by *T. b. rhodesiense* (WHO, 2006; Jelinek *et al.,* 2002). Although campaigns against sleeping sickness in the 1960s was significant in bringing the disease below epidemic proportions, however, there is presently a dramatic resurgence of both forms of the disease as a result of wide spread civil disturbances and wars, reduced health budgets, dismantling of disease control programmes and animal reservoir host (Rahman, 2002). Sleeping sickness is an emerging public health problem in many African countries including Nigeria (Waiswa *et al.,* 2003) and poses as a major health risk to tourists visiting tropical Africa (Ouma *et al.,* 2002). Since domestic livestock are known to be reservoirs of *T.b. gambiense* in West Africa (Osho *et al.,* 2002), its present a major health problem for the human population. In Nigeria, although the status of sleeping sickness is not well understood, there have been reports of outbreaks resulting into deaths in some endemic foci (Edeghere *et al.,* 1998; Airauhi *et al.,* 2001)

**Risk factors associated with endemic neglected zoonotic diseases in Nigeria**

Understanding the risk factors for a disease is critical for developing an effective prevention strategy. Human behaviour, socio-economic conditions and cultural trends are often as important as animal-related factors in determining zoonotic disease patterns in a community.

**Animal reservoir:** The wide spread distribution of zoonotic pathogens in domestic and wild animal population represents a large reservoir of these organisms. The spread of infection could likely occur from affected to susceptible animals when wild and domesticated animals share pasture or territory (O'Relly and Daborn, 1995; Michel *et al.,* 2006). Wild animal zoonosis represents a permanent reservoir of infection and poses a threat to control and elimination programs.

**Animal products consumption:** Consumption of animal products especially fresh milk and meat has long been regarded as the principal mode of transmission of some zoonotic pathogens from animals to humans **(**Acha and Szyfres, 1987; Bikas *et al.,* 2003**)**. In rural areas, an estimated 90% of the total milk produced is consumed fresh or sour (Walshe *et al.,*

1991), and most dairy products such as yoghurts, cheese, ice creams are prepared from unpasteurized milk (Cousins and Williams, 1995) hence, most rural dwellers are highly vulnerable to zoonotic infections. Zoonotic diseases from contaminated animal products may also be brought to urban areas by vendors from the rural areas. Zoonotic pathogens have been detected in milk and meat samples in Nigeria (Idrisu and Schnurrenberger, 1977).

**Plate 1:**
Potential danger to human health?

**Plate 2:**
Companionship or health risk?

**Close human contact with animals:** Close physical contact between humans and animals, particularly pet animals is unavoidable in most communities in Nigeria (Plate 1 and 2). For example, in many parts of the country, pet animals (dogs and cats) are an integral part of human social life; they are part of several homes as either guard or companion animals. Also, in most rural areas, domestic cattle are kept in close proximity to human shelters. In addition, the occupation of most people (Veterinarians, abattoir workers, wildlife staff, hunters and other agricultural workers) brings them in close physical contact with animals. Physical contact between humans and potentially infected animals poses a public health risk (Cosivi *et al.,* 1998).

**Hygienic practices:** Proper hygienic practices could play a major role in controlling some of these neglected zoonoses. For example the consumption of unpasteurized milk and undercooked meat most especially in the rural areas and particularly amongst the Fulani pastoralists could be of a serious public health implication. When hygienic and quality control standard are ignored by food processing enterprise the final consumers of animal products such as yoghurt, cheese, suya are at high risk of infection with milk-and meat-borne zoonosis. Proper hygiene on farm and slaughter houses could also help to check the spread of these zoonoses within herd and dressed carcases, which also go a long way to minimize human exposure. Such hygienic practices are usually difficult to be complied with especially in our rural communities (Cosivi *et al.,* 1998).

**Impact of Neglected Zoonotic Diseases in Nigeria**

There is an increasing demand for meat, eggs and other animal products across the globe as a result of demographic growth, urbanization and economic development (Steinfeld et al., 2006), and at the same time there is intensification of animal husbandry and the development of peri-urban livestock production systems which have resulted in increased contact between people and livestock and, consequently, increased risk of some zoonotic diseases (Acha and Szyfres, 2003).

In Nigeria, the endemic neglected zoonotic diseases which are caused by pathogens that can infect livestock and humans are poorly controlled in livestock and represent a health hazard to humans. Although estimates of the impact of these neglected zoonoses on human health in Nigeria is limited or non-existent, the mere presence of the causative agents in the animal population is of public health concern, and the contribution these zoonoses make to the burden of

poverty by undermining livelihoods both by causing illness in the household and threatening its livestock and their output year-in, year-out need to be evaluated precisely.

