COMPLIANCE WITH INFECTION CONTROL PRACTICES AMONG VETERINARIANS IN NIGERIA

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTERS OF SCIENCE (M.Sc)

IN EPIDEMIOLOGY OF THE UNIVERSITY OF IBADAN

DEPARTMENT OF EPIDEMIOLOGY, MEDICAL STATISTICS AND ENVIRONMENTAL HEALTH (EMSEH)

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SEPTEMBER, 2012

CERTIFICATION

I certify that this project by MAKINDE GABRIEL IFEOLUWA of the Department of Epidemiology ad Medical Statistics was, College of Medicine, University of Ibadan, was carried out under my supervision.

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ACKNOWLEDGMENT

My gratitude goes to my supervisor Dr. Olufunmilayo. I, Fawole for the immense worth of support and input she made from its inception to the very end. Your forthrightness and demand for academic excellence will continue to influence my future endeaviours.

My heartfelt gratitude extends to my second supervisor, Dr. Benedict Emikpe who his unavoidably absent as at the conclusion of the project but made tremendous impact at ensuring the possibility of this project. To you I say thank you.

My big thank you to Dr. G.R.E.E.E Ana for his immense guidance and contribution to my academic programme and particularly my project. I will never forget the role you played at helping me when you did know me from anywhere.

I express my heartfelt gratitude to all my lecturers at the department of Epidemiology and medical Statistics, Faculty of Public Health, University of Ibadan for imparting in me invaluable knowledge.

My endless gratitude goes out to the following people who made varying degree of assistance throughout my programme: Pastor Tope Opaleye and family, Omolola Gidado, Damilola Osakinde, Deji Kilanko, Peter Omoniyi, Jide Adekunle, Elvis Isiri, Ofovwe Agofure, Ernem Etukiren, Bamkole Olowo, Yomi, Temidayo Falegan, Opemipo Akosile and others to many to mention.

To my parents Pastor and Mrs. H.O Makinde and siblings for sharing in my burdens and being a pillar of support each time the situation seemed insurmountable.

Above all, to Him Immortal, Invisible, Invincible, the only wise God. My source of life, who kept His promise in bringing me to this stage of my career and afforded me an opportunity to contribute to the development of humanity. I will never fail to appreciate YOU

ABSTRACT

Veterinarians are professionals with high level of knowledge on animal disease care and were trained on modes of zoonotic diseases transmission. The global rising prevalence of morbidity and mortality among these professionals from zoonotic infections have highlighted them as the most at risk group among other exposed category of personnel that have daily contact with animals. This is worrisome as they are regarded as defence or bridging population for zoonoses entry into the human population. Studies that considered factors associated with compliance with standard infection control practices among veterinarians are very rare at the national level. It was against this background that this study was conducted to assess compliance with standard infection control practices by veterinarians in Nigeria.

The study was a cross sectional survey. Purposive sampling was used in the administration of structured questionnaire to 320 attending veterinarians at the Nigerian Medical Veterinary Association Annual Conference held in Ilorin Kwara state on 21-24th November, 2011. Data analysis was carried out using SPSS 15.0: Descriptive statistics and chi-square test was used to calculate proportions of sociodemographic and practice characteristics of veterinarians; and to test for association between these factors with levels of compliance and standard infection control practices respectively. Logistic regression was used to determine the relationship between these factors and compliance with standard infection control practices. Levels of standard infection control compliance

The age range of veterinarians was 22-68 while their mean age was 38.97 (SD=8.7). Majority of veterinarians 51.1% and 61.2% during risky medical procedure for zoonosis transmission did not comply with appropriate infection control practices. Veterinarians who were owners of their practice were found to be less likely than those employed in government veterinary clinic to have complied with standard infection control practices (OR=0.673, 95%CI= 0.152-0.693). Also, veterinarians with >15 years of practice were found to be less likely than those having ≤15 to have complied with standard infection control practices (OR=0.416 (0.230-0.753). Unlikely compliance with standard infection control practices were also found among veterinarians with ≥60 weekly working hours (OR=0.519, 95%CI=0.278-0.971) compared with those with >60 weekly working hours. Veterinarians working within practices without written infection control

policy were significantly more likely to fail in comply with standard infection practices (OR=3.714, 95%CI=1.870-7.373).

There is need for policy makers to ensure that veterinary establishments have infection control policy. There is also need to ensure that they comply with these infection control practices.

Keywords: personal protective equipment (PPE), Infection control practices (ICP), Veterinarians, Zoonosis

Word count: 406

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Standard infection control policy and practices in veterinary practices has been highly regarded by relevant national and international health agencies as one of the channel through which animal to human transmission of zoonotic infections can be curtailed. Prevention is believed to be best achieved when veterinary personnel strictly adhered to standard infection control whilst engaging in their professional practices. Interactions between animals and humans may occasionally result in infection. It is estimated that of the 1,415 agents causing disease in humans, 868 (61%) are zoonotic. Also, of the 175 pathogens defined as emerging infections, 75% are zoonotic (Taylor et al. 2001; Jones et al. 2008).

Global standard for infection control policy and infection best practice in veterinary practice against transmission of zoonoses include amongst a list: the establishment and continuous implementation of the following: infection prevention and control strategies designed to protect patients, owners, veterinary personnel and the community. It further includes a formal infection control program, a written infection control manual and an infection control practitioner, active or passive surveillance system and routine practices that are critical to infectious disease prevention and control (CCAR, 2008).These guidelines provide a practical and comprehensive understanding of zoonotic diseases, and empower veterinarians to significantly reduce the risk of zoonotic infection to themselves, their staff or clients (AVAG, 2011).

The objectives of standard infection control guidelines are to raise awareness of the scope of zoonotic disease risk in veterinary medicine; address infection control issues specific to veterinary practice; provide practical, science-based veterinary infection control guidance; and provide a model infection control plan for use in individual veterinary facilities (NASPHV, 2006).

The promotion and support for control of zoonotic infection transmission is a global priority as call for comprehensive yet specific guidelines for preventing infection from animal associated diseases continues to mount (Wright et al. 2008). Some of the zoonotic infections risks with devastating health implication on both animal and human and yet could be minimized by use of appropriate standard infection control practices include: Plague, brucellosis, Ringworm, Rabies, Salmonelliosis, Gastro-intestinal bacteria, gastro intestinal parasites and Anthrax (Javma 2008).

Compared with other parts of the world, sub-Saharan Africa has the heaviest burden of infectious diseases of animals and twelve of the fifteen diseases that were formerly considered by the OIE as the most contagious are found in Africa. Furthermore, the spread of livestock diseases in Africa has worsened in recent years. For example, contagious bovine pleuropneumonia (CBPP), which was reasonably controlled in the 1970s and 1980s, has again become widespread (Rweyemamu et al 2006). In Nigeria and in other parts of the world zoonoses remain a source of mortality and morbidity (Coker et al, 2000)

To ensure effective eradication of zoonotic infection transmission to humans WHO, during a convergence of veterinary personnel and other stakeholders proffered modalities aimed at delivery of fundamentals of public health programs. These modalities should be made as

close as possible to the individual, small group or community. The health fundamental programs should include basic hygiene principles, quarantine and isolation, biosecurity and inexpensive vaccines, as well as more sophisticated priorities such as surveillance systems, diagnostic capability, treatment options and depopulation capability. The ideal would be zoonotic disease control and food safety programmes that educate the individual in methods and practices that can be carried out at zero to low cost, with minimal equipment and materials. These programs would ultimately require considerable human resource but little monetary investments, especially if the human resources came from the local community (WHO/FAO/ OIE 1999).

While globalization has yielded many benefits for society, it also has created many new challenges, particularly with regard to animal, human, and environmental health. Livestock contribute significantly to the livelihoods of hundreds of millions of people worldwide and global demand for foods of animal origin has been steadily increasing for decades. Despite the clear benefits of livestock for humans, some livestock production practices are associated with certain forms of environmental degradation, and trade in livestock and livestock products can contribute to the emergence and spread of new animal and zoonotic diseases (David, 2010).

1.2 PROBLEM STATEMENT

Researches have shown that an estimated 64% of 1,415 recognized human pathogens are zoonotic (Heeney, 2005) and 73% of 177 emerging or reemerging pathogens originated from animals. In the practice environment, whether in a building or "in the field," veterinary personnel are frequently exposed to recognize and unrecognized infectious pathogens, many of which are zoonotic (compendium of veterinary practice, 2006). Veterinarians, their staff

and clients are at greater risk of contracting or transferring zoonotic disease due to their extended contact with animals. Many of the animals are sick or asymptomatic carriers of infectious disease (Baker and Gray 2009).

Veterinarians viz-a-viz animal health professionals are believed to have a high level of knowledge on animal disease care and training on modes of zoonotic disease transmission. However, there is a global rise in prevalence of morbidity and mortality within these professional from zoonotic infections. Veterinary personnel are often the first to encounter potentially infected animals; they and their staff are at the risk of developing of zoonotic infections and may serve as the first line of defense or as a bridge for disease entry into the human population (Jennifer et al 2005.).

1.3 JUSTIFICATION

To preserve the health of high risk individual such as veterinarians and other animal health care workers, it is necessary to discover the extent of association of certain demographic factors and practice characteristics as it affect compliance to standard zoonotic infection control practices and guidelines. There has been a global call for the preservation of public health. This is expected to be done through the strengthening and collaboration of relevant health agencies. This effort aimed to address zoonotic infection control compliance; as an integral part of controlling zoonotic infection at human interface by high risk populations such as veterinarians, a dearth of studies exist nationally that needed to consider the relationship between certain demographic factors such as gender, age, categories of veterinary employment, years of veterinary practice and weekly working hours, veterinarians practice characteristics such as location of practice, nature of services,

availability of written infection control guidelines for staff and compliance with standard infection control practices.

It is pertinent to determine practice of veterinarians in Nigeria as well as their compliance towards best standard infection control practices. This is considered important as shown by studies that; they are one of the high risk groups at contracting zoonotic infection compared to other occupationally exposed animal personnel.

