

A Multidisciplinary Approach in the Control of Zoonoses in Nigeria

Ngutor Karshima S.

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*Ngutor Karshima S.

Department of Animal Health, Federal College of Animal Health and Production Technology Vom, Plateau State, Nigeria.

Abstract

The emergence and re-emergence of zoonotic diseases such as avian influenza and Lassa fever in 2004 and 2012 respectively as well as the human African trypanosomosis in the 1990s and the increased prevalence rates of endemic and neglected zoonoses such as rabies, tuberculosis, salmonellosis, brucellosis and so on in Nigeria calls for attention. These diseases pose serious threats to human and animal populations, food security and safety, national economy and losses of environmental diversity especially in Nigeria. Despite all these challenges however, little or no attention is given to the control of these zoonoses by professionals involved, especially through inter-disciplinary collaboration. This review identifies the individual roles of different professionals and emphasized on inter-disciplinary approach to zoonoses control in Nigeria. This can only be achieved through collaborations between the veterinarian, physician, environmental health personnel, the media as well as the Ministries of Agriculture, Health, Environment and Communication.

Keywords: Multidisciplinary, control, zoonoses, Nigeria

* Corresponding author: Department of Animal Health, Federal College of Animal Health and Production Technology Vom, Plateau State, Nigeria.

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Introduction

Zoonoses are diseases and infections that are naturally transmissible between vertebrate animals and man (WHO, 2006). They exert dual impacts on human population that are livestock dependent. This could be either through direct risk of infection by zoonoses or through reduced production by the livestock resulting in food insecurity and poverty (Molyneux *et al.*, 2011). It is estimated that over 600 million people globally are livestock-dependent, and represent up to 70% of the marginalised and poor population (FAO, 2004). These communities are the most exposed to the risk of zoonoses, but are typically isolated from political processes, communication, education, and health care, due to geographic, economic, and socio-cultural factors, which exacerbate problems of awareness and health-care delivery (Molyneux *et al.*, 2011).

They can be transmitted directly by contact with the infected animal as is seen in rabies, via contaminated environment (e.g. anthrax), via food (e.g. salmonellosis) or indirectly via vectors such as tsetse fly, ticks, and mosquitoes (e.g. human African trypanosomiasis, ehrlichiosis, and West Nile fever respectively). Their transmission require three elements namely; the source of the organism, a susceptible host, and a means of transmission between the hosts (Siegel *et al.*, 2007). The control of zoonoses therefore most target eliminating or isolating the source, reducing host susceptibility through immunization, or interrupting transmission cycle.

The control of zoonoses has remained problematic due to reasons such as lack of reliable qualitative and quantitative data on disease burden in endemic countries. This must go beyond the traditional disability-adjusted life year assessment to measure and incorporate monetary and health burdens resulting from production losses due to disease in animals (Maudlin *et al.*, 2009). Others include little knowledge of clinicians and policy makers on the causes of zoonoses in humans (John *et al.*, 2008), unavailability of diagnostic tools for zoonotic diseases in rural health centers except at the referral centers (Molyneux *et al.*, 2011). Finally,

data collection systems for zoonotic diseases are often fragmentary, collected independently by the public health, veterinary or wildlife sectors and recorded and reported separately, if they are recorded at all, resulting in a failure to identify disease outbreaks. This review targets the control of zoonoses in Nigeria with emphasis on a collaborative approach.

The Control of Zoonoses in Nigeria

Veterinarian role

Veterinarians are accessible, expert sources of information regarding zoonotic diseases and should be prepared to inform clients of risks specific to their communities (Lipton *et al.*, 2008; Dvorak *et al.*, 2008). The vast majority of zoonotic diseases in humans, as well as potential zoonotic diseases that companion animals are capable of transmitting are documented (Bharwana *et al.*, 2012). The veterinarian possesses qualities which can be directed to the investigation and management of human diseases and, although primarily trained to deal with diseases of lower animals, has a herd or population approach to the practice of medicine (Schwabe, 1986). The veterinarian must recognise and quarantine infected animals both within herds and at borders where animals are imported (Bharwana *et al.*, 2012). The management of occupational risk in the veterinary practice is a very important issue. Veterinary personnel should always wear protective equipment appropriate for all situations. As much as possible injuries through needles should be avoided as this may serve as portal of entry for pathogens (Weese and Jack, 2008). Client's education about issues such as the importance of vaccinating animals against zoonotic diseases such as rabies, control of endo and ectoparasites, as well as bite prevention will also help protect the community against zoonoses (NASPHV, 2010). Clients can also be educated by veterinary personnel of the possible risk of contacting zoonoses through ingestion of raw or undercooked animal products such as milk (e.g. salmonellosis, Campylobacteriosis, brucellosis) and beef (bovine tuberculosis, cysticercosis).

