KNOWLEDGE AND PRACTICE OF LIVE BIRD SELLERS ON HEALTH RISKS AND PREVENTIVE MEASURES OF AVIAN INFLUENZA IN AN URBAN COMMUNITY IN LAGOS STATE, NIGERIA

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KEYWORDS

Avian influenza
Live bird sellers
Avian influenza health risks
Avian influenza preventive measures
Food safety measure
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Zoonotic disease
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ACRONYMS

AI	Avian influenza
AICP	Avian Influenza Control Project
FAO	Food and Agriculture Organization of the United Nations
FSA	Fowl Sellers Association
HPAI	Highly pathogenic avian influenza
LBS	Live Bird Sellers
NVRI	National Veterinary Research Institute
UNICEF	United Nations Children's Fund
WHO	World Health Organization

LIST OF DEFINITIONS

Zoonotic disease:	Diseases that could be transferred from animals to humans
Transboundary disease	Animal disease prevalent in more than one country which is difficult to control with known biosecurity measures and has serious health and economic consequences.
Food Safety:	Process of ensuring that the entire food chain (from producer to consumer) is safe
Risk Communication:	The process of explaining risk. It is one of the three major elements of risk analysis.

ABSTRACT

Background

Avian Influenza (AI) is a contagious viral zoonotic disease with great public health implications and negative socioeconomic impact (WHO, 2006a). The highly pathogenic avian influenza (HPAI) infection is transmitted from birds to man mostly through contact with contaminated poultry and objects (*INFOSAN*, 2005), hence people who come in contact with birds such as live bird sellers (LBS) are the more vulnerable population (WHO, 2006a). Inadequate knowledge of AI health risks and poor practice of AI preventive measures amongst LBS increases the risk of spread of the infection in both humans and animals.

Aim

The aim of this study was to describe and quantify the knowledge and practice of LBS with regards to avian influenza health risks and preventive activities in Agege, an urban area in Lagos State, Nigeria.

Methods

The study was a cross-sectional, descriptive study of the knowledge and practice of LBS in respect of AI health risks and preventive measures. Interviews using a semi-structured questionnaire (Appendix 1) were conducted between 25th August and 30th September 2009 for all eligible LBS in Agege. The questionnaire was used to collect demographic information, knowledge of AI health risks, AI preventive measures and practice of LBS. These practices were assessed in terms of conformity with the national and FAO guidelines. Data were analyzed using EPI Info (v3.3.2) software. Descriptive

statistics of sample characteristics were obtained using means and frequencies. Associations between variables were tested using Fishers exact and Chi-square tests.

Results

A total of 107 LBS were interviewed out of the study population of 116 (92% response rate). The study revealed a high knowledge of signs of AI infection in birds. Awareness of AI signs, symptoms and preventive measures was high but the use of prescribed AI preventive measures was rather low. Knowledge of AI human health risk was poor, only 8.4% described it adequately.

Conclusions and Recommendations

Knowledge of AI infection and preventive measures was high but the practice by the LBS was rather unsatisfactory. Their knowledge of human health risk was also poor. There is need for more enlightenment programmes and training for this group of stakeholders on AI preventive measures and human health risks to improve their knowledge and practice on AI infection specifically and zoonotic diseases in general.

It is also recommended that government should put in place a regulatory body to formulate national guidelines on practice of LBS and monitor their activities and that of others involved in the food chain of live birds to ensure adherence to stipulated guidelines. In addition community health education is required to familarize the customers of LBS and the general public on AI human health risks and preventive measures.

DECLARATION

I declare that ***knowledge and practice of live bird sellers on health risks and preventive measures of Avian Influenza in an urban community in Lagos State, Nigeria*** is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Full Name: Chinyere Charity Ilonze **Date: May, 2010**

Signed:

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

1.1: Background

The highly pathogenic avian influenza (HPAI) virus, H5NI strain is of public health importance and it poses a danger to the human population because it can be transmitted directly from poultry to humans. Avian influenza (AI) is an important transboundary disease (Tseggai, 2009) occurring in the different continents of the world. An avian influenza outbreak in poultry as a result of HPAI virus, H5N1 strain was first reported in Nigeria in 2006 (Adene & Oguntade, 2006). Within this period (2006), the disease had also been found in about 9 Asian countries (WHO, 2006a) and at least 8 countries in Africa with 16 human cases and 7 fatalities (*Bamako Declaration*, 2006). Currently, outbreaks of HPAI in poultry have been reported in 63 countries/territories, Bhutan being the last newly infected country in February 2010 (FAO, 2010). On the other hand, human cases and deaths have been recorded in 15 countries (WHO, 2010). This recent global outbreak has been the most severe ever recorded (FAO, 2007a).

Studies indicate that live poultry markets are sources of rapid dissemination of AI virus (Kung, Guan, Perkins, Sims, Ellis and Sims, 2003) as commercial movement of poultry and poultry products poses the potential for poultry to poultry transmission (FAO, 2007b; *Bamako Declaration*, 2006) as well as poultry to human transmission of HPAI (Shortridge, Gao, Ito, Kawaoka and Markwell, 2000). Furthermore, birds may be traded in the asymptomatic stages of AI incubation (Monne *et al.*, 2008) and transported to various locations thus resulting in further spread of the infection.

Live bird sellers (LBS) in Nigeria are mostly small scale traders who sell and process live poultry in the open market. Due to the nature of their trade as retailers, they have the opportunity to interact directly and pass on information to the consumers and small scale poultry farmers who re-stock their farms sometimes from the live bird markets (Adene and Oguntade 2006). In addition, LBS can serve as informants to official authorities in tracing sources of poultry diseases (Personal communication with Dr. S. Allison, Avian Influenza desk officer, Lagos State Ministry of Agriculture, 11 April 2009). They are influential in the communities and their knowledge and practice of AI health risks and preventive measures is of public health concern.