Hence, this study aimed to investigate compliance towards infection control practices among veterinarians in Nigeria as this will go a long way at showcasing to relevant health authorities the need to enact infection control policies and provision of information and training on infection control practices among veterinarians for prevention and control against zoonotic infection transmission.

1.4 OBJECTIVES OF THE STUDY

GENERAL OBJECTIVE.

To determine the compliance with appropriate infection control practices among veterinarians in Nigeria.

SPECIFIC OBJECTIVES.

The specific objectives of this study are:

- To assess the utilization of infection control practices by veterinarians.
- To determine compliance with appropriate infections control practices that applies to a particular medical procedure

- To assess the relationship between veterinarians practice characteristics and compliance with standard zoonotic infection control practices.
- To determine the relationship between veterinarians' sociodemographic factors and compliance with standard infection control practices

1.5 RESEARCH QUESTIONS

What is the proportion of veterinarians' utilization of infection control practices?

What proportion of veterinarians complies with appropriate infection control practices during medical procedures?

What demographic factors of veterinarians are related with compliance with standard infection control practices?

What practice characteristics of veterinarians are related with compliance with standard infection control practices?

CHAPTER TWO

LITERATURE REVIEW

2.1 ZOONOSES.

A zoonosis or zoonoses is any infectious disease that can be transmitted between species (in some instances, by a vector) from animals to humans or from humans to animals (the latter is sometimes called reverse zoonoses or anthroponosis) (WHO, 2008). In a study of 1415 pathogens known to affect humans, 61% were zoonotic (Taylor et al, 2001). Partial lists of agents that can carry infectious organisms that may be zoonotic are: bats, birds, cats, cattle, dogs, flies, goats, mice, rabbits and so on. List of major infectious agents are fungi, viruses and bacteria. A partial list of zoonoses among a wide range includes these amongst others: *anthrax, plague, brucellosis, tuberculosis bovis, salmoneliosis, rabies, ringworm, Lassa fever, yellow fever* (WHO, 2008).

Zoonotic diseases have both direct and indirect effects on livestock health and production (Smiths and Cutler, 2004). Indirect effects occur as a result of the risk of human disease, the economic impact on livestock producers through barrier to trade, the costs associated with control programmes, the increased cost of marketing produce to ensure it is safe for human consumption and the loss of market because of decreased customer confidence (McDermott and arimi, 2002; Perry et al, 2002)

In Nigeria, there exists a class of zoonoses called endemic neglected zoonotic diseases such as: Anthrax, brucellosis, Bovine Tuberculosis, Rabies, Lassa Fever, Animal Trypanosomosis and Echinococcosis. They are called neglected zoonoses because they were

not prioritized by primary health care managers and relevant policy makers at all levels of government (WHO, 2006). These neglected zoonotic pathogens infect livestock and humans and are often poorly controlled in livestock making them to constitute serious 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. With a population of over 140million people, urbanization, economic development; and the concomitant intensification of animal husbandry coupled with the development of peri-urban livestock production systems, the risk posed by the neglected zoonoses in Nigeria are enormous and their control in Nigeria is nearly non-existent and their impact on human health is largely unknown (Ehizibolo et al, 2011).

2.2 Zoonosis in Animals

It is a known fact that 61% of 1415 disease infection from zoonotic infection emerged from animal sources (Taylor et al, 2001). A wide range of single or multiple infections occur in any zoological animal, livestock and wild ones. Of every economy of countries in the world animal agriculture has a significant proportion in those countries sources of revenue. Hence, it is unimaginable the extent of losses that will occur when an animal product yield is reduced due to debilitating zoonotic infections among livestock and poor acceptability of animal products for consumption due to public awareness that some animal products are potential routes of human infections.

Compared with other parts of the world, sub-Saharan Africa has the heaviest burden of infectious diseases of animals and twelve of the fifteen diseases that were formerly considered by the OIE as the most contagious are found in Africa. Furthermore, the spread of

livestock diseases in Africa has worsened in recent years. For example, contagious bovine pleuropneumonia (CBPP), which was reasonably controlled in the 1970s and 1980s, has again become widespread. Serious animal diseases are also the most important impediment to international market access for African livestock commodities (Rweyemamu et al 2006). An example of zoonoses that have immense health implication on livestock and are equally responsible for prevalence of morbidity in human is brucelliosis.

Brucelliosis: It is defined as a contagious systemic bacterial disease primarily of ruminants, characterized by inflammation of the genital organs and fetal membranes, abortion, sterility and formation of localized lesions in the lymphatic system and joints (WHO, 1971; CDC, 2005). Brucellosis is a chronic disease of animals caused by Gram negative and facultative non-motile intracellular bacteria of the genus *Brucella*. Brucellosis is a disease of domestic, livestock and wild animals with serious zoonotic implications in man; causing huge economic losses to the livestock industry (Cadmus et al, 2006). Ishola et al., 2001 and other detailed studies confirming the problem of brucellosis in Nigeria's livestock have been documenting with evidence of the spread of the disease in all parts of the country which is usually accompanied by severe economic losses.

Serological prevalence rate of between 0.20% and 79.70% have been reported in various parts of the country to date. The infection has been reported in various animal species in Nigeria. These demonstrate how brucellosis has been identified as an endemic and problematic disease in Nigeria. However, the infection is not static; it is evident from previous studies that prevalence varies at different times and locations. This is especially apparent where there is no control policy, like Nigeria. There is a pattern of low and high prevalence in specific areas of the country and prevalence variability also arises between

herds in the same area. Although prevalence in brucellosis has been shown to be low in most dairy and private farms, it is actually on the increase among nomadic and semi-nomadic herds which contribute about 95% of all annual food population in Nigeria (Cadmus et al, 2006).

2.3 Zoonosis among human population

Infections of domestic and wild animals that are transmitted directly or by an arthropod vector to humans are a major cause of morbidity and mortality worldwide and particularly in Nigeria (Coker et al, 2000). Zoonosis infection into human population could be as a result of many modes of transmission. Chief mode of transmission could be from bites and scratches from animal, from human consumption of raw unprepared animal product or transmission from infected most at-risk animal personnel and other persons whose work has animal related practices. Bites and food related zoonoses include Rabies, Brucelliosis, Bovine Tuberculosis, Bacillus Anthrax to mention a few. Zoonotic infections that are endemic in Nigeria include tuberculosis, trypanosomiasis, toxoplasmosis, taeniasis, rabies, lassa fever and yellow fever. Zoonotic food-borne infections (caused by Campylobacter, Salmonella and Escherichia coli O157:H7) and cryptosporidiosis are emerging. Sporadic cases such as strongyloidiasis, ascariasis, leptospirosis, scabies, pentastomiasis and African histoplasmosis have been reported (Coker et al, 2000)

The increase in urban and peri-urban livestock production poses a risk of introducing zoonoses that were formerly regarded as rural diseases to urban areas (Mahy et al,, 2000; Perry et al, 2002). Generally, human population comprises of individuals with varying knowledge about basic infection preventive practices. Hence, the implication of unguarded

consumption and interaction with animals capable of biting or individuals working with animals may yield a sick and unproductive population. Also, with a population of over 100 million and the need for improved health care delivery, Nigerians are at considerable risk considering the seriousness of these infections (Coker et al, 2000). An example of an important animal to human zoonosis is rabies.

Rabies: Rabies is an acute viral infection of the central nervous system, caused by a lyssavirus in the family *Rhabdoviridae*. It affects all mammals, including humans, cats, dogs, and wildlife and farm animals. Worldwide it is estimated that there are around 50-70,000 rabies cases in humans each year, predominantly occurring in less developed countries. Nigeria has a high potential for spread of rabies with poor management in human cases as she was one of the countries that imported human rabies into UK within the past ten years (Zoonoses Report, 2010). The virus is present in the saliva of the affected animal and the most frequent method of transmission is by bites, scratches or licks to broken skin or mucous membranes. Dogs are the most common source of infection worldwide. Bats carrying classical rabies have also been reported as a source of human infection in the Americas (Zoonoses Report, 2010).

A study to assess rabies-related knowledge and practices among persons regularly exposed to bats and bat habitats in Thailand found that general awareness of rabies transmission and severity were relatively high, however, awareness of bat rabies in particular was low, with only 10% of participants identifying bats as a potential source of rabies and 36% failing to say they would take any specific action if bitten or scratched by a bat. Bat exposures conducive to potential lyssavirus transmission were also common in this population as four activity groups were observed. Of the four activity group guano miners

(harvesters of birds dung for fertilizers) were found to report the highest frequency of transdermal bat exposures, the least knowledgeable about rabies, and were the least likely to say they would respond to bat exposures in a manner that would ensure rabies prevention within the community (Robertson et al, 2011)

2.4 Zoonoses among most at risk group

Concerns for occupationally related zoonotic infection are mounting due to considerable members of the public who are by profession engage in any form of animal practices (Schelling et al 2003; Swai et al, 2009). A class of such individuals includes normadic herd farmers, zooworkers, livestock workers, abattoir workers, animal products sellers to mention a few. Among the high risk category, veterinarians are at increased risk for infection by zoonotic pathogens and could play a role in spreading animal pathogens to human population (Baker et al, 2009). Whenever emerging infectious diseases are first seen in veterinarians it indicate an animal pathogen has gained the ability to spread across species and hence veterinarians may serve as unprotected biological sentinels for emerging zoonoses (Javma, 2009).

The public health implication of this is that an uncontrolled and unprotected infection practice by this group poses a direct threat to health of the general public. This threat would lead to a level of transmission of either a novel zoonotic infections or reintroduction of those that had been previously controlled into the unprotected population.

Different management practices and environmental circumstances in traditional and small holder livestock keeping system in rural and peri urban areas can increase the risk of zoonoses (Omudu et al, 2007). These practices, which could decrease or increase the risk of

zoonoses, in the various livestock keeping systems and to the public as a whole, will depend on awareness, perception, knowledge and attitude zoonoses (Shirima et al, 2003, John et al, 2008). This level of awareness and knowledge is likely to be different in traditional cattle farmers where cattle has been kept for generation and the smallholder system, which is relatively new and where only some of the diary farmers have had a tradition of cattle keeping (Emmanuel et al, 2010). Emmanuel et al in 2002 (Tanzania) showed in his study to investigate difference in awareness, knowledge, perception and attitude to zoonoses between rural animal farmers and peri urban livestock workers that 85% of the rural animal farmers were significantly at higher risk of zoonotic infection compared to peri urban animal farmers.