Clients with immunocompromised conditions, who insist on keeping their companion pets for

psychologic benefits, can have them regularly check for zoonotic diseases to ensure that they do not pose any threat to them (Grant and Olsen, 1999).

The role of veterinary meat inspection which targets public health can never be over emphasized in Nigerian abattoirs. This if properly done will help to protect the 10% human population that is said to suffer from food-borne zoonoses annually (Schlundt *et al.*, 2004; Kaferstein and Abdussalam, 1999). Routine disease surveillance and monitoring as well as disease reporting will help in providing disease records and identifying outbreaks immediately. Veterinarians can also pass information to the physicians when new diseases that have the potentials of infecting human are identified.

The risk of transmission of vector-borne zoonoses can be greatly reduced in Nigeria if veterinarians will institute, monitor and ensure the execution of vector control programmes for diseases such as human African trypanosomiasis, onchocerciasis, babesiosis, ehrlichiosis among others. Wound infections and abscesses can be caused by many zoonotic pathogens (Meyers *et al.*, 2008). So, veterinarians should wear protective outerwear and gloves during debridement, treatment, and bonding of wounds. Immunization against known zoonoses is mandatory. Practicing veterinary personnel in Nigeria who have contact with animals should receive pre-exposure rabies vaccination and antibody titer assessed every two years (Trevejo, 2000; CDC, 2008). They should also receive routine tetanus vaccination every 10 years (CDC, 2006a), avian influenza (CDC, 2006b), and swine influenza vaccinations (CDC, 2009).

Other roles may include development and production of biologicals, the control of animal populations which may serve as reservoirs of zoonotic pathogens, participation in outbreak investigations, prevention and control of food-borne illnesses of animal origin, and participation in environmental activities including vector, water, wildlife, and use of animal monitors.

Physician role

The physician can help in the control of zoonoses through proper clinical diagnosis and treatment of infectious diseases of humans. Prevention is said to be better and cheaper than

cure, therefore zoonotic disease prevention through immunization is necessary.

The risks of pet ownership for chronically immunosuppressed pet owners are considerably greater than the immunocompetent. It is reported that almost 100,000 cases of reptile-associated salmonellosis is reported in the United States annually as a result of companionship with these animals (Kahn *et al.*, 2007). It is therefore necessary for physicians to advise their immunocompromised patients of the higher risk of associating with pets and encourage them to present such pets to the veterinarians for routine checkup and immunization against known and potential zoonotic diseases. Some animals especially those that can bite or scratch should simply not be pets for people at risk because the danger of zoonotic disease transmission is too great (Kahn *et al.*, 2007), physicians should be able to provide this advice to their immunocompromised patients. In addition, patients owning pets may be advised by their physicians to routinely submit stool samples at periodic intervals so that they can be checked for zoonotic helminths such as toxocariasis and diphyllorhynchiasis. Patients should also be educated on the importance of careful hand washing after handling animals as a significant disease prevention measure (Reed and Kaplan, 1996).

Moreso, adequate protective measures observed by physicians while attending to patients, and careful usage of sharp objects to avoid being pricked will also do a lot of good in the prevention of zoonoses. Routine surveillance and monitoring of human diseases and adequate reporting of such diseases will provide information on available diseases and also help to identify emerging zoonoses immediately.