1.2: Problem Statement

There is a knowledge gap regarding the importance of live bird markets and by extension LBS in the spread of HPAI in Nigeria and thus it has been recommended that various pathways capable of serving as mechanisms of spread such as LBS practices be analyzed (Obi, Olubukola and Maina, 2007) LBS poor hygienic practices have made live bird markets poor in bio- security and a potential source for spread of poultry diseases to other locations (FAO, 2008). Experts are of the opinion that there is a high risk of AI pandemic following the previous outbreaks, hence recommended contingency planning for reduction of AI impacts (*AICP NIGERIA*, 2009*).* It is therefore imperative that the LBS's must have adequate knowledge of AI health risks and good practice in preventive measures against spread of AI.

1.3: Context and setting

This study was conducted in Agege, Lagos state. Lagos is a metropolitan city within latitude 6□ 27’ 11” N and longitude 3□□ 23’ 44” E and situated in South West Nigeria which lies on the Atlantic coast in the Gulf of Guinea. Adene and Oguntade (2006) had previously described Lagos state as the capital of poultry business in Nigeria. Agege was selected because it has the biggest live bird market activities and a large number of poultry farms. There are 5 major live bird markets in Agege (*AICP NIGERIA*, 2007). Agege stretches over approximately 18 square kilometers, and it has a population of about 1 million people. The health facilities consist of 1 hospital which is a secondary healthcare facility and 3 clinics owned by government and about 120 private hospitals (*Agege Local Government,* 2008). The inhabitants of Agege Local Government area are mostly low income earners who live in overcrowded housing without adequate sanitation facilities (*Agege Local Government,* 2008). A combination of the inadequate infrastructure, poor housing facilities, high population density and mass poverty in the Agege Local Government Area, predisposes the residents to a high burden of infectious diseases. Zoonotic diseases are likely to be of considerable importance in this area of study because the intensity of agricultural practices is high. The State Government Agricultural Department, animal hospital and the major abattoir within the state are located in Agege (*Lagos state*, 2008).

1.4: Purpose of study

The study is intended to provide an insight into the practices and the essential role of live bird sellers in AI preventive measures. It seeks to describe the knowledge of AI health

risks amongst LBS. The study would therefore contribute to knowledge and resources on general practice of LBS, their knowledge of AI health risks and preventive measures. The report of the study may be used for further strategic control of AI and enable the relevant authorities to review and make necessary adjustment in their programmes to properly integrate LBS in the intervention plans. In addition, the study could serve as an essential preliminary to future quantitative research (Pope & Mays, 1995) that would assist in the design of appropriate health risk communication and other intervention strategies to ensure improvement in practice of LBS in the management of poultry zoonotic diseases.

1.5: Aim of Study

To describe and quantify the knowledge and practice of live bird sellers on health risks and preventive measures of Avian Influenza.

1.6: Objectives

The objectives of the study were;

1. To assess the knowledge of LBS on AI health risks and preventive measures.
2. To describe the current practice of LBS in terms of AI preventive measures.
3. To assess the possible association between LBS's knowledge of AI health risks and preventive measures and their current practice.

CHAPTER 2: LITERATURE REVIEW

2.1: Live Bird Sellers (LBS) in Nigeria

Live bird sellers are mostly traders with little or no technical background in poultry science or veterinary medicine but engage in the trade of live birds as their source of livelihood. These individuals learn the trade by serving as apprentice in the business for a period of time. LBS sell predominantly chickens but also trade in other birds such as duck, guinea fowl, ostriches and pigeons. Their services may include slaughter and dressing of the birds. LBS operate in sections of various open markets in every state in Nigeria with less than 73% of the live bird markets owned and equipped with minimal infrastructure by the government (*AICP NIGERIA*, 2008). However, the LBS provide for themselves cages, baskets, tables, equipment for slaughter and other items they require for their trade. The number of LBS in any particular market varies from as few as 12 (Ayangburen market, Lagos) to as high as 900 (Central market, Sokoto) depending on the capacity of the market (*AICP NIGERIA*, 2008). LBS buy stock directly from farmers or wholesalers and sell to individual consumers without recourse to biosecurity and screening for poultry diseases. They (LBS) serve as links between farmers or poultry wholesalers and consumers: and are therefore strategic in the poultry food chain and potential spread of poultry diseases (Adene and Oguntade 2006).

There is no regulatory authority currently mandated to regulate the activities or issue licenses to LBS. They therefore do not have any form of government regulation or license but form an interest group known as Fowl Sellers Association that serves as social

control and also represent their interest at any official quarters *(*Adene and Oguntade 2006; *AICP NIGERIA*, 2008). The practice of the trade is self regulated by this Association and this is primarily for the preservation of business. There is however some freelance LBS who do not belong to any association. The non-licensing of LBS implies that there are no legal and standardized procedures in carrying out activities within their trade. Although, the Animal Diseases (Control) Decree of 1988 contains general guiding principles on animal trade (*FGN*, 1988), it does not address specific issues of LBS. Other laws and regulations relating to poultry practice which are also not strictly targeted at the poultry sub sector include; the Meat Hygiene legislation of 1969, National Biosafety Guidelines of 1994 and Meat Inspection and Hygiene Act of 2002 (Obi, *et al.*, 2007).

A large percentage (75%) of poultry raised in Nigeria are handled by LBS and sold through live bird markets (*AICP NIGERIA*, 2008). Although the large commercial farmers slaughter and sell off 90% of their birds as packaged chilled products without involving the LBS (Adene & Oguntade, 2006), their sales constitute only 13.83% of the total bird population sold while the traditionally managed birds handled by LBS constitute about 86.17% (Yakubu, Liman and Laseinde, 2006). The nature of trade of LBS involves close contact with these live birds and therefore predisposes them to avian zoonotic diseases. People who patronize LBS are also at risk of zoonotic diseases and human to human transmission is possible though in rare cases especially when the bio security measures of LBS are poor. Live birds also serve as carriers or source of transmission of zoonotic diseases like AI to humans (Obi, *et al.*, 2007).