2.5 Veterinarians: personnel at increased risk for zoonoses

Veterinarians are uniquely qualified and broadly trained to help prevent the transmission of zoonotic diseases; these professionals play an important role in promoting public health through educating clients about diseases that may be transmitted from pets and livestock to humans (Glickman, 1992). Reports from a recent study which ascertained how animal viruses move to human populations, found that a potential route was through veterinarians. Veterinarians are called "bridging population," spreading pathogens to their families, their communities and the various groups of animals for which they provide care (Javma, 2009)

To further confirm the assertion that veterinarians were potential route of transmission to human population another report showed that veterinarians are at markedly increased risk of zoonotic influenza virus infection (Myers et al, 2006; Saenz et al, 2006) and the risk in veterinarians can exceed that of individuals in other occupational group that have extensive exposure to animals (Myers et al, 2006; Koopmans et al, 2004). This outcome was perceived

to be counterintuitive as veterinarians given their professional training are assumed would have a comprehensive understanding of measures of preventing zoonotic infection transmission. The report found that veterinarians had an increased risk for various pathogens, including swine influenza, avian influenza, and swine hepatitis E viruses; *Brucella; Coxiella burnetii; avian and feline Chlamydia psittaci; methicillin-resistant Staphlococcus aureus;* and *Bartonella* bacteria. Additionally, the review provided evidence that veterinarians could be infected with animal pathogens that are not widely recognized as zoonotic (Javma, 2009). From results of interviews of veterinarians, it was noted that veterinarians may fail to wear protective barriers, such as gowns and gloves, because of discomfort, lack of availability, additional costs, and a belief that there is a low risk of zoonotic infection (Javma, 2008). Hence failure to comply with use of standard infection control practices could have been responsible for veterinarians susceptibility to zoonoses compared with other high risk groups.

2.6 Perceptions of veterinarians about zoonotic infections risk and compliance towards standard infection control practices

In the study conducted among US veterinarians (Javma, 2005) to assess the knowledge and perception of veterinarians about infection risk and to examine specific predictors to their non compliance to standard Infection control practices it was noted that generally, with respect to some selected zoonotic pathogens many respondents affirmed their concern about the risk of the identified zoonotic infection. However the statistics of the study showed that across the practice categories i.e. small animal, large animal and equine animal practice, a higher proportion of veterinarians did not comply with use of appropriate personal protective equipment despite their high perception of zoonotic infection risk. In the same study, across

the entire practice category, a higher proportion of veterinarians were ranked low in the final total PA (Precaution Awareness) score indicative of poor infection control compliance.

A number of demographic factors and practice characteristics were put forward to examine the association with non compliance with practices protective of zoonotic infection transmission. The study included factors considered to be strongly linked with non compliance to ICPs such as are gender, age, type of employment, years of practice, number of weekly working hours and ownership of board certification of practice. Practice characteristics also investigated included location of practice, nature of services, possession of written infection control policy for practice facility and their vaccination status.

Findings in the study indicated that gender was associated with differences in veterinarians' approaches to ICPs showing that the male gender was associated with low PA ranking among small animal and large animal veterinarians. This was substantiated from result of different studies that found that even in regular community settings and health-care settings, males may be less likely to comply with hand washing recommendations than females (John et al, 2003). Across category of animal practice factors such as small animal and equine veterinarians employed in practices that had no written infection control policy were significantly more likely to have low PA ranking than equine practitioners not working in a teaching or referral hospital were more likely to have low PA ranking than equine practitioners working in such institutions. Others studies reveal that veterinarians may flagrantly neglect wearing protective barriers, such as gowns and gloves, because of discomfort, lack of availability, additional costs, and a belief that there is a low risk of zoonotic infections (Jennifer et al, 2008).

The study conducted among US veterinarians in 2005 by Wright et al revealed that the percentage of respondents who reported always washing their hands prior to eating, drinking, or smoking at work was low; barely half of small animal practitioners and fewer than a third of large animal or equine practitioners reported engaging in this protective behavior (small animal=55.2% large animal=31.1%, Equine=28.1). Veterinarians in all three categories reported even lower rates of hand washing between patient contacts (small animal=48.4, large animal=18.2, equine animal=18.2). Unwashed hands pose a risk for zoonotic disease transmission to humans and for nosocomal transmission among veterinary patients. Their study also revealed that small animal veterinarian respondents, most were concerned about risks associated with ringworm organisms (71.2%), gastrointestinal bacteria (38.8%), gastrointestinal parasites (36.5%), leptospirosis (33.7%), rabies virus (21.5%).

Despite the stated perceptions of risk, most concerned small animal veterinarians still did not engage in use of appropriate PPE when managing animals with clinical signs suggestive of certain zoonotic illnesses as 70.7% of small animal veterinarians who were concerned about rabies did not use appropriate PPE during examination of an animal with neurologic signs; Among the large animal veterinarian respondents, most were concerned about ringworm organisms (73.1%), gastrointestinal bacteria (71.3%), *leptospires* (59.0%), *Brucella spp* (36.2%). Of the large animal veterinarians reportedly concerned about dermatophytosis, 43.4% failed to use appropriate PPE during examination of an animal with dermatologic signs. Among the equine veterinarian respondents, most were concerned about gastrointestinal bacteria (40.5%) and ringworm organisms (40.3%). However, 90.1% of equine veterinarians who were concerned about dermatophytosis did not use appropriate PPE during examination of an animal with dermatologic signs.

2.7 Zoonotic disease transmission.

Transmission of pathogens requires three elements: a source of the organism, a susceptible host, and a means of transmission between them (Siegel et al, 2007). Infection control involves eliminating or isolating the source, reducing host susceptibility, or interrupting transmission of the agent (NASPHV, 2010).

Source: These are animal sources of infections. They include animals that are clinically ill, those that are sub-clinically infected, and animals that harbor endogenous microflora that are pathogenic to humans. Environmental sources of infection include contaminated walls, floors, examination tables, scales, cages, bedding, equipment, supplies, feed, soil, and water (NASPHV, 2010).

Host susceptibility: This refers to individuals' immune system varying ability able to resist colonization by an infectious agent, become transient or persistent asymptomatic carriers, or develop illness. Susceptibility can be affected by various factors, including vaccination status, age, underlying diseases, immunosuppression, pregnancy, and deficiencies or disruptions in the body's primary defense mechanisms (NASPHV, 2010).

Routes of transmission: Pathogens are transmitted via three main routes: contact, aerosol, and vector-borne transmission. Some agents may be transmitted by multiple routes (Siegel et al, 2007)

Contact transmission: Contact transmission occurs when pathogens from animals or their environments enter a human host through ingestion or through cutaneous, percutaneous, or

mucous membrane exposure. Contact transmission may be direct or indirect. Direct transmission may occur during examination, bathing, and general handling of animals or during administration of treatments. Indirect transmission involves contact with a contaminated intermediate—objects such as cages, equipment, and soiled laundry. Direct and indirect transmission most often occur through hand-to mouth contact (Siegel et al, 2007)

Aerosol transmission: Aerosol transmission occurs when pathogens travel through the air to enter a host. Aerosols may be large droplets that are deposited on the mucous membranes or smaller particles that are inhaled. For most pathogens transmitted by this route, specific data defining risk of infection are limited; in general, risk of aerosol transmission increases with proximity to the source and duration of exposure.

Aerosols can contain environmentally persistent pathogens that serve as a source for indirect contact transmission. Large droplets are created by coughing, sneezing, and vocalization and by procedures such as lancing abscesses and dentistry. Particles that can be inhaled may be generated through procedures such as suction, bronchoscopy, sweeping, vacuuming, and high-pressure spraying. Certain aerosolized pathogens may remain infective over long distances depending on particle size, the nature of the pathogen, and environmental factors. (Lenhart et al. 2004) Two zoonotic pathogens known to be transmitted over long distances are *Coxiella burnetii* and *Mycobacterium bovis* (Acha et al, 2003; McQuiston et al)

Vector-borne transmission: Vector-borne transmission occurs when vectors such as mosquitoes, fleas, and ticks transmit pathogens. Animals may bring flea and tick vectors in contact with veterinary personnel. Working in outdoor settings may increase risk of exposure to arthropods.

2.8 Essential standard infection control guidelines and practices protective of zoonotic infection transmission

Infection control in human medicine has evolved considerably in the past 30 years with the recognition of HIV and hepatitis B and C viruses. Currently, the cornerstone of human infection control is the use of "Standard Precautions" (Garner, 1996), which provide a basis for the principles of veterinary standard practices. Infection control practices vary tremendously from one veterinary practice to another and often are not sufficient to prevent zoonotic disease transmission (McQuiston, 2006; Wright, 2006). The Veterinary Standard Precautions (VSP) outlined in this text is a collection of standard guidelines designed to reduce the risk of zoonotic infections among personnel in private veterinary clinics and hospitals from both recognized and unrecognized sources of infection. They are to be used with all patients, regardless of their diagnosis, when contacting blood, all body fluids, feces, exudates, non-intact skin, or mucous membranes (CVSP, 2006). In addition, VSP include practices to prevent bites and other trauma induced by veterinary patients that may result in exposure to zoonotic pathogens. Some highlighted ones include:

2.8.1 Personal Protective Practices.

Hand washing

Hand washing is the single most important measure to reduce the risk of disease transmission (Garner, 1996; Boyce 2002). Hands should be washed between animal contacts and after contact with blood, body fluids, secretions, excretions, and equipment or articles contaminated by them. Hand washing with plain soap and running water mechanically removes soil and reduces the number of transient organisms on the skin, whereas

antimicrobial soap kills or inhibits growth of both transient and resident flora (Ayliffe, 1978; Steere, 1975). All soaps also have the effect of dissolving the lipid envelope of enveloped viruses, and have cell wall effects that are bactericidal. Staff with animal contact should keep fingernails short (Lin, 2003). Correct hand washing technique include (NASPHV, 2006): Wet hands with running water, place soap in palms, rub together to make lather, scrub hands vigorously for 20 seconds, rinse soap off hands and dry hands with a disposable towel.