Community role

Community engagement and participation has played a critical role in successful zoonotic disease control and elimination campaigns in many countries (Sleigh *et al.*, 1998; Kaneko *et al.*, 2000; Espino *et al.*, 2004; Beier *et al.*, 2008). The benefits of community participation for disease control and elimination are yet to be fully realized. A study of community participation in 5 African countries in the programme of the Roll Back Malaria Initiative

found the practical reality of community engagement to be still generally low (Chilaka, 2005). Possible explanations include; poor understanding of the constructs of participation in developing countries, inadequate health infrastructures and financial resources to support a community participation programme, and differing interpretations of the concept between policy makers, planners and health care professionals (Rifkin, 1996; Chilaka, 2005).

The community role in an effective zoonotic disease control in Nigeria may include prompt reporting of animal and human diseases to the nearest veterinary and medical centres respectively. Any increase in frequency of a disease, massive dead of wildlife and domesticated animals must be reported promptly without eating such animals. Hunters within the community must ensure that wild animal killed for human consumption as bush meat must be subjected to meat inspection to avoid infection with emerging diseases of wildlife origin (Barre-Sinoussi, 1996; Leroy *et al.*, 2004; Wolfe *et al.*, 2004).

Vector control for vector-borne zoonoses requires effective participation of local community (Winch *et al.*, 1992), and has become the cornerstone of primary zoonotic disease control (Abad-Franch *et al.*, 2011). Residents of a community may have better chances of discovering vectors in their own community than a visiting team searching the community for a few minutes every several months (Wisnivesky *et al.*, 1988; Bryan *et al.*, 1994; Marsden, 1994; Gurtler *et al.*, 1995; Cuba-Cuba *et al.*, 2003). In addition, community participation may be done for trap security, where community members take on responsibility for ensuring that traps are not damaged or stolen (Brightwell *et al.*, 2001). The application of insecticides against vectors may be inconveniencing to the people and grazing animals. Therefore community participation may range from tolerance, through provision of labour or financial contribution, to making decisions on control methods, their implementation and coordination of all activities (Barrett and Okali, 1998).

Feeding habits in the community settings may need to be addressed especially in nomadic settlements where milk is taken raw directly from

the udder of cows (Onoja *et al.*, 2010). This increases the risk of milk-borne zoonoses like tuberculosis, salmonellosis, and shigellosis among others. Also, eating of raw or undercooked meat should be discouraged among community members to reduce risk of infection with cysticercosis and hydatidosis (Pawlowski and Murrell, 2000; Rajshekhar *et al.*, 2003; Engels *et al.*, 2003).

Flooding is associated with outbreaks of water-borne zoonoses such as anthrax, campylobacteriosis, salmonellosis, cholera among many others. Members of the community should endeavour to boil water before drinking especially when flood is experienced as was observed between July and October, 2012 in most States of Nigeria. Overcrowding should be avoided especially during outbreaks of respiratory diseases like avian and swine influenza. Community-led total sanitation is another innovative strategy for mobilizing communities to completely elimination open defecation, with sustainable impacts on enteric zoonotic disease control (Kar and Chambers, 2008).

Community participation can be promoted through public meetings with officials, experts, followed by endorsement from senior members of the community to promote public awareness, sensitizing people to important issues and encouraging participation. In addition, distribution of leaflets, posters and other publicity materials, visitation by health professionals and extension workers as well as drama presentation may also help in promoting community participation (Mavrocordatos, 1998).

Environmental role

Public health scientists are increasingly discovering that the recent emergence of infectious diseases has an origin in environmental change (Morse, 1995; Patz *et al.*, 2000; Eisenberg *et al.*, 2007). Zoonotic diseases with environmental reservoirs such as air-borne (Rothernberg *et al.*, 1998; Klov Dahl *et al.*, 2001; Shen *et al.*, 2004), water-borne (Colwell, 2004; Eisenberg *et al.*, 2007), and disease for which land use change modulates vector population such as vector-borne diseases (Lindblade *et al.*, 2000; Ostfeld and Keesing, 2000) requires collaboration between the physician,

veterinarian, environmental health workers and other discipline for effective control.