2.2: Aetiology, Clinical signs and Burden of Avian Influenza

Avian Influenza (AI) is a contagious viral disease of animals caused by the avian influenza virus which occurs naturally amongst wild birds without any clinical signs. The virus is of the family *Orthomyxoviridae* and the different subtypes are distinguished by the haemagglutinin (H) and neuraminidase (N) antigens which cover the virus surface. Sixteen different H antigens (H1-H16) and nine N antigens (N1-N9) have been identified to date. The subtypes are identified based on their distinct antigen combination e.g H5N1 or H1N1, though a particular subtype may include similar but distinct strains (FAO, 2007c).

Avian Influenza exist in low pathogenic and high pathogenic form (Swayne and Suarez, 2000). The low pathogenic infections usually cause mild symptoms such as ruffled feathers, drop in egg production etc. and may go unnoticed (Adene and Oguntade 2006). The highly pathogenic form of Avian Influenza (HPAI) infection in birds is characterised by rapid spread among the flock and sudden death. Other clinical manifestations of HPAI (in poultry) include difficult breathing, staggering gait, bleeding from the nostrils, diarrhoea, severe depression and bluish discolouration of comb and wattle (FAO, 2007b). The highly pathogenic infection and the low pathogenic form are caused by the influenza A virus but it is only the subtypes H5 and H7 that has caused high pathogenicity to date and not even all the combinations with different N antigens within those two subtypes are HPAI (FAO, 2007c).

Avian influenza infection has been reported to affect humans via zoonotic transmission from poultry (WHO, 2006b; *INFOSAN*, 2005; FAO, 2007a) although the mechanism of transmission remains uncertain (Dudley, 2008).

The recent cases of avian influenza in human in many countries were caused by HPAI H5N1 strain (WHO, 2006a). It is also possible that outbreaks can occur due to low pathogenic avian influenza viruses also (WHO, 2009). The former strain is extremely virulent in humans because it replicates excessively in the lungs to cause sustained increased production of cytokines in the host (Van Reeth, 2007). Infection by HPAI in humans is usually via contact with infected animals, contaminated surfaces, objects and faeces. The virus cannot be transmitted to humans through properly cooked poultry or poultry products (*INFOSAN*, 2005). The clinical symptoms (in humans) are similar to that of human influenza i.e. cough, sore throat, fever and muscle aches. This may be accompanied by conjunctivitis, diarrhoea and neurological changes (WHO, 2009). The risk of death in humans has mainly been associated with progressive respiratory failure (Beigel *et al.*, 2005).

HPAI infection poses two major risks for human health; (i) risk of infection from poultry to humans, and (ii) risk of person to person infection with possible mutation of the virus, creating the danger of a global human pandemic (*INFOSAN*, 2005). However, Van Reeth (2007) reported that a human pandemic is only possible with extensive genetic changes in animal avian influenza viruses to cause human to human transmission but the H5N1 AI virus does not have the capacity to do so. Human infections resulting from both

low pathogenic and high pathogenic strains of the AI virus have been reported in Asia, Europe and North America. The public health risk of AI is therefore not restricted to the H5N1 strain but includes other virus subtypes such as H1N1, H7N2, H7N3, H7N7 and H9N2 (Dudley, 2008). Human AI cases however have resulted mainly from infection due to poultry to human transmission and a total of 499 cases has been reported globally since the outbreak in 2003 (WHO, 2010). Deaths that were reported occurred in 15 different countries in Asia and Africa including Nigeria. According to WHO (2010), a total of 295 deaths with the highest incidence (139) occurring in Indonesia was recorded (Table 1).

The animal health implications and economic burden of AI in Nigeria is enormous and has resulted in huge economic losses and unemployment (World Bank, 2007). HPAI infection in poultry caused by H5NI strain was diagnosed in Nigeria in February 2006 (Joannis *et al.*, 2006; *AICP NIGERIA*, 2008), and by mid 2007, 25 states out of the 36 states in Nigeria had recorded HPAI outbreaks (Obi, 2007). In Lagos State, by September 2007, Avian Influenza outbreaks had been reported in 34 farms with a total mortality of 414,910 birds (*AICP NIGERIA*, 2007), while a total of 1,250,452 birds have been culled and 755,929 reported dead by March 2008 (*AICP NIGERIA*, 2008). In Nigeria, only 1 fatal human case has been recorded since the outbreak (Obi, 2007; Adene and Oguntade 2006; Obi *et al.,* 2007), however the origin of the disease in Nigeria remains unknown (Tseggai, 2009). There are possibilities that the disease entered into Nigeria via illegal importations of live poultry and or through migratory wild birds (Obi, 2007).

Table 1: Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Reported to WHO (3 August 2010)

Country	2003		2004		2005		2006		2007		2008		2009		2010		Total	
	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	cases	deaths	Cases	deaths	cases	deaths	cases	deaths
Azerbaijan	0	0	0	0	0	0	8	5	0	0	0	0	0	0	0	0	8	5
Bangladesh	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Cambodia	0	0	0	0	4	4	2	2	1	1	1	0	1	0	1	1	10	8
China	1	1	0	0	8	5	13	8	5	3	4	4	7	4	1	1	39	26
Djibouti	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
Egypt	0	0	0	0	0	0	18	10	25	9	8	4	39	4	20	8	110	35
Indonesia	0	0	0	0	20	13	55	45	42	37	24	20	21	19	6	5	168	139
Iraq	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	3	2
Lao People's Democratic Republic	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	2	2
Myanmar	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Nigeria	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
Pakistan	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	0	3	1
Thailand	0	0	17	12	5	2	3	3	0	0	0	0	0	0	0	0	25	17
Turkey	0	0	0	0	0	0	12	4	0	0	0	0	0	0	0	0	12	4
Viet Nam	3	3	29	20	61	19	0	0	8	5	6	5	5	5	7	2	119	59
Total	4	4	46	32	98	43	115	79	88	59	44	33	73	32	35	17	503	299

Total number of cases includes number of deaths. All dates refer to onset of illness.WHO reports only laboratory-confirmed cases. . Indonesia numbers indicate cumulative total of sporadic cases and deaths which occurred during 2009 (WHO, 2010).