Gloves wearing

Gloves reduce the risk of pathogen transmission by providing barrier protection. They should be worn when touching blood, body fluids, secretions, excretions, mucous membranes, and non-intact skin. However, wearing gloves (including sleeves) does not replace hand washing (Goldmann, 1991; Olsan, 1993).

Gloves should be changed between examinations of individual animals or animal groups (e.g., litter of puppies/kittens, group of cattle) and between dirty and clean procedures on a single patient. Changing gloves between patients reduces the likelihood of spreading microorganisms from an animal to another animal or person. Gloves should be worn when cleaning cages and environmental surfaces. They should be removed promptly after use, avoiding contact between skin and the outer glove surface. Disposable gloves should not be washed and reused (NASPHV, 2008). Hands should be washed immediately after glove removal. Gloves come in a variety of materials. Choice of gloves depends on their intended use. If latex allergies are a concern, acceptable alternatives include nitrile or vinyl gloves.

Facial Protection

Facial protection prevents exposure of mucous membranes of the eyes, nose and mouth to infectious materials. Facial protection should be used whenever exposures to splashes or sprays are likely to occur (Garner, 1996; Weese, 2004). Facial protection should include a mask worn with either goggles or a face shield. A surgical mask provides adequate protection during most veterinary procedures that generate potentially infectious aerosols. These include dentistry, nebulization, suctioning, bronchoscopy, lavage, flushing wounds and cleaning with high pressure sprayers.

Respiratory Protection

Respiratory protection is designed to protect the respiratory tract from zoonotic infectious diseases transmitted through the air. The need for this type of protection is limited in veterinary medicine. However, it may be necessary in certain situations, such as when investigating abortion storms in small ruminants (Q fever), significant poultry mortality (avian influenza), ill psittacines (avian chlamydiosis) or other circumstances where there is concern about aerosol transmission. The N-95 rated disposable particulate respirator is a mask that is inexpensive, readily available, and easy to use. Fit-testing of the N-95 respirator is recommended but not required by the OSHA Respiratory Protection Standard. Respiratory evaluation and training should be provided for all personnel who use respirators (USDLSHA, 1910).

2.8.2 Protective Outerwear.

a. Lab Coats and Coveralls: This apparel is designed to protect street clothes or scrubs from contamination but is generally not fluid resistant, so they should not be used in situations

where splashing or soaking with potentially infectious liquids is anticipated. For most personnel, this outerwear should be changed daily. Garments should be changed promptly whenever visibly soiled or contaminated with body fluids or feces. These garments should not be worn outside of the work environment (Garner, 1996).

b. Non-Sterile Gowns: Gowns provide more coverage for barrier protection than lab coats. Permeable gowns can be used for general care of patients in isolation. Impermeable gowns should be used to provide greater protection when splashes or large quantities of body fluids are present or anticipated. Disposable gowns should not be reused. Reusable fabric gowns should be laundered between each use. Gloves are indicated whenever gowns are worn. Gowns and gloves should be removed and placed in the trash or laundry bin before leaving the animal's environment. Hands should be washed immediately afterwards (Weese, 2004). Employees should be trained to properly remove gowns to avoid contaminating themselves or their environments. The outer (contaminated) surface of a gown should only be touched with gloves.

c. Footwear

Footwear should be suitable for the specific working conditions (e.g., rubber boots for farm work) and should protect veterinary personnel from exposure to infectious material as well as trauma. Recommendations include shoes or boots with thick soles and closed toe construction, which are impermeable to liquid, and easily cleaned. Disposable shoe covers or booties add an extra level of protection when heavy quantities of infectious materials are present or expected.

d. Head covers

Disposable head covers provide a barrier when gross contamination of the hair and scalp is expected. Disposable head covers should not be reused

2.8.3 Protective Actions during Veterinary Procedures

Intake of Animal patients

Waiting rooms should be a safe environment for clients, animals and employees. Aggressive or potentially infectious animals should be placed directly into an exam room. Animals with respiratory or gastrointestinal signs, or a history of exposure to a known infectious disease should be asked to enter through an alternative entrance to avoid traversing the reception area (CDC guidelines, 2005). If they must come through the reception area, they should be carried or placed on a gurney and taken directly into an exam room.

Examination of Animals

All veterinary personnel must wash their hands between examinations of individual animals or animal groups (e.g., litter of puppies/kittens, herd of cattle). Hand hygiene is the most important measure to prevent transmission of zoonotic diseases while examining animals. Every exam should have a sink with running water, a liquid soap dispenser, and paper towels. Alcohol-based hand gels may also be provided for use in conjunction with handwashing. Veterinary personnel should wear protective outerwear and use gloves and other protective equipment appropriate for the situation. Potentially infectious animals should be examined in a dedicated exam room and should remain there until initial diagnostic procedures and treatments have been performed.

a. Needlestick Injury Prevention

Needlestick injuries are among the most prevalent accidents in the veterinary workplace (Poole et al, 1998). The most common needlestick injury is inadvertent injection of a vaccine (Langley et al 1995). In a 1995 survey of 701 North Carolina veterinarians, 27% of respondents had accidentally self-inoculated rabies vaccine and 7% (23% of large animal veterinarians) live Brucella vaccine (Langley et al, 1995). Needle punctures sustained during procedures such as fine needle aspiration are potential sources of zoonotic pathogens (Ramsey, 1994). The most important precaution is to avoid recapping needles.

b. Barrier Protection

Gloves should be worn during venipuncture on animals suspected of having an infectious disease and when performing soft tissue aspirations. Currently, there is no data indicating that venipuncture on healthy animals carries a significant risk of infection.

Diagnostic Specimen Handling

Feces, urine, aspirates, and swabs should be presumed to be infectious. Protective outerwear and disposable gloves should be worn when handling these specimens. Discard gloves and wash hands before touching clean items (e.g., microscopes, telephones, food). Although in veterinary practices animal blood specimens have not been a significant source of occupational infection, percutaneous and mucosal exposure to blood and blood products should be avoided.

Eating and drinking must not be allowed in the laboratory. More injuries than it prevents (USDLSHA, 2005). When it is absolutely necessary to recap needles as part of a medical procedure or protocol, or if a puncture-proof, leak-resistant sharps container is not

available, a mechanical device such as forceps can be used to replace the cap on the needle or the one-handed "scoop" technique may be employed (CCARE, 2006). This technique involves holding the syringe with the attached needle or the needle hub alone (when unattached) and scooping or sliding the cap, which is lying on a horizontal surface, onto the needle's sharp end.

Once the point of the needle is covered, the cap is tightened by pushing it against an object, or by pulling the base of the needle cap onto the hub of the needle with the same hand holding the syringe. When injecting live vaccines or aspirating body fluids or tissue, the used syringe with the needle attached should be placed in a sharps container. Following most other veterinary procedures, the needle and syringe may be separated for disposal of the needle in the sharps container. This can be most safely accomplished by using the needle removal device on the sharps container, which allows the needle to drop directly into the container. Needles should never be removed from the syringe by hand. In addition, needle caps should not be removed by mouth. Sharps containers are safe and economical, and should be located in every area where animal care occurs (NASPHV, 2008; Grizzle et al. 2001). Sharps should not be transferred from one container to another. Devices that cut needles prior to disposal should not be used because they increase the potential for aerosolization of the contents (Seibert, 1994).

Obstetrics

Common zoonotic agents, including Brucella, Coxiella burnetii, and Listeria monocytogenes, may be found in high concentrations in the birthing fluids of aborting or parturient animals, stillborn fetuses, and neonates (Heymann, 2004). Gloves, sleeves, mask

or respirator, face shield or goggles, and impermeable protective outerwear should be employed as needed to prevent exposures to potentially infectious materials. During resuscitation, blowing into the nose or mouth of a non-respiring neonate should be discouraged.

Necropsy

Necropsy is a high risk procedure due to contact with infectious body fluids, aerosols, and contaminated sharps. Non-essential persons should not be present. Veterinary personnel involved in or present at necropsies should wear gloves, masks, face shields or goggles and impermeable protective outerwear as needed. In addition, cut-proof gloves should be used to prevent sharps injuries. Respiratory protection (including environmental controls and respirators) should be employed when band saws or other power equipment are used. Decisions regarding whether to perform necropsy on animals suspected of having a notifiable infectious disease or foreign animal disease should be made in consultation with the state veterinarian (NASPHV, 2008)

Bite and Other Animal-Related Injury Prevention

During their careers, the majority (61%-68%) of veterinarians suffer an animal-related injury resulting in hospitalization and/or significant lost work time (Neinhaus et al, 2005). These are mainly dog and cat bites, kicks, cat scratches and crush injuries, and account for most occupational injuries among veterinarians (Neinhaus et al, 2005). In a recent study seeking to identify factors associated with increased risk of being bitten by a dog or cat in a veterinary teaching hospital, pets identified with a warning sign or considered more difficult to handle were four to five times more likely than other animals to have bitten a staff member while hospitalized. Yet only 47% of dogs and cats considered likely to bite were muzzled

compared to 12% to 14% of animals considered were unlikely to bite (Drobatz et al, 2003). Veterinary personnel reliably interpret the behaviors associated with an animal's propensity to bite; their professional judgment should be relied upon to guide bite prevention practices. Approximately 3% to 18% of dog bites and 28% to 80% of cat bites become infected (Drobatz et al, 2005).

Most clinically infected dog and cat bite wounds are mixed infections of aerobic and anaerobic bacteria. The most commonly isolated aerobes are Pasteurella multocida (cats), Pasteurella canis (dogs), streptococci, staphylococci, Moraxella, and Neisseria weaverii; the most commonly isolated anaerobes include Fusobacterium, Bacteroides, Porphyromonas, and Prevotella (Drobatz et al, 2005). In addition, rare but serious systemic infections with invasive pathogens including Capnocytophaga canimorsus, Bergeyella zoohelicum, Bartonella henselae, and CDC nonoxidizer group may occur following bites or scratches (Drobatz et al, 2005; Lemoal et al, 2003).