The environmental health personnel can organize campaigns that focused on sanitation, hygiene, housing, and consequences of blocking water ways with refuge, indiscriminate use of insecticides, pesticides and herbicides. These campaigns effectively controlled many significant communicable pathogens (Eisenberg *et al.*, 2007). Other environmental factors that effect zoonotic disease transmission which must be addressed by environmental health personnel include overcrowding (Kenyon *et al.*, 1996), urbanization and homelessness (Hunter and Thomas, 1984) and migration (Springeth *et al.*, 1958).

Policy maker role

The surveillance and control of zoonoses depend upon the policies and action implemented at a local, national, regional and world level. Inadequacy of the policies and actions implemented at just one of these levels can compromise the effectiveness of results achieved at the other levels, regardless of their relevance or quality.

Effective control of zoonoses in Nigeria requires adequate disease control policies by policy makers. This will be in prioritising zoonoses based on their burden and following this with resource allocation. Policy makers should monitor disease control programmes for effectiveness and sustainability. They should ensure that guidelines for importation of animals and animal products, control posts and meat inspection are adhered to by professionals involved.

Media role

The overall aim of any zoonotic disease prevention and control programme is to ensure safety of the human population, and it begins with educating the populace of the risk and dangers of the disease and possible ways of transmission. The media is the best source of information for a mass audience. The effectiveness of the media in disseminating disease information was reported (Karshima *et al.*, 2010).

The one world, one health, one medicine concept

The world is said to be a global village, comprising humans, animals and the agents that cause disease. Many emerging health issues are linked to increasing contact between human and wildlife, intensification and integration of food production, and the expansion of international travel (WHO, 1999). Global trade of wildlife also exacerbates the problem of disease emergence (Karesh *et al.*, 2005). Travel by air and transportation via water have connected all countries into one world. Microorganisms can travel by plane across the world in time frames shorter than their incubation periods (Frank, 2008). According to King (2008), no where is remote and no one is disconnected as far as disease transmission is concerned.

This concept of “one health, one medicine” promotes collaborative efforts of multiple disciplines, working locally, nationally and globally to reach optimal health for people, animals and the environment, and has been discussed for many years. However, the concept was lost and the medical and veterinary disciplines developed into separate professions despite the ongoing discovery of numerous commonalities in the two professions.

The one health concept to forge multidisciplinary collaborations has in theory been widely embraced while in practice genuine integration lags behind, not only across academic discipline, but also with respect to integration of research with policy (Day, 2011). This concept is the unifying concept to bring together medical and veterinary professions as well as policy makers under the umbrella of environmental health. Effective surveillance of zoonotic pathogens and control of the diseases they cause requires multidisciplinary integration across human and animal populations as well as the environment. Such integration is lacking in the contemporary veterinary and medical communities (Shaffer, 2008).

Despite the challenges in the area of multidisciplinary collaboration, the one health concept has long been embraced in some countries. For example in Scotland, the Scottish Centre for Infection and Environmental Health (SCIEH) is a

governmental organisation made of medical, veterinary and environmental health staff. This body is saddled with the responsibility of identifying and preventing zoonoses in both human and animal populations through surveillance. Other governmental and quasi-governmental agencies with multidisciplinary membership responsible for the coordination of national public health service delivery through detection, investigation and respond to public health emergencies include the US Centre for Disease Control and Prevention (CDC), National Public Health Institute (NPHI) of Finland and the Chinese Centre for Disease Control and Prevention (Rodier *et al.*, 2007). However in Nigeria, collaborative approach to zoonotic disease control has not achieve any progress and thus both medical and veterinary disciplines are existing as separate professions. Collaboration in zoonotic disease control in Nigeria is necessary in the following areas.

Preventive medicine

Prevention is said to be better and cheaper than cure. Prevention of zoonoses through animal interventions is cheaper and safer since the ultimate target is public health. For example, although human rabies can be prevented through timely post-exposure prophylaxis, the high cost of vaccination which is 50 times the cost of intervention in animal populations places a significant burden on individuals and families in Nigeria.