2.3: Avian Influenza health risks communication

With the current global epidemic of AI since 2003 and the confirmation of the existence of the disease in Nigeria in 2006, the agricultural sector has been receiving attention both from the National government and international organisations (Adene and Oguntade 2006; Obi, *et al.,* 2007). The effective control and prevention of AI demands various public health intervention including a strategic risk communication plan (Di Giuseppe, Abbate, Albano, Marinelli and Angelillo, 2008). Although the non-availability of accurate information and data hinders timely strategic planning and interventions in the agricultural sector (Adene and Oguntade 2006; Obi, *et al.,* 2007), various organisations

such as United Nations' Children's Fund (UNICEF), International Organisation for Migration (IOM), World Health Organization (WHO), National Veterinary Medical Association (NVMA) and others continually carry out AI health risk communication activities amongst poultry handlers. UNICEF is the lead International Agency in AI risk communication activities in Nigeria and works in close collaboration with the Ministry of Information in this regard (Obi, *et al.*, 2007). FAO has prescribed guidelines for poultry handlers on preventing AI health risks (Appendix 2).

AI health risk communication, like other risk communication involving government procedures is often hampered by bureaucratic bottle necks because different government bodies are usually involved. The involvement of different communication channels may sometimes create confusion with inaccurate or diluted information reaching the recipients (Byrd and Cothern, 2000). AI health risk is communicated to relevant stakeholders such as the LBS through effective public health education programmes using various methods. The use of mass media has been described to be very effective (Maton, Butraporn, Kaewkangwal and Fungladda, 2007; Schmidt, et al., 2009) but the perception of the risk and the attitude of the people towards the risk cannot be predicted (Byrd and Cothern, 2000).

In a recent Knowledge Attitude and Practice (KAP) cross sectional descriptive survey in Nigeria, 90% of the 200 poultry farmers sampled believed that HPAI was lethal only to birds, only 56% correctly described some of the AI risk factors while 61%, of the respondents knew some risk factors and 58% believed there could be human infection

associated with AI (Fasina, Bisschop, Ibironke and Meseko, 2009). The findings of this study may however not be generalised as only 8 out of the 25 HPAI affected states in Nigeria were sampled, and no other important group such as LBS was considered. The findings by Fasina, et al., (2009) were however consistent with another cross sectional descriptive study on assessment of Avian Influenza awareness among 102 randomly selected households in Nasarawa State, Nigeria, where the knowledge of AI health risks amongst respondents was as low as 44% (Yakubu and Musa, 2008). Though this study population was consumers and not poultry handlers, the result of these two studies emphasized the dangers and high risk of human infection in Nigeria because of poor knowledge of AI risks and reiterated the need for further studies and AI risk communication activities. These findings were also consistent with the report that African generally have unconcerned attitude towards animal diseases (Katung, 2001).

2.4: Avian Influenza Preventive and Food Safety Measures

The poultry food chain which extends from poultry farming, processing of poultry products to human consumption of the products in Nigeria is complex. This food chain often involves LBS whose practice are not regulated and therefore do not have any harmonized guidelines for AI preventive and food safety measures (Obi, *et al.*, 2007). A similar complexity in the poultry market chain has been reported in Cambodia (Van Kerkhove *et al.,* 2009) and several other countries are known not to have a unified system in poultry trading.

Food safety is a complex and difficult process with new challenges arising from time to time (Taylor, Margaret, Glavin, Moris and Woteki, 2003). FAO has however prescribed guidelines for AI preventive and food safety measures which have been adopted by Nigeria as national guideline. It has been reported that most developing countries still rely primarily on traditional agricultural methods for their food supply thus have been urged by WHO to adopt food safety as a priority in their public health programmes and strengthen their epidemiological surveillance (WHO, 2002).

There is dearth of studies on the general practices of LBS including their AI preventive measures practices (Di Giuseppe, *et al*., 2008), however some recent surveys on live bird markets in Nigeria seem to indicate that LBS have poor practice of AI preventive measures (*AICP NIGERIA*, 2008). Yee, Capenter, Mize and Cardona (2008) on the contrary described the live bird marketers in Southern California as having good practice and assert that as a result, there is absence of low pathogenic Avian Influenza virus in their live bird market system. The few available studies on AI preventive measures and food safety have focused mostly on formal poultry handlers rather than the informal LBS. In the earlier mentioned study conducted to assess AI risk perception amongst 200 poultry workers, 57% of the respondents were aware of the food safety implications of Avian Influenza (Fasina, *et al.,* 2009). This survey shows the same trend with a similar study conducted also amongst poultry workers in Italy where 58% of the respondents had food safety knowledge of AI (Abbate, Di Giuseppe, Marinelli and Angelillo, 2006). Another study in Thailand showed that 92% of the respondents who were consumers had a sound knowledge of AI food safety (Takeuchi, 2006). However,

various factors such as literacy levels (Yakubu & Musa, 2008), cultural beliefs, religious beliefs and socioeconomic conditions (Petterssons, *et al*., 2004) have been shown to influence people's practice regarding food safety and AI preventive measures. The public perception of food safety is known to differ from that of the experts. Most times, the non food safety experts tend to place more emphasis on factors that do not compromise the food safety standard while neglecting those that pose a substantial food safety threat (Luning *et al.*, 2007). This was observed in the study by Fasina, *et al.,* (2009) which reported that the farmers pay more attention to maximizing profits while compromising on food safety measures in the course of their trade.