Veterinary personnel should take all necessary precautions to prevent animal-related injuries in the clinic and in the field. These may include physical restraints, bite-resistant gloves, muzzles, sedation, or anesthesia, and relying on experienced veterinary personnel rather than owners to restrain animals. Practitioners should remain alert for changes in their patients' behavior. Veterinary personnel attending large animals should have an escape route in mind at all times (Neihaus et al, 2005). When bites and scratches occur, immediate and thorough washing of the wound with soap and water is critical. Prompt medical attention should be sought for puncture wounds and other serious injuries. The need for tetanus immunization, antibiotics or rabies post-exposure prophylaxis should be evaluated. Animal

bites may need to be reported to local or state public health agencies. Emergency contact information should be posted in the clinic.

Dental Procedures

Dental procedures create infectious aerosols and there is risk of exposure to splashes or sprays of saliva, blood, and infectious particles. There is also the potential for cuts and abrasions from dental equipment or teeth (Holmstrom et al, 2005). The veterinary staff performing the dental procedure and anyone in the immediate vicinity (e.g. the veterinary anesthesiologist) should wear protective outerwear, gloves, mask, and a face shield or goggles. In one study, irrigating the oral cavity with a 0.12% chlorohexadine solution significantly decreased bacterial aerosolization (NASPHV, 2008).

Resuscitations

Resuscitations are particularly hazardous because they may occur without warning and unrecognized/undiagnosed zoonotic infectious agents may be involved. For example, a dog that presents in respiratory failure after being hit by a car may have been in the road due to clinical rabies. Barrier precautions such as gloves, mask, and face shield or goggles should be worn at all times. Never blow into the nose/mouth of an animal or into an endotracheal tube to resuscitate an animal; instead, intubate the animal and use an ambubag or an anesthesia machine/respirator.

2.8.4 Environmental Infection Control

Isolation of Infectious Animals

Patients with a contagious or zoonotic disease should be clearly identified so their infection status is obvious to everyone, including visitors allowed access to clinical areas. Prominent signage should indicate that the animal may be infectious and should outline any additional precautions that should be taken (Weese, 2004; Contagious Dis. Std, 2005).

Ideally, veterinary practices should utilize a single-purpose isolation room for caring for and housing contagious patients (Contagious Dis. Std, 2005). Alternatively, a dedicated exam room that can be easily emptied of non-essential equipment, cleaned and disinfected can be transformed into an isolation room. A mobile cage unit may be brought in for exclusive use by the infectious animal. If an isolation room has negative pressure air handling, air pressures should be monitored daily while in use and the air should be exhausted outside of the building, away from animal and public access areas, employee break areas, and air intake vents (CDC, 2005).

Only the equipment and materials needed for the care and treatment of the patient should be kept in the isolation room. Items intended for use in the isolation room should remain in this area and duplicate new items purchased for use elsewhere in the hospital. When necessary, items removed from the isolation area should be taken apart, cleaned, and disinfected prior to removal. Use of disposable articles can minimize the need to bring soiled items out of the isolation room. Access to the isolation room should be limited and a sign-in sheet should be kept of all people having contact with a patient in isolation (CDS, 2005).

Depending on the diagnosis and the mode of transmission of the disease, clean (nonsterile) gowns, shoe covers, gloves, masks and eye protection should be worn when handling an animal with a zoonotic disease. The gloves should be discarded, but typically the

rest of the personal protective equipment (e.g., gown, mask) may be re-used and should remain in the isolation room with the patient. However, if the gown, mask, or other protective equipment is contaminated with body fluids, it should be replaced. Protective equipment should be cleaned and disinfected between patients. Potentially contaminated materials should be bagged before transport within the practice and disinfected or disposed of appropriately according to their level of hazard. In many cases, all the materials used in the isolation room would be treated as bio-waste (Weese, 2004).

Cleaning and Disinfection of Equipment and Environmental Surfaces

Proper cleaning of environmental surfaces, including work areas and equipment, prevents transmission of zoonotic pathogens. Environmental surfaces and equipment should be cleaned between uses or whenever visibly soiled. A recent report indicated that directed misting application of a peroxygen disinfectant for environmental decontamination is effective in veterinary settings (Patterson et al, 2005). Surfaces where animals are housed, examined, or treated should be made of non-porous, easily cleanable materials. Surfaces should be cleaned to remove gross contamination before disinfection because organic material decreases the effectiveness of most disinfectants (Dwyer, 2004). When cleaning, avoid generating dust that may contain pathogens by using central vacuum units, wet mopping, dust mopping, or electrostatic sweeping (e.g. Swiffer). Surfaces may be lightly sprayed with water prior to mopping or sweeping. Areas to be cleaned should be appropriately ventilated. Clean items should be kept separate from dirty items. Gloves should be worn when cleaning equipment, animal cages, and surfaces.

Clean and disinfect equipment according to its intended use, the manufacturer's

recommendations, and practice policy. Equipment must be cleaned before sterilization or chemical disinfection. Exposure to aerosols generated by brushes during cleaning can be minimized by implementing preventive work practices, such as wearing facial protection and containing splatter. Normal dishwashing of food and water bowls is adequate for hospitalized patients with infectious diseases (Garner, 2003), although disposable dishes might be considered for animals hospitalized in isolation. Toys, litter boxes, and other miscellaneous items should be discarded or cleaned and disinfected between patients. If these items are visibly soiled, gloves should be worn. Litter boxes should be cleaned or disposed of at least daily by a non-pregnant staff member. Hands should be washed after finishing a cleaning activity.

CHAPTER THREE

METHODOLOGY

3.1 STUDY AREA

The study location was Nigeria. Nigeria, a country with a land mass of 923, 768 Sq Km is located in the gulf of guinea of West- Africa sub region of the continent of Africa, lying between latitude 4°16' and 13°53' north and longitude 2°40' and 14°41' east. It is bordered by Niger in the North, Chad in the Northeast, Cameroun in the East and Benin in the West. Nigeria has a tropical climate with distinct wet and dry seasons associated with the movement of the wind: the rain bearing south westerly winds and the cold, dry and dusty north easterly winds commonly referred to as Harmattan. It is presently made up of 36 states and a Federal Capital Territory (FCT) grouped into six major geopolitical zones: North Central. North East, North West, South East, South- South and South west.

Nigeria's population is unevenly distributed across the country. Large areas in the chad Basin, the middle Niger Valley, the grassland plains, among others, are sparsely populated. The average population density for the country in 2006 was estimated at 150 people per square kilometer. The most densely states are Lagos, Anambra, Imo, Abia and Akwa Ibom. Most of the densely populated states are found in the in the South East. Kano state, with an average density of 442 persons per square kilometer, is the most densely populated state in the north.

3.2 STUDY DESIGN

This is a unanimous descriptive cross-sectional study conducted to assess compliance with standard infection control practices among veterinary professionals in Nigeria.

3.3 STUDY POPULATION

The study population consisted of members of the Nigerian Veterinary Medical Association (NVMA) in attendance at the annual conference. The NVMA is the professional association of veterinarians in Nigeria.

3.4 SAMPLE SIZE DETERMINATION

The sample size was calculated using Leslie Kisch's formular for estimating single proportion

$n=Z^2Pq/d^2$

n= minimum sample size

Z=1.96

P=the proportion of personnel practice appropriate infection control practices were estimated at 25% (0.25) (JAVMA, 2005)

q=1-p

d=5% level of significant

$n=(1.96)^2(0.75)(0.25)/0.05^2$

n=288 respondents

Adjustment for non response (set at 10%) was done by using the formula employed in calculating non response i.e.

Expected sample size = sample size/1-proportion of non response=288/1-0.1

n=320

3.5 SAMPLING TECHNIQUE

Purposive sampling was used for the administration on questionnaire to the attending veterinarians at the conference. This technique was employed on the basis that ninety to ninety-five percent of attendees were registered veterinary professionals of the national association that had their practices across different zones of Nigeria. This evidence was trustworthy enough to detect the objectives the study was aiming at. Hence study instrument was applied on them until the required number in the sample size was achieved.

3.5.1 Inclusion criteria:

Membership of Nigeria Veterinary Association of Nigeria in attendance at the annual conference

3.5.2 Exclusion Criteria:

Non members of NVMA veterinarians and non veterinarians at the conference

3.6 DATA COLLECTION

Information was obtained from veterinarian using a structured self administered questionnaire. The structured questionnaire consisted of three sections broken down into fourteen questions. It was designed to capture veterinarians' sociodemographic factors, general use of infection control practices, compliance with appropriate infection control practices during normal and highly specific medical procedures.

Pretest of the questionnaire was done for a combination of twenty veterinarians of the

Oyo state veterinary clinics, Mokola, and Institute of Agriculture Research and Technology, Apata, Ibadan. The administration of the structured questionnaire to the study population was at the meeting of members of Nigerian Veterinary Medical Association which took place at Kwara Hotel, Ilorin, Kwara State on 21-24 November 2011. The researcher collected the data by himself.

3.6.1 STUDY VARIABLES

Independent variables:

a) **Sociodemographic factors**: These include age, gender, years of veterinary practice, weekly working hours. Other sociodemographic factors such as category of employment was suggestive of clinical practice comprising: self employed practice owner, partner in practice and government owned clinical practice.

b) **Practice characteristics**: These includes amongst some, veterinarians location of practice (categorized into teaching hospital, referral hospital, private hospital and government veterinary teaching hospital) and provision of written infection control policy for personnel in their practices

Dependent variables: the outcome variables were categories of summed up scores of veterinarians compliances with infection control practices designated as good (≥70) or poor (≤70) compliance.

3.7 DATA MANAGEMENT AND STATISTICAL ANALYSIS

Data obtain was entered, edited, and analyzed with SPSS statistical software (version 15). Independent variables were sociodemographic factors (such as age, gender, years of

veterinary practice, category of employment), practice characteristics (such as location of practice nature of practice and provision of written infection control policy for personnel in their practices), Descriptive statistics was used to compute frequencies, proportions. Tables were used to present proportion of veterinarians in each of the sociodemographic factors and practice characteristics, general use of infection control practices (hygienic practice and PPE protective of zoonotic infection), veterinarians' compliance with appropriate ICPs during specific high risk medical procedures.