Management of immunocompromised patients

The bond between humans and animals has been recognized for many years, and pet ownership has been associated with emotional and health benefits (Angulo *et al.*, 1994; Beck and Meyers, 1996). However, pet ownership may also pose health risk through the zoonotic transmission of infectious diseases, especially in the immune-compromised (Grant and Olsen, 1999). For example, it is estimated that about 3,300,000 adult Nigerians are living with HIV/AIDS, this amounts to a prevalence of 3.6% (UNAIDS, 2010). This group of people and those living with other immuno-compromised conditions such as pregnancy (Moore *et al.* , 1993), malignancies and diabetes mellitus (Trevejo *et al.*, 2005) own or have

contacts with pets and other livestock which increase their risk of becoming infected if such animals are carrying zoonotic agents. In addition the ingestion of infected animals may also result in infection since they are already immune-compromised. These groups of people should be advised by their physicians and veterinarians to routinely present their pets for veterinary checkup so that they do not serve as sources of infection with zoonotic agents.

Education

In the 19th century, there was considerable collaboration, particularly in veterinary and medical education and research unlike today (Khan *et al.*, 2007). Part of the problem might stem from the fact that medical schools typically do not emphasize the ecology of zoonotic pathogens, as is done in schools of veterinary medicine (Khan *et al.*, 2007). This lack of emphasis on the ecology of zoonotic pathogens in medical schools might explain the findings by Grant and Olsen, who studied the roles of physicians and veterinarians in preventing zoonotic disease risks in immuno-compromised patients. They found that physicians were generally not comfortable discussing these issues with their patients, yet the patients did not view veterinarians as a source of information for human health (Grant and Olsen, 1999). For effective control of zoonoses in Nigeria, it is necessary for veterinary and medical schools to provide their students the opportunities to learn about how animal and human health can impact on each other.

Inter-disciplinary communication

There should be enhanced communication between veterinarians, physicians and environmental health workers to secure exchange of relevant epidemiological information and reports on prevention and control activities for zoonotic diseases. For example, both the veterinarian and the physician can work with the environmental health personnel to trace disease outbreaks to the source, prevent and control outbreaks and public emergencies (Zinsstag *et al.*, 2005). In addition, in the face of an outbreak of a zoonotic disease or the emergence of any potential zoonotic pathogen in animals, the veterinarian should communicate such

epidemics to the medical counterparts immediately so that together the transmission to humans can be prevented and vice versa.

Implementation of common control programmes

The health sector alone can only detect and treat cases of zoonotic diseases among humans. The prevention or elimination of zoonotic diseases require long-term actions from the veterinary sector to decrease incidence among diseased animals and reduce or interrupt transmission to humans (WHO, 2003). This requires high-level commitment between the health sector and veterinary sector to implement common control programmes. For example, during the Nigerian avian influenza and Lassa fever outbreak in 2004 and 2012 respectively, there was need for common control programmes that never existed throughout the fight against these two menaces. Infact both sectors played separate and independent roles in the control of these two zoonoses. It is necessary that in subsequent cases of emerging zoonoses in Nigeria, efforts should be geared towards common control programmes. This will result in concurrent detection and treatment of the zoonoses in humans as well as interruption of transmission to humans through animal interervention.

Research, surveillance and monitoring of zoonoses

It is estimated that 61% of human infectious diseases are of animal origin, and majority (71.8%) of the diseases that emerged in the last 10 years are said to have resulted from animals and their products (Jones *et al.*, 2008), while only 3% of known zoonotic pathogens are said to utilize humans as their primary reservoir (Shaffer, 2008). Effective surveillance and monitoring of zoonotic pathogens and control of the diseases they cause requires integration across human and animal populations (Shaffer, 2008). Nigerians would benefit if more collaborative research projects are conducted by physicians, veterinarians and environmental health personnel to investigate zoonotic agent-host interactions. Among the many ways to promote these projects are multi-agency sponsored collaborative research grants and more

training grants for veterinarians, physicians and environmental health personnel interested in public health. These efforts will increase our understanding of how zoonoses expand their host range and would, ultimately improve prevention and control strategies against zoonoses.