2.5: Live Bird Sellers (LBS) Knowledge and Practice

Most research on the knowledge of Avian Influenza health risks in Nigeria and globally has focused on poultry farmers or consumers and have reported a remarkable improvement in their knowledge of AI (Joannis *et al.,* 2008). A cross sectional survey amongst 140 poultry workers in Lagelu Local Government Area, Oyo State, Nigeria revealed that 92% of the poultry workers interviewed had a broad knowledge of AI while their knowledge of preventive measures varied. However 61.4% described the infection correctly and 78.6% agreed that the infection can be fatal (Fatiregun and Saani, 2008). The study however was conducted amongst poultry workers who received more attention during the AI outbreak hence the findings may not be generalised for LBS. Moreover, the sample size was not large and data collection was done using structured questionnaire which is known to produce information bias.

Reports on LBS practices however suggest that they often do not adhere to biosecurity measures (Obi, *et al.,* 2007). They accept and mix birds from different sources, there are no species differentiations and often they do not practice an "all in and all out" method of stocking but mix the old and new stock. The LBS are also reported to handle birds without any protective clothing and a large percentage of them interchange their cages with one another (*AICP NIGERIA*, 2008) resulting in possibility of spread of diseases. Furthermore, LBS do not disinfect their tools and cages and also do not dispose their waste properly (*AICP NIGERIA*, 2008; Yohanna, Anjas, Indaryati, Norjannah and Ratna, 2007).

Recent survey reports seem to indicate a high risk of human exposure to HPAI in live bird markets because the virus circulates amongst the birds in the market without obvious symptoms and biosecurity measures are very poor (Obi, *et al.*, 2007). These reports indicate that AI risk communication towards LBS in Nigeria needs to be directed more at addressing biosecurity measures at live bird markets. In order to improve on the biosecurity of live bird markets, the Lagos state Avian Influenza Control Project (AICP) disinfected 31 major live bird markets by the end of the year 2007 (Allison, 2007). A field survey involving 174 live bird markets was carried out in the 36 states of the Federation sampling 174 live poultry markets (*AICP NIGERIA*, 2008), the findings of which has led to ongoing construction of model live bird markets (Personal communication with Dr. Allison, Avian Influenza desk officer, Lagos State Ministry of Agriculture, 2nd February 2009). The role of live bird markets in the spread of HPAI remains uncertain and an area for further research (Obi *et al.*, 2007). The survey reports

and the disinfection activities by AICP NIGERIA suggest that the LBS either have a poor knowledge of AI risks or show nonchalant attitude towards it, which is consistent with the findings of Fasina *et al.*, (2009).

In conclusion, there has been little or no emphasis in the literature on the knowledge and practices of LBS regarding AI health risks and preventive measures, probably because of their low profile in developed countries and the fact that in developing countries like Nigeria, commercial poultry farmers who are better structured are more recognized, hence the need for research into LBS knowledge and practices.

CHAPTER 3: METHODOLOGY

3.1: Study Design

This study was a cross-sectional, descriptive study of the knowledge and practice of LBS with respect to Avian Influenza health risks and preventive measures. A cross-sectional, descriptive study design was chosen because if correctly performed, it has been shown to be objective, credible and of scientific rigor to quantify and describe knowledge and practises (Blanche and Durrheim, 2006).

3.2: Study Population and Sample

The target population was live bird sellers in the 5 major live bird markets in Agege, an urban community in Lagos State, Nigeria. The study population was all live bird sellers registered under the Fowl Sellers Association (FSA). The list of persons (sampling frame) was made available by the Association secretariat. Each of the 5 markets had 15, 18, 20, 23 and 40 traders resulting in a sample frame of 116. All traders on the list were interviewed, i.e. this was a census survey of LBS registered with the FSA. All those not registered under the Association were excluded from the study since they operated as freelance traders and could change their location at any time.

3.3: Data Collection

Prior to data collection, approval was received from the chairpersons of the FSA in the 5 markets where the survey was to be conducted. The approval was given after discussions with them on the purpose of the study and they received assurances of the confidentiality of their information. The Participant Information Sheet (Appendix 3) and Informed Consent Form (Appendix 4) were also presented.

The data were collected during an interview with each LBS using a semi-structured questionnaire with closed and open ended questions. A copy of the questionnaire is attached as Appendix 1. Demographic data of the LBS, information on their knowledge of AI symptoms, human health risk, and their practices of AI preventive measures were collected using the questionnaire. Interviews were conducted in English language with minor explanations in "pidgin English" (local form of English commonly spoken in informal businesses in Lagos). Interviews were conducted with respondents after explaining the reason for the study and obtaining their consent via a signed consent form.

Five veterinary students were co-opted to assist in data collection. The questionnaire was pre-tested on 10 LBS in the Oshodi area of Lagos which has a similar setting to the study site, and relevant adjustments were made based on practical realities before finally administering the questionnaire to the study population.

3.4: Data Management and Analysis

Data collection was done every other day within the study period, which (25th August to 30th September 2009). The data collectors cross checked data collected for completeness and errors before leaving the site. The researcher also checked the questionnaires and gave immediate feedback to data collectors on any discrepancies observed in the filling of the questionnaires to avoid a repeat occurrence. Four (4) respondents were re - visited due to serious errors observed in their responses.

To minimize error, there was double entry of responses from each respondent done independently by 2 persons who went out together as a team. The two independent entries were finally matched. Data collected were entered into Excel and exported into Epi Info (3.3.2) software. Entered data were cleaned by the researcher and descriptive information for all variables was generated and further examined for errors. Frequencies, proportions, means and other parameters were computed in Excel and Epi Info using descriptive statistics. The demographic variables were cross-tabulated with other variables such as level of education and knowledge of signs and symptoms of AI in man using Fisher's exact or chi-square to tests the strength of association. The p-values of < 0.05 were considered statistically significant.