Test of association was carried out using chi-square which was used for cross tabulation to detect association between sociodemographic factors and infection control compliance of veterinarians. It was also used to test association between veterinarians practice characteristics and infection control compliance. This was set at $P>0.05$

Multiple logistics regression analysis at $p>0.05$ was computed for factors that tested significant at the chi-square analysis. Factors that were significant at logistic regression analysis were finally retained and discussed.

3.8 DEFINITION OF TERMS

Compliance with appropriate ICP: Table 3.1 beloelow illustrates the basis for categorizing veterinarians self reported responses on use of personal protective equipment. On the basis of veterinarians responses personal protective equipment used when handling animals with specific clinical signs or when performing certain activities was designated as appropriate or not appropriate on the basis of whether the choice of PPE they used reduced exposure to known zoonotic disease agents or, in the case of blood exposures, whether the level of PPE conformed to standard guidelines practiced in human medicine (USDL OSHA,

2007). Appropriate practices included the use of protective outer clothing and gloves when handling an animal that had dermatologic signs, respiratory tract signs, vomiting or diarrhea, neurologic signs, or hemorrhage. Protective outer clothing and gloves were also the minimum PPE considered appropriate during handling of feces or urine samples, collection of blood samples, and performance of an oral or rectal examination. In addition to protective outer clothing and gloves, the additional use of a surgical mask or eye protection was considered appropriate for handling products of conception or aiding in parturition, performing surgery, or performing a necropsy

Table 3.1: Illustrating the basis for categorizing veterinarians use of personal protective equipment.

Activity	No special precaution taken (level 1)	Protective clothing or gloves (level 2)	Protective clothing and gloves (level 3)	Protective clothing, gloves, surgical mask, goggles or face shield (level 4)	Protective clothing, gloves, surgical mask, goggle and face shield (level 5)	**Levels of PPE considered appropriate for activity's zoonotic transmission risk**
Handling an animal that appears healthy						1 through 5
Handling an animal with respiratory signs						3 through 5
Handling an animal with neurologic signs						3 through 5
Handling products of conception or assisting with parturition						4 and 5
Performing a necropsy or handling tissues						4 and 5

Comparison on the basis of infection control rankings: The main variables of interest needed to determine the associations being investigated were selective demographic factors, practice characteristics of veterinarians under study while the main outcome measure was the compliance of veterinarians to standard infection control practices. This was achieved by assigning to respondents a compliance score ranging from 1-4 on the basis of their responses to practices protective of zoonotic infection risk (higher score represent higher compliance of ICP). Within a practice type, respondents' scores were summed up and categorised as being within ≥70 (good) or <70 (poor) scores (good or poor compliance score ranking respectively). Significant characteristics associated with standard infection control compliance scores ranking at $p<0.05$ at cross tabulation were included in a multiple logistic regression analysis by fitting a series of hierarchical regression model. Characteristics in the final model was retained at $p<0.05$.

CHAPTER FOUR

RESULTS

4.1 Socio-demographic factors of veterinarians

From table 4.1 below, the total number of veterinarians was 288. Majority of these veterinarians (43.1%) were in the age group 40 years and above, 89.2 % were males. Few of these veterinarians (2.4%) had 31 years and above years of veterinarian practice. Government veterinarian teaching hospital reported the lowest respondent (30.6%) while the ownership of clinic and partner in practice reported the same proportion of respondents. The veterinarians who belong to the ≤ 60 weekly working hour categories reported a higher percentage (86.5%) of the respondents while 97.6% of the veterinarians are certified to practice.

Table 4.1: Frequency table describing the socio demographic factors of veterinarians

Characteristics	N= 288	(%)
Age range	22-28	
Mean age	38.97	
Age groups	(8.649)	
20-29		18.4
30-39	53	38.5
≥40	111	43.1
	124	
Gender		
Male	257	89.2
Female	31	10.8
Years of veterinary practice		
1-15	207	71.9
16-30	74	25.7
≥31	7	2.4
Category of employment		
Ownership of clinic	100	34.7
Partner in practice	100	34.7
Government veterinary teaching hospital staff	88	30.6
Total no of weekly working hours categories		
≤60	249	86.5
>60	39	13.5

4.2 Practice characteristics of veterinarians

The table 4.2 below shows that more (30.9%) of veterinarians were in private practice. Also most of the veterinarians (44.4%) were engaged in clinics and mobile practices. Veterinarians who had written infection control policy in their practices were (57.3%). The veterinarian whose practice was provided with particulate respirator were low (30.9%).

Table 4.2: Frequency table describing veterinarians practice characteristics.

Characteristics	N = 288 (%)	
Location Of Practice		
Teaching hospital	58	(20.1)
Referral hospital	55	(19.1)
Private practice	89	(30.9)
Government vet. hospital	67	(23.3)
Teaching hosp. and private practice	19	(6.6)
Nature Of Services		
Clinic services only	52	(18.1)
Clinic and mobile service	128	(44.4)
Ambulatory	64	(22.2)
Clinic services and ambulatory	44	(15.3)
Practice Has Written Infection Control Policy		
Yes	165	(57.3)
No	123	(42.7)
Practice Provided With Particulate Respirator		
Yes	89	(30.9)
No	199	(69.1)

4.3 General assessment of infection control practices compliance by veterinarians

General assessment of veterinarians infection control practices and sharps object management (management of waste item, devices that have corners, edges or projection capable of cutting or piercing the skin), found that a high proportion 66.3% of all veterinarians reported always washing their hand before eating or drinking, similarly, 61.1% of veterinarian also reported always washing their hands between patients contact. Many of the veterinarian 62.8% reported recapping of needles prior to disposal. When dealing with an animal suspected to have serious zoonotic disease 35% of veterinarians reported always using a barrier or isolation practice.

Table 4.3: Frequency of veterinarian's utilization of infection control practices

Infection control practices (Specific practice or Behaviour)	Frequency of use of infection control practices				Total
	Never	Sometimes	Mostly	Always	
Hand washing practices before eating or drinking	3 (1)	33 (11.5)	61 (21.5)	191 (66.3)	288 (100%)
Hand washing practice between patient contact	6 (2.00)	50 (17.4)	56 (19.4)	176 (61.1)	288 (100%)
Recapping of needles prior to disposal	18 (6.3)	36 (12.5)	53 (18.5)	181 (62.8)	288 (100%)
Disposal of needles in approved sharps container	22 (7.6)	77 (26.7)	49 (17.0)	140 (48.6)	288 (100%)

4.4 Utilization of personal protective equipment use during medical procedures

Veterinarians reported using a combination of personal protective equipment during medical examinations on animals. Personal protective equipment use during examination of animal with respiratory signs varies among veterinarians as 27.1% reported using protective clothing or gloves, 28.8% reported using protective clothing and gloves, 25.3% reported using protective clothing plus gloves plus surgical mask, goggles or face shield, 6.3% reported use of protective clothing, gloves, surgical mask, goggles and face shield. Also, while performing surgery on animals, 23.3% reported using protective clothing or gloves, 22.6% reported using protective clothing and gloves, 34.7% reported using protective clothing and gloves, surgical mask, goggles or face shield and 17.4% reported using a combination of protective clothing and gloves, surgical mask, goggles and faceshield

Table 4.4: Frequency table describing use of additional personal protective equipment during medical procedures by veterinarians

Practice procedure	Personal protective equipments					Total
PPE use when	No special precaution taken (%)	protective gloves or clothes (%)	protective gloves and clothes (%)	Protective clothing and glove plus surgical mask, goggles or face shield (%)	Protective clothing, glove plus surgical mask, goggle and face shield (%)	(%)
handling animal that appears healthy	80 (27.8)	113 (39.2)	74 (25.7)	20 (6.9)	1 (0.3)	288(100)
Handling animal having dermatologic signs	20 (6.9)	112 (38.9)	126 (3.8)	20 (6.9)	10 (3.5)	288 (100)
Handling animal having respiratory problems	36 (12.5)	78 (27.1)	83 (28.8)	73 (25.3)	18 (6.3)	288 (100)
Handling an animal having hemorrhage	8 (2.8)	113 (39.2)	127 (44.1)	27 (9.4)	13 (4.5)	288 (100)
Handling products of conception	6 (2.1)	97 (33.7)	130 (46.2)	39 (13.5)	14 (4.9)	288 (100)
Performing surgery	6 (2.1)	67 (23.3)	65 (22.6)	100 (34.7)	50(17.4)	288 (100)
Performing necropsy	10 (3.5)	64 (22.2)	98 (34.0)	73 (25.3)	42(14.6)	288 (100)

4.5 Veterinarians self reported compliance with appropriate infection control practices

Table 4.6 shows that majority of veterinarians reported compliance with appropriate personal protective equipment when examining healthy animal and other medical examinations and procedure. As veterinarians who handle animals that appear healthy, handling animal that has dermatologic signs, gastrointestinal signs, neurological signs, and respiratory problems, reported higher appropriate use of infection control practice (60.1, 60.4, 59.4, and 70.5% respectively). During the medical procedure of performing necropsy and handling products of conception or assisting in parturition more veterinarians reported compliance with inappropriate infection control practices (51.1% and 61.2% respectively)

Table 4.5 Veterinarians self reported compliance with appropriate infection control practices

Practice scenarios (animal handling and medical procedures)	N (%)
Handling an animal that appears healthy	
Appropriate	288 (100.0)
Handling animal that has dermatologic signs	
Appropriate	173 (60.1)
Handling animal that has respiratory problems signs	
Appropriate	203 (70.5)
Handling animal that has gastrointestinal signs	
Appropriate	174 (60.4)
Handling animal has neurologic signs	
Appropriate	171 (59.4)
Handling animal has hemorrhage	
Appropriate	191 (66.3)
Handling fecal samples	
Appropriate	181 (62.8)
Handling urine samples	
Appropriate	178 (61.8)
Handling products of conception or assisting in parturition	
Appropriate	110 (38.2)
When performing surgery	
Appropriate	171 (59.4)
When performing necropsy	
Appropriate	141 (48.9)