Diagnosis

The effectiveness of correct and accurate diagnosis in the prevention and control of zoonoses can never be over-emphasized. Correct diagnosis and subsequent treatment of infected individuals helps to interrupt transmission of disease to susceptible uninfected individuals (Buscher *et al.*, 1999). Collaboration is essential in diagnosing zoonoses especially when concurrent outbreaks are occurring in both human and animal populations. This will help confirm if the human and animal disease is caused by the same zoonotic pathogen. For instance, reports showed that zoonoses presented as non-specific, febrile illness, for example brucellosis (Zribi *et al.*, 2009), leptospirosis (Biggs *et al.*, 2010), rickettsiosis and Q-fever (Prabhu *et al.*, 2010) are often misdiagnosed as malaria (Reyburn *et al.*, 2004; Nankabirwa *et al.*, 2009).

Information dissemination

Information dissemination is also an essential aspect of zoonotic disease control. The public health team can pass information that can help community members to protect themselves and interrupt disease transmission through the media. For example, the flooded areas of Nigeria needed to be informed of the aftermaths of flooding such as water-borne diseases and possible precautions to prevent zoonotic disease outbreaks in camps.

Policy making

For any effective policy making in relation to disease control in Nigeria, the professionals involved must be carried along. Policy makers at the local, state and national levels must work in collaboration with the veterinary, medical and environmental health representatives in the ministries of Agriculture, Health and Environment respectively. The representatives in the various Ministries will in turn have to involve their field

epidemiologists and public health personnel for effective control of zoonoses.

Conclusion and Recommendations

Understanding the role of wildlife and domestic animals in the emergence and transmission of zoonoses will help in embracing the one health concept in their control. Since human medicine often does not delve deeply into the role of animals in the transmission of zoonotic agents (Glasser *et al.*, 1994; Tan, 1997), and veterinary medicine does not cover the clinical aspects of human diseases (Grant and Olsen, 1999), zoonotic disease control in Nigeria requires involvement of both veterinarians and physicians.

To confront the threats of emerging zoonotic diseases in Nigeria, professionals must embrace the fact that zoonotic pathogens infect both humans and animals and, as a result these professionals must work closely to promote human health.

A number of endemic and epidemic zoonoses, particularly rabies, tuberculosis, brucellosis, cysticercosis, salmonellosis, psittacosis occur in Nigeria. These and emerging zoonotic diseases present a threat to human and animal populations, food security and safety, environmental diversity and significant economic losses by reducing the availability of animal products and create barriers to international trade of live animals and animal products in Nigeria. There is a great need for high-level recognition that human and animal health are inseparable, and that the veterinary, medical and environmental sectors share the common goal of protecting, promoting and improving the health and well-being of human populations in Nigeria through animal and environmental interventions.

Effective control of zoonoses in Nigeria requires that both human and animal health issues be handled together. This will involve putting in place common zoonotic disease monitoring, surveillance and control programmes, efficient and common diagnostic facilities. In addition, prevention can be achieved through animal intervention, zoonoses control policy priorities and mass dissemination of useful disease prevention information through the media. Government

policies targeting zoonoses control such as the meat inspection act and control posts as well as the guide lines for importation of animals and animal products should be adhered to and be monitored by the government for effectiveness and sustainability.

Moreso, certain factors militating effectiveness of the few zoonoses control programmes existing in the country, such as; poor funding of zoonotic disease control programmes, inadequacy of professionals and reluctance of the available professionals to perform their duties, indiscriminate provision of bush meat by local hunters for human consumption, and others such as; uncontrolled importation of animals and animal products through the country's porous borders, failure of government agencies to monitor existing control programmes as well as failure of governments at the national, state and local levels to play their roles in the area of zoonotic disease control must be addressed. Attitudinal change by Nigerians and controlling the underscored factors will play a critical role in the control of zoonoses in Nigeria.

For effective and sustainable control of zoonoses in Nigeria, it is recommended that the national burden of these diseases be assessed and prioritized based on their morbidity, mortality and economic losses. Multi-sectoral committees responsible for surveillance and control of zoonoses should be created at all levels of government. There should also be in place common multi-sectoral plan for the control of zoonoses in humans and animals as well as standardized veterinary and public health diagnostic laboratories in order to improve diagnostic techniques. There should also be enhanced communication between veterinary, health and environmental services as well as community members to secure exchange of relevant epidemiological information and reports on prevention and control activities for zoonotic diseases.

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