3.5: Validity and Reliability

Selection bias was ruled out by having an all inclusive sample. The data collectors were adequately trained and the data collection tool pre-tested by them thus ensuring that appropriate skills were acquired before undertaking the survey. Measurement bias was

minimized by using a questionnaire designed to be simple and short. Moreover the questionnaire was pre-tested in a similar study group and appropriately formatted to reduce errors of data collection and entry into the database. Bias resulting from self reporting was minimized by the interviewer administering the questionnaire although unreliable information cannot be ruled out since respondents may report what they ought to be practising instead of what they actually practise.

3.6: Generalisability

In terms of generalisability, this study may not be generalised to the whole of Nigeria since only one community was used in the study. The study results will however have relevance more broadly in similar settings where LBS operate. It is expected that the findings of this study would be relevant in generating hypotheses which could be tested.

3.7: Ethical Considerations

Ethical approval was obtained from the Research Ethics committee of the University of the Western Cape. Verbal consent and approval was received from the Executives of the Fowl Sellers Association (FSA) Agege area in order to gain access to the LBS. Participants were informed of the type and purpose of the study. They were also assured of the confidentiality of their responses and signed written consent forms were obtained from them. They were told of their rights to participate voluntarily and to withdraw at will with no harm to them. They were also informed that their responses could not be traced to individual participants. Participants were informed that information from the

study would be shared with the National Avian Influenza Control Project (AICP) in the Federal Livestock Department (FLD) of the Federal Ministry of Agriculture and Rural Development, Lagos State Ministry of Agriculture and Avian Influenza Desk in WHO Nigeria office to enable them take relevant actions related to LBS in the control and prevention of AI and other zoonotic diseases.

CHAPTER 4: RESULTS

The results of the knowledge and practice of live bird sellers on health risks and preventive measures of avian influenza in an urban area in Lagos, Nigeria are presented in this section.

4.1: Characteristics of participants

The total sample size used for the study was 107 which is a 92% response rate from the study population of 116. All the LBS in Agege were females (no males). The age range of the participants was between 33 years and 64 years with a mean (± SD) age of 47.2 (± 6.7) years. Over 50% of the respondents were above 40 years while 33 and 64 years were the youngest and oldest age recorded respectively (Table 2). Most (67.3%) participants were educated beyond primary school level but only four (3.7%) had tertiary education while 12 (11.2%) did not have any formal education (Table 2). There was a wide variation in the number of years of experience as live bird sellers with a mean (± SD) years of 19.1 (± 9.7) but none had less than 4 years of experience while the maximum years was 40 (Table 3).

Table 2: Age distribution of participating live bird sellers

Age (years)	Frequency	%	Mean (± SD) yrs	Median (years)	Min (years)	Max (years)
31-40	23	21.5	47.2 (± 6.7)	47	33	64
41-50	58	54.2				
51-60	19	17.8				
61 and above	7	6.5				
Total	107	100.0				

Table 3: Educational level of participating live bird sellers

Level of education	Frequency	%
No formal education	12	11.2
Primary school	23	21.5
Senior secondary school	68	63.6
Tertiary	4	3.7
Total	107	100.0

Table 4: Years of experience of participating live bird sellers

Experience as LBS (years)	Frequency	%	Mean (± SD) yrs	Median (years)	Min (years)	Max (years)
≤ 3	0	0	19.1 (± 9.7)	20	4	40
4 – 10	29	27.1				
11-20	31	28.9				
21-30	32	30.0				
31 above	15	14.0				
Total	107	100.0				

4.2: Decision and reasons to continue live bird trade

The study result indicated that all the LBS were willing to continue in their trade despite AI health risks and other zoonotic diseases associated with birds. Most of the respondents will continue the business due to high degree of profitability (Figure 1). Thirty percent (30%) of the respondents reported death of their birds as a result of AI infection. None of the respondents reported any depopulation of birds by relevant authorities due to AI infection. A few participants (2.8%) however reported that their reasons for continuing the trade was that AI and other poultry diseases do not cause harm in man though they could be transmitted. Some other reasons given by the participants include that the trade was a family enterprise so they had no choice (2%); others reported that they had stayed too long in the trade and would rather not search for a new one (3%), while some reported that they had invested heavily and therefore cannot quit (2%).

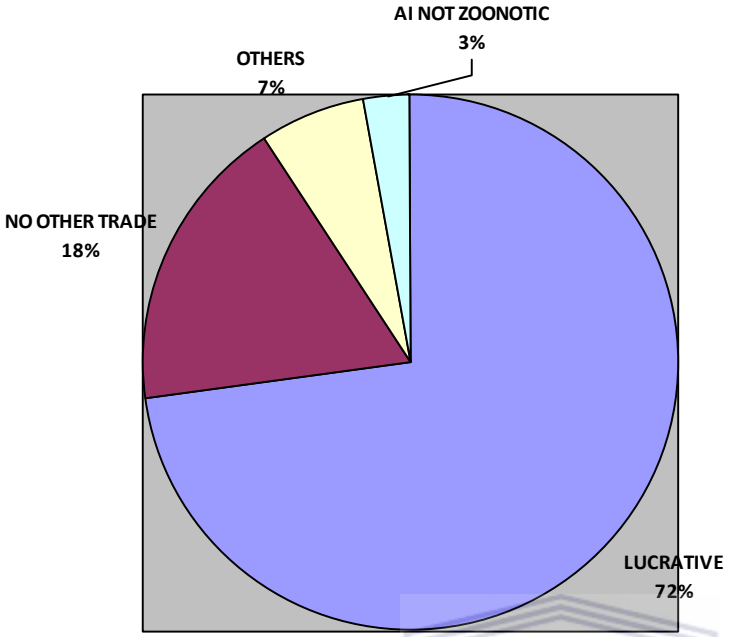


Figure 1: Reasons for continuing live bird trade despite AI health risks

4.3: Training/Seminars

This study indicated that 67% of the respondents had attended different trainings/seminars organized by various national and international organizations on AI within the past 3 years (Table 5). The most common topics covered by these trainings were:- What is Avian Influenza?, How to Protect Yourself and Others from Bird Flu, How to Identify bird Flu, What to do when you Suspect Avian Influenza, Avian Influenza:- Protect birds, Protect man!