4.6 Socio-demographic factors of veterinarians by level of infection control practices

From table 4.7 below, 60 veterinarians were reported to have good compliance with standard infection control practice. Of this number were 95% were males and 53.3% were above the age of 40 years old. However, this was not statistically significant (P >0.05). Of this same number of veterinarians who were estimated to comply with standard infection control practices 56.7% belong to the group of veterinarians with ≤15 years of veterinary practice and 43.3% of them were employed in government veterinary practice. These two were statistically significant (P<0.5)

Table 4.6: Cross tabulation for association between socio demographic factors by compliance with standard infection control practices

Characteristics	Ranked scores of infection control practices			
	Good compliance score (≥70) N = 60	Poor compliance score (<70) N=228	N=288	P-value
Gender				
Male	57 (95.0)	200 (87.7)	257 (89.2)	0.105
Female	3 (5.0)	28 (12.3)	31 (10.8)	
Age				
20-29	9 (15.0)	44 (19.3)	53 (18.4)	0.195
30-39	19 (31.7)	92 (40.4)	111 (38.5)	
≥40	32 (53.3)	92 (40.4)	124 (43.1)	
Years of veterinary practice				
≤15				
>15	34 (56.7)	173 (75.9)	207 (71.9)	**0.003**
	26 (43.3)	55 (24.1)	81 (28.1)	
Weekly working hours				
<60 (hrs)	40 (66.7)	181 (79.4)	221 (76.7)	**0.038**
≥60 (hrs)	20 (33.3)	47 (20.6)	67 (23.3)	
Category of employment				
Owner	22 (36.7)	78 (34.2)	100 (34.7)	**0.012**
Partner	12 (20.0)	88 (38.6)	100 (34.7)	
Government veterinary employment	26 (43.3)	62 (27.2)	88 (30.6)	

4.7 Practice characteristics of veterinarians by level of compliance with standard infection control practices

Table 4.8 below showed that veterinarians working in practice that had written infection control policy has a greater compliance (78.3%) with infection control practices compared with 21.7% of veterinarians who work in practice without written infection control policy and had complied with infection control practices. This was significant at $p<0.1$ ($p=0.001$)

Table 4.7: cross tabulation for association between veterinarians practice characteristics by compliance with standard infection control practices

Characteristics	Ranked scores of infection control practices		Total	P-value
	≥70 Good compliance (%) N=60	<70 Poor compliance (%) N=228	288 (%)	
Nature of services				
Clinic	7 (11.6)	45 (19.7)	52 (18.1)	0.144
Clinic and mobile service	27 (45.0)	101 (44.3)	128 (44.4)	
Ambulatory	19 (31.7)	45 (19.7)	64 (22.2)	
Clinic and ambulatory	7 (11.7)	37 (16.2)	44 (15.3)	
Location of practice				
Teaching hospital	12 (20.0)	65 (28.5)	77 (26.7)	
Referral hospital	14 (23.3)	41 (18.0)	55 (19.1)	
Private hospital	15 (25.0)	74 (32.5)	89 (30.9)	
Government veterinary hospital	19 (31.7)	48 (21.1)	67 (23.3)	0.272
Availability of written infection control policy in practice				
Yes	47 (78.3)	118 (51.8)	165 (57.3)	
No	13 (21.7)	110 (48.2)	123 (42.7)	0.001

4.8 Logistic regression analysis of selected demographic factors and practices characteristics to levels of compliance with infection control practices

Table 4.7 below shows the result of logistic regression of significant demographic factors and practice characteristics using the chi-square test. Veterinarians who were owners of practice were about two times less likely than government employed veterinarians to comply with standard infection control practices. However, this was not statistically significant. (OR=0.673, 95%CI=0.348-1.299). Emerging from the same category, veterinarians employed as partners in practice were three times less likely than veterinarians employed by government to comply with standard infection control practices. This relationship is statistically significant. (OR=0.333, 95%CI= 0.152-0.693)

Veterinarians who have had more than 15 years of veterinary practice were two times less likely than those with ≤15 years of veterinary practice to comply with infection control practices. This association is statistically significant. (OR=0.416; 95%CI=0.230-0.753)

Veterinarians that worked for more than 60 hours per week were two times less likely than those that worked less than 60 hours weekly to comply with infection control practice. This relationship is statistically significant (OR=0.519, 95%CI=0.278-0.971)

Veterinarians who had written infection control policy in their practices were three times more likely to have complied with standard infection control practices than veterinarians whose practice had no written infection control policy. This relationship was statistically significant. (OR=3.713, 95%CI=1.870-7.37)

Table 4.8: Logistic regression analysis of selected demographic factors and practices characteristics to <70 poor score in infection control practices

Variables	Odd Ratio	95%CI	p-value
Category of veterinary employment			
Partner in practice	0.603	0.348 – 1.299	0.238
Owner	0.673	0.152- 0.693	**0.04**
Government veterinary employee(ref)	1.00	----------	
Years of veterinary practice			
>15 years of veterinary practice	0.416	0.230 – 0.753	**0.048**
≤15 years of veterinary practice (ref)	1.00	----------	
Weekly working hours			
≥60 weekly working hours	0.519	0.278 – 0.971	**0.040**
<60weekly working hours (ref)	1.00	----------	
Availability of written infection control policy in practice establishment			
Available	3.713	1.870 – 7.373	**0.000**
Not available (ref)	1.00	----------	

Chapter 5

DISCUSSION

This study was aimed at assessing the relationship sociodemographic factors and practice characteristics with compliance to appropriate infection control practices among veterinarians engaged in clinical practice in Nigeria.

5.1 Socio-demographic characteristics of study population.

From the assessments of demographic factors of veterinarians gender was unequally distributed among veterinarians as a higher proportion 89.2% of them were males. This predominance of males veterinarians over female may possible due to the fact that in developing countries certain occupations such farming, engineering and veterinary practice amongst many are still traditionally believed by women to be reserved for only males. From the category of employment of veterinarians majority of them were either owners of their practice or partner in practice. Their employment status may not necessarily be associated with economic situation of the country which has a very high rate of unemployment because they are already equipped and licensed to either be owners of their practice or be partner in practice

5.2 Practice characteristics

Many veterinarians reported that their practice establishment is lacking N-95 particulate respirator. This is equipment that could prevent nasal inhalation of infectious pathogen during medical procedure. This low use of N-95 particulate respirator among veterinarians could be as a

result of its non availability within the immediate reach of veterinarians and basic information on its protective ability have not been known by veterinarians.

5.3 Utilization of infection control practices by veterinarians

Results indicated that reported behaviors regarding hand hygiene, sharps management, and barrier or isolation practices as well as personal choices for personal protective equipment in common practice scenarios varied widely among practitioners. In this present study, general assessment revealed that a high proportion 66.3% of all veterinarians reported always washing their hand before eating or drinking and a high proportion 61.1% of veterinarian also reported always washing their hands between patients contact. This is at variance with study conducted among veterinarians in US in whom low proportions of veterinarians engage in the practices of washing of hands before eating, drinking, smoking and between patients contact. Hygienic practices of proper hand washing before eating, drinking and between patients contact are of both animal and public health relevance because they are infection control practices that could reasonably reduce transmission of zoonotic infections. Infectious pathogens are known to have varying degrees of survival in medium such as crevices of fingernails, palms of hand and other exposed body parts, therefore zoonotic diseases transmission may be controlled at this end.

The study also indicated that veterinarians engaged in activities that increased the risk of percutaneous injury, such as recapping of needles prior to disposal. Majority of them were reported to be doing so. This was consistent with study conducted among US veterinarians that revealed high frequency of recapping of needles by the veterinarians. In veterinary medicine, commonly reported practices, such as recapping of needles or washing and reuse of needles and syringes, present an unacceptable and preventable risk for parenteral exposures of health personnel to pathogens in blood

samples. The concern for these personnel is that they stand a high risk of contracting blood borne zoonotic infections which may likely differ from that for which the animal is receiving treatment from.

Greater proportion of veterinarian reported using of additional PPE when handling animals with some specific clinical signs. However, a relatively high proportion of veterinarians did not use needed personal protective equipment such as protective gloves and clothing, surgical mask, goggles and face shield during highly specific medical procedures such as assisting in parturition, surgery and performing of necropsy. This finding was consistent with the study among veterinarians in U.S.A which revealed low proportion of use of required PPE by veterinarians across identified animal practice of small animal, large animal and equine animal practice. Failure of health personnel to use appropriate adequate personal protective materials during high risk medical procedure has serious public health implications because highly pathogenic infectious agents can be transmitted to unprotected health personnel. Hence, they may become human reservoir of zoonotic infections to the entire public.

5.4 Compliance with infection control practices

Many veterinarians reported that they complied with appropriate use of PPE during examination of ill animals even with physical signs, than when compared with use of PPE during examination of healthy animals; however, the type of PPE used was not always appropriate to protect against transmission of likely pathogens. In the present study, appropriate PPE use (including wearing of protective clothing and gloves) during examination of ill animals or handling of high-risk products was reported by over an average number of veterinarians. This proportion of compliance was more

than those of small and equine veterinarians in the US study (Baker et al, 2005) which used appropriate PPE when handling high risk products. Additional use of personal protective equipment during examination of animals are acceptable infection control practices considered to be protective of the health of veterinary personnel and that of the public. Compliance was necessary because no animal patients should be considered healthy and thus appropriate protective materials must be complied with to minimize potential infection transmission during the medical examinations.

Most veterinarians did not use appropriate PPE veterinarians did not use appropriate PPE when assisting with parturition and handling products of conception despite the fact that small droplets or aerosols of body fluids (with an associated high risk for *C burnetii* and *Brucella* spp transmission) can be released during both procedures (Komiya et al 2003, Pappas et al, 2005). This finding was consistent with the study conducted among US veterinarians as greater than 95% of veterinarians in each group reported low compliance to infection control practices during the practice procedure. When veterinary personnel fail to comply with the specific infection control practices during medical procedures regarded as potential route of transmission of zoonotic infections they will ultimately become a vehicle of zoonotic disease development and transmission in human population.