**Principles of animal intervention**

Effective control of the neglected zoonotic diseases and other zoonoses likewise would result in decreased disease burden; poverty reduction and increased food supply for large numbers of the poor population and thus contribute to national economic development and achievement of the Millennium Development Goals (UN, 2007). Controlling these diseases in humans ultimately depends on controlling it in animals by effective surveillance and immunization (Turnbull *et al.,* 1999). The neglected zoonoses are primarily maintained in the animal reservoir but can affect humans as a result of different risk factors, behavioural traits or cultural habits. Therefore, their elimination is only possible by interventions that vigorously target animal reservoirs (Zinsstag *et al.*, 2007). An important aspect of a successful zoonosis control that has proved effective in developed countries is adequate compensation of farmers for culled livestock (Zinsstag et al., 2007), however, such programmes have been difficult in Nigeria due to lack of resources as such livestock farmers especially the Fulani are reluctant to cooperate whenever the cure or prevention of a disease demand slaughter of the herd not minding the economic and public health consequences. Some of these endemic zoonoses in Nigeria are preventable (Rabies, Brucellosis, Anthrax) through adequate vaccination of the animal hosts, but due to the dismantling of disease control programmes, declining economy, widespread civil disturbances and reduced health financing there has been a plethora of these diseases in our locality. Studies have shown that zoonoses control through animal intervention is cost-saving and cost-effective for the agricultural and public health sectors (Bogel and Meslin, 1990; Roth et al., 2003) comparable to cost effectiveness of control in humans. There is need to evaluate quantitatively the cost-effectiveness of different control strategies of the endemic zoonoses in Nigeria in order to clearly understand and appreciate the need to focus on such interventions. Apart from cost effectiveness, zoonoses control in animal host is most likely to minimize human exposure. If animals are protected, then humans are also protected, but if the reservoir animal hosts are neglected, they then constitute a threat to the human population. Therefore, animal intervention in the control of zoonoses is likely to assume a more plausible measure to control/prevent human exposure and illness.

**Animal Intervention Strategies**

Although the basic strategies required for the control and elimination of the endemic NZDs in Nigeria are well known, but they are often neglected or ignored. Control measures should be directed at both animals and humans and their interaction with each other.

Some intervention strategies include: Education and training of high risk population, mass vaccination of animals, test and slaughter/treatment of animals, restriction/movement control of animals, meat and milk hygiene, safe disposal of animal waste and improved by-product management

**Critical role of partnership between the Medical and Veterinary profession**

There is a long history of poor coordination and cooperation among professionals in domestic and international public health and animal health agencies (Torrey and Yolken, 2005). Cooperation among the medical and veterinary professionals was suggested to foster effective control and elimination of emerging microbial threats (Torrey and Yolken, 2005).

The medical and veterinary practitioners in many countries of the developed world are working in partnership to effectively protect and promote the health of persons. Centralized strategic partnership across human and animal health sector has improved early detection and response to several important zoonotic diseases threatening the public's health. However, in Nigeria, a wide gap still exists between these two professional bodies.

For example the US Center for Disease Control and Prevention, the National Public Health Institute of Finland and the Chinese Center for Disease Control and Prevention. These National Public Health Institutes are usually governmental or quasi-governmental agencies with a central focus and organisational structure that allow coordination of national public health service delivery and ensure a country's ability to detect, investigate and respond to public health emergencies (Rodier *et al.,* 2007). The general lack of resource commitment to health issues in the developing countries seriously hampers such collaboration and partnership that will foster evaluation and analysis of health status; public health surveillance and disease control. According to the concept of 'one health and one medicine' (Schwabe, 1984; Zinsstag and Weiss, 2001), the control of zoonoses is beneficial to both human and animal health, therefore the need for the medical and veterinary professionals to invest resources in common control strategies (Zinsstag *et al.,* 2005; 2007).

Strong collaboration between the medical and veterinary professionals is therefore encouraged in the

areas of diagnosis, surveillance and control of emerging and neglected zoonoses in Nigeria. Information transfer and sharing of ideas, knowledge and facilities between these two sectors on matters relating to zoonoses must be put in place for the wellbeing of the society. The link between the veterinary and the medical profession can be nurtured at the training levels (Undergraduate and post-graduate) through common courses, and by initiating joint zoonoses control programme. Such cooperation and partnerships will inadvertently foster the much-needed political will and support required for effective and efficient control and elimination of the endemic neglected zoonoses in Nigeria.

**Conclusion and Recommendation**

Although the basic strategies required for the control and elimination of the endemic zoonotic diseases in Nigeria are well known, these diseases are still widely distributed in most parts of the country and often neglected or ignored. This could be due to several factors which may include; financial constraints, lack of political will, lack or scarcity of trained professionals, as well as the underestimation of the importance and impact of these zoonoses on human health and animal production by the government and relevant agencies. Hence, control measures are not been applied or are inadequately applied in most parts of the country. The key for controlling these neglected zoonoses (Anthrax, Bovine tuberculosis, Brucellosis, Rabies, Echinococcosis) in Nigeria is to focus on interventions that target animal reservoirs and adequate education of the public about risk avoidance

Due to the fact that these zoonoses poses a potential hazard to both animal and public health, surveillance programs in humans and animals should be considered a priority especially in high risk areas. The economic implications of the endemic neglected zoonoses on human health and animal production in Nigeria need to be fully assessed. There is also need for stronger collaboration between the veterinary and medical professionals in Nigeria for effective disease control particularly in rural communities for the wellbeing of man. The government at all levels should be greatly concerned and support disease control measures by adequately funding the relevant agencies

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