TABLE 5: Participation in training on AI by live bird sellers

Training	Frequency	%
Yes	72	67
No	35	33
Total	107	100.0

4.4: Knowledge of signs and symptoms of avian influenza infection

The LBS knowledge of signs and symptoms of AI for both man and bird were quantified to describe their knowledge of AI health risks.

4.4.1: Knowledge of signs and symptoms of avian influenza infection in man

The overall knowledge of AI symptoms in man among the LBS in Agege was poor, as only 8.4% of the participants could describe the symptoms correctly (Table 7). The most frequently recognized signs and symptoms of AI in man were reported as cough and conjunctivitis (Table 6). Ten (10%) of the respondents associated the infection with diarrhoea and muscle ache. A third (35%) of the respondents indicated that they do not know any symptoms in man (Table 6), while 3.7% could mention only one symptom (Table 7). However, 28.9% and 16.8% of the respondents were able to mention 3 symptoms and 2 symptoms respectively (Table 7).

Table 6: Signs and symptoms of Avian Influenza infection in man as reported by live bird sellers in Agege (N=107)

Signs and symptoms of AI	Frequency (n)	Percentage (%)
Cough	67	63
Sore throat	43	40
Fever	34	32
Muscle ache	11	10
Conjunctivitis	63	59
Diarrhoea	11	10
Don't know	37	35

Table 7: Knowledge score of signs and symptoms of Avian Influenza infection in man as reported by live bird sellers in Agege.

Variable	Frequency	%
Mentioned six signs and symptoms correctly	9	8.4
Mentioned five signs and symptoms correctly	2	1.9
Mentioned four signs and symptoms correctly	6	5.6
Mentioned three signs and symptoms correctly	31	28.9
Mentioned two signs and symptoms correctly	18	16.8
Mentioned only one sign and symptom correctly	4	3.7
Unable to mention any signs and symptoms correctly	37	34.7
Total	107	100

The result of the cross tabulation comparing educational qualification of LBS with the knowledge of the different symptoms of AI in man is shown in Table 8. Statistical important p-values are shown in bold. The LBS educational qualification did not seem to affect the overall knowledge of the various symptoms of AI in man, except for cough where a significantly greater proportion of LBS with secondary/tertiary education (100% vs 66%) identified cough as a symptom of AI ($p = 0.002$).

Table 8: Association between educational qualification of respondents and the knowledge of symptoms of AI in man

Variable	Educational Qualification					
	No formal/primary	**Secondary/Tertiary**	**Total**	**Fishers exact**	**OR**	**95% CI**
Cough						
Yes	6 (66.6%)	61 (100%)	67	**0.002**		
No	3 (33.3%)	0 (0%)	3			
Sore throat						
Yes	4 (44.4%)	39 (64%)	43	0.26	0.45	0.1096 to 1.8574
No	5 (55.6%)	22 (36%)	27			
Fever						
Yes	5 (55.6%)	29 (47.5%)	34	0.073	1.38	0.3376 to 5.6359
No	4 (44.4%)	32 (52.5%)	36			
Muscle ache						
Yes	3 (33.3%)	8 (13.1%)	11	0.143	3.31	0.6873 to 15.9656
No	6 (66.7%)	53 (86.9%)	59			
Conjuctivitis						
Yes	8 (88.9%)	55 (90.2%)	63	0.1	0.73	0.0750 to 7.0505
No	1 (11.1%)	5 (8.2%)	6			
Diarrhoea						
Yes	1 (11.1%)	10 (16.4%)	11	0.1	0.64	0.0716 to 5.6769
No	8 (88.9%)	51 (83.6%)	59			

On the other hand, training of LBS on AI was strongly associated with the knowledge of symptoms of AI in man with all the associations being highly significance (Table 9). This

indicates that LBS who attended training were more likely to have a good knowledge of the symptoms of AI in man.

Table 9: Comparison of training on AI with knowledge of signs and symptoms of AI in man

Variable	Training on AI		Total	Fishers exact	OR	CI
	Yes	**No**				
Cough						
Yes	60 (100.0%)	7 (70.0%)	67	**0.0022**	-	
No	0 (0.0%)	3 (30.0%)	3			
Sore throat						
Yes	30 (75.5%)	3 (11.1%)	33	**0.001**	24.62	6.3586 to 95.2915
No	13 (24.5%)	24 (88.9%)	37			
Fever						
Yes	27 (73.0%)	7 (21.2%)	34	**0.0001**	10.03	3.3186 to 30.3055
No	10 (27.0%)	26 (78.8%)	36			
Muscle ache						
Yes	11 (26.8%)	0 (0.0%)	11	**0.002**	-	
No	30 (73.2%)	29 (100.0%)	59			
Conjuctivitis						
Yes	57 (100.0%)	6 (46.2%)	63	**0.001**	-	
No	0 (0.0%)	7 (53.8%)	7			
Diarrhoea						
Yes	10 (26.3%)	1 (3.1%)	11	**0.008**	11.07	1.3313 to 92.0741
No	28 (73.7%)	31 (96.9%)	59			

4.4.2: Knowledge of signs of avian influenza Infection in birds

The results show that the participants had a good knowledge of signs of AI infection in birds. All participants could mention at least 2 symptoms (sudden death and bluish discoloured comb and wattle) and 96% of them mentioned ruffled feathers with 92% and 83% respectively also able to mention depression and difficulty in breathing. The two symptoms least known were staggering gait and nose bleeding which was only mentioned by 29% and 24% of respondents respectively. No participant was totally ignorant of the symptoms of AI in birds but 2.8% of them could mention just 3 symptoms (Tables 10 and 11). More than half (55%) could mention five symptoms of AI in birds.