5.5 Predictors of veterinarians compliance with standard infection control practices

Employment, years of veterinary practice and weekly working hours go a long way to influence the level of compliance among veterinarians. With respect to category of veterinary practice, veterinarians who were owners of their practice may likely not comply with infection control practices due to independent nature of their practices. They are at liberty of choosing whether to personally use and enforce infection control practices in their establishment or not. This calls on government health agencies to establish a department that will strictly monitor the enforcement of infection control practices across all levels of veterinary employment. This will ensure the eradication of possible transmission of zoonotic at this human juncture.

Veterinarians with long years of work exposure may likely not comply with standard infection control practice. This may be due to their belief that the skill and experience they acquired over time were sufficient in preventing them from contracting zoonosis. Therefore they may not consider the health implications of unprotected veterinary practice. Relevant health agencies should embark on screening of veterinary personnel for possibility of zoonotic infection among this group. This should be done regardless of their years of practice as this may serve as evidence to veterinarians that they must maintain absolute infection control practices.

Veterinarians having prolonged working hours may likely not be complying with standard infection control practices. This result could possibly be that veterinarians due to their financial obligations worked for extended hours to earn more and the attending consequences is that many essential infection control practices may be overlooked in order meet up with daily schedule of huge

clients demanding their services apart from their official veterinary appointment. However, evidence of this was not captured by this study.

Similar study conducted among veterinarian in the US did not reveal any of the sociodemographic variables that were significant in this study however, it reveal among other demographic factors that gender was associated with difference in veterinary approaches to infection control practices as respondents in small animal and large animal practices were significantly more likely to have poor/low PA ranking indicating less than ideal infection control practices (JAVMA, 2008). Attesting to this finding were results of other studies that indicated that in regular community and health care settings males maybe less likely than females to comply with hand washing recommendations. This could be to the fact that male gender has typical characteristics of overlooking simply hygiene principles like hand washing at periodic intervals after some activities were being done. The health concern is that the increase in level of morbidity might be seen in the males from infectious pathogens compared to the females

Among practice characteristics only availability of written infection control policy in veterinarians practice was significant. Veterinarians who have no written infection control policy may likely not comply with standard infection control practices. This is because there is nothing to educate and remind veterinarians as well as other personnel that essential infection control practices must be consciously implemented and subconsciously inculcated into every specific scenario of veterinary practice. This finding is consistent with study among US veterinarian in which veterinarians working in practices that did not have a written infection control policy were significantly more likely to have low PA (Precaution Awareness) rankings. This suggested that practice policies play an important role in influencing personal choices for ICPs among veterinarians as they will able to choose from available protective equipment that which match their perception of

contracting infections. Infection control policy is a guide that specifies independently the basic protective actions and equipment that ought to be used in containing infection transmission from an animal source. Its presence will heighten awareness of zoonosis among veterinary staff hence, the possibility of their complying with infection control practices.

From similar study conducted in US (Baker *et al.*, 2005) among veterinarians, practice characteristic such as teaching hospital or referral hospital from the category of veterinarians' base of practice was found to be significant to lower level of compliance with ICP. This was observed among equine veterinary practitioners. Teaching hospitals and referral clinics are often viewed as setting the standard of care and they would be expected to implement more rigorously (JAVMA, 2008)

5.7 LIMITATION OF THE STUDY

The targeted population required to investigate the study objectives were professionals hence their responses was expected to at least be consistent with what they practice in their various establishments. However, due to the fact that the data collection was at an annual meeting, the issue of equal representation of veterinarians from each state of the federation to ensure fair chance of participation from each state the nation comprise of could not be guaranteed. There also exist the possibilities veterinarians did not give responses that reflected the true state of their practice. These responses if they are not honest may lead to response bias. There is need for further studies that would investigate the evidence of zoonotic infections with respect to non compliance with standard infection control practices

5.8 Conclusion

Veterinary practices that include critical and rigorous implementation of zoonoses infection control programs and equipment was not done in Nigeria. Majority of veterinarians did not have N-95 particulate respirator equipment. A high proportion of veterinarians were estimated to be recapping needles prior to disposal an act considered as a potential route of infection transmission both in human and veterinary medical practice.

A large proportion of veterinarians had used personal protective equipment inappropriately.

Sociodemographic factors significantly related with compliance of veterinarians with standard infection control practices were veterinarians who were owners of their practices veterinary clinics, veterinarians who have had ≥15 years of veterinary practice and veterinarians who worked a total of ≥60 hour per week. Veterinary practice in an establishment without written infection control policy was the only factor among practice characteristics significantly related with compliance with standard infection control practices

5.9 Recommendations

Education of veterinarians on the need to build a culture of infection control practices into their practice system is highly advocated. This is considered critical in confronting the challenges of infection control compliance among veterinarians. It is believed that once standard infection practices becomes a benchmark and a routine in day to day operations conscious and subconscious implementation would be automatic and they can as well promote compliance among other veterinary personnel. This inextricably applies to all veterinarians irrespective of years of veterinary experience or number of weekly working hours. This study recommends that relevant government authorities should renew commitment to spiral health implication of emerging and reemerging zoonoses and ensure necessary logistics are in place to protect veterinary personnel as a means of preserving public health. this should as also well as to investigate barriers to monitoring of compliance to implementation of standard infection control practices.

The availability of a written policy may serve as a resource to help educate or remind veterinarians about appropriate protective practices. In addition, practice owners who support implementation of an infection control policy may be more likely to observe and remind veterinary personnel to adhere to recommended protective practices and to provide appropriate infection control supplies (e.g. gloves and gowns), thereby influencing personal choices made by their associates. In the authors' opinion, every practice (whether clinic-based or mobile) should have a written infection control policy accessible to the practice employees, and management should provide training and oversight on the implementation of the plan. This study suggest the adoption of a Compendium of Veterinary Standard Precautions developed by National Association of State Public Health Veterinarians of the US in 2006 that addresses prevention of zoonotic diseases in veterinary personnel and includes a model infection control plan for veterinary practices. This to a

large extent will guide the implementation of infection control practices in Nigerian veterinary practice.

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QUESTIONNAIRE TO ASSESS COMPLIANCE WITH INFECTION CONTROL PRACTICES AMONG VETERINARIANS IN NIGERIA

Dear Respondents,

This questionnaire was designed to assess the compliance with infection control practices among veterinarians in Nigeria. It contains three sections; A - Socio-demographic data, B-Practice characteristics, C-Infection control compliance (protective behavior and use of personal protective equipment)

Please answer all questions as honestly as you can, all your responses will be confidential and we will protect any information you give us to the best of our ability. To ensure confidentiality, your name will not be written on this questionnaire or on any of our records, you will only be identified with a number. The information gathered will help to identify the need for infection control policy and provision of information and training on standard infection control practices to veterinarians

However, this study is entirely voluntary, you have no risk or any form of disadvantage if you do not want to participate. Please in order to be sure that you actually accepted to take part in the study voluntarily, kindly sign your signature in the space provided.

Thank you for giving your audience.

_____ _____

Date Signature of respondents

SECTION A: DEMOGRAPHIC DATA

1. GENDER A) Male [ ] B) Female [ ]

2. What was your age at your last birthday? .....

3. For how many years have you been practicing? .....

4. Identify among the following which employment category you belong

A) Ownership of practice [ ] B) Partner in practice [ ] C) Government employed veterinary personnel [ ]

5. What is your total number of working hours per week? .....

6. Do you have board certification for practice A) Yes [ ] B) No [ ]

SECTION B: PRACTICE CHARACTERISTICS

7. From the following list to which category of animal practice or veterinary practice do you belong?

A) Large animal [ ] B) Small animal [ ] C) Equine animal [ ] D) control post [ ] E) Research [ ] F) Abattoir [ ] G) Control post [ ] H) others [ ] (please specify) .....

8. Where among the following is your veterinary practice located? A) Teaching hospital [ ] B) Referral Hospital [ ] C) Private hospital [ ] D) Government veterinary hospital [ ] E) Others (please specify)

9. What is your nature of services among these list A) clinic service only [ ] B) Clinic and mobile service [ ] C) Ambulatory [ ] D) Clinic and ambulatory services [ ] E) Others (please specify) .....

10. Doe your practice has written infection control practices? A) Yes [ ] B) No [ ]

11. Does your practice provide personnel with accessible particulate respirator? A) Yes B) No

SECTION C: INFECTION CONTROL COMPLIANCE (*protective behavior and use of personal protective equipment in specific practice scenarios*)

NB: In the under listed please tick the appropriate response that correspond to your practices

12. How often do you practice hand washing hygiene during the following situations?

Infection control practice or behavior	Never	Sometimes	Mostly	Always
Before eating or drinking				
Washing or sanitizing hands between patients contact				

13. How often do you comply with the following sharp management practices?

Infection control practice or behavior	Never	Someti mes	Mostly	Always
Recapping of needles prior to disposal				
Disposal of needles in approved sharps container				
Sterilization and reuse of disposable needles and syringes				

13. How often do you engage in isolation or barrier practices during the following situations?

Infection control practice or behavior	Never	Sometimes	Mostly	Always
Isolation or quarantine of the affected animal				
Restriction of the number of persons that have contact with affected animal				
Removal of outer wear before contact with other patients				
Sterilization of all equipment after use on affected animal				

14. For each of the following animal practice scenario a list of personal protective equipment are provided; please tick the PPE you do use during each practice scenario

Practice scenario	No special precaution taken	Protective clothing or gloves	Protective clothing and gloves	Protective clothing and gloves plus surgical mask, goggles or face-shield	Protective clothing and gloves plus surgical mask, goggles and face shield
Handling an animal that appeared healthy					
Handling an animal dermatologic signs					
Handling an animal with respiratory signs					
Handling an anima with gastrointestinal signs					
Handling an animal with gastrointestinal signs					
Handling an animal with hemorrhage					
Handling of fecal samples					
Handling of urine samples					

Collection of blood samples					

Practice scenario	No special precaution taken	Protective clothing or gloves	Protective clothing and gloves	Protective clothing and gloves plus surgical mask, goggles or face-shield	Protective clothing and gloves plus surgical mask, goggles and face shield
When performing oral examination					
When performing rectal examination					
Handling of products of conception or assisting with parturition					
When performing surgery					
When performing necropsy or handling tissue					