Table 10: Signs of Avian Influenza infection in birds as reported by live bird sellers in Agege (N=107)

Signs of Avian influenza in birds	Frequency (n)	Percentage (%)
Sudden death	107	100
Bluish discoloured comb & wattle	107	100
Ruffled feathers	103	96
Severe depression	98	92
Difficult breathing	89	83
Staggering gait	31	29
Nose bleeding	26	24
Don't know	0	0

Table 11: Knowledge score of signs of Avian Influenza infection in bird as reported by live bird sellers in Agege.

Variable	Frequency	%
Mentioned seven signs correctly	14	13.1
Mentioned six signs correctly	18	16.8
Mentioned five signs correctly	59	55.1
Mentioned four signs correctly	13	12.2
Mentioned three signs correctly	3	2.8
Mentioned two signs correctly	0	0
Mentioned only one sign correctly	0	0
Unable to mention any preventive measures correctly	0	0
Total	107	100

The training of LBS did not seem to have any significant association with their knowledge of signs of AI in birds. Table 12 show p-values of no statistical significance in comparing LBS training on AI with the knowledge of signs of AI in birds, except for difficulty in breathing which was identified correctly by proportionately more LBS who had training ($p = 0.001$).

Table 12: Comparison of LBS training on AI with knowledge of signs of AI in birds

Variable	TRAINING ON AI		Total	Fishers exact	OR	CI
	YES	NO				
Ruffled feathers						
Yes	71 (98.6%)	32 (91.4%)	103	0.101	6.66	0.6664 to 66.4815
No	1 (1.4%)	3 (8.6%)	4			
Severe depression						
Yes	69 (95.8%)	29 (82.9%)	98	0.056	4.76	1.1138 to 20.3316
No	3 (4.2%)	6 (17.1%)	9			
Sudden death						
Yes	72 (100.0%)	35 (100.0%)	107			
No	0(0.0%)	0 (0.0%)	0			
Staggering gait						
Yes	23 (37.7%)	8 (22.9%)	31	-	1.58	0.6240 to 4.0216
No	49 (80.3%)	27 (77.1%)	76			
Bluish discoloured comb & wattle						
Yes	72 (100.0%)	35 (100.0%)	107			
No	0(0.0%)	0 (0.0%)	0			
Nose bleeding						
Yes	21 (29.2%)	5 (14.3%)	26	-	2.47	0.8436 to 7.2355
No	51 (70.8%)	30 (85.7%)	81			
Difficult breathing						
Yes	70 (97.2%)	19 (54.3%)	89	**0.001**	29.47	6.2246 to 139.5580
No	2 (2.8%)	16 (45.7%)	18			

4.5: Reporting suspected AI cases to relevant authorities

Further results of this study indicated that 93% of the participants would report to the relevant authorities only when there is sudden death of the flock and not when they observe suspected symptoms.

4.6: Knowledge of avian influenza zoonotic transmission and preventive measure

The study results show that all the respondents were aware that AI can be transmitted to humans from birds. All participants (100%) were able to describe correctly the method of transmission via infected birds (Table 13).

TABLE 13: Methods of AI transmission to humans from birds as reported by live bird sellers (N = 107)

Variable	**Frequency**	**%**
Contact with infected birds	100	100
Contact with infected faeces	96	90
Contact with infected surface	95	89
Others (eating infected poultry, contact with infected eggs, during slaughter of infected birds)	11	10
Don't know	0	0

Similarly, awareness of AI preventive measures was very high with 97% of the participants stating that they were equipped with the information. Their source of information was however variable, with the majority of them (70%) obtaining the information from government sources whilst 18% heard from the Fowl Sellers Association (FSA) and the remaining 12% obtained information from the mass media and other sources (Fig 2).

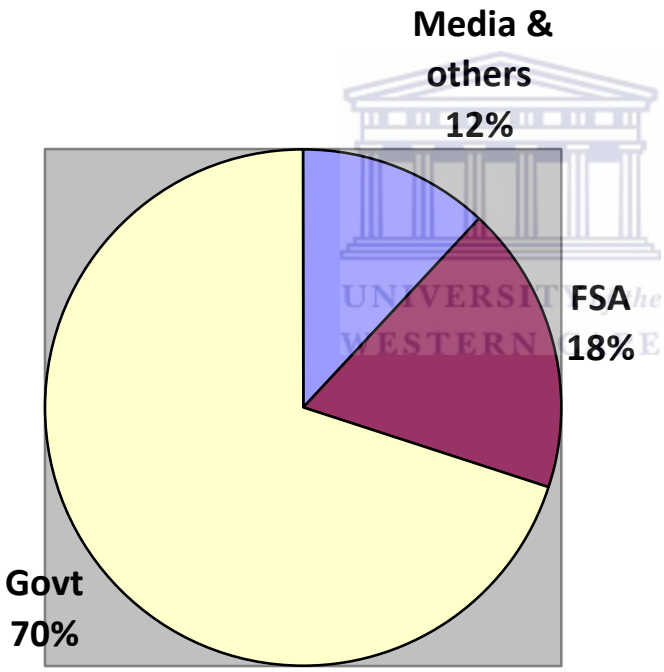


Figure 2: Source of information on AI preventive measures as reported by live bird sellers in Agege (N=107)

The study also revealed that the knowledge of the different preventive measures was high as over 80% of the participants had knowledge of at least 6 of the various preventive measures (Table 15). Although there was no participant who could not mention at least one preventive measure, 0.9% and 2.8 % of the participants were able to mention just 3 and 4 preventive measures respectively. Ninety nine percent (99%) of them mentioned frequent cleaning and disinfection of cages and slaughter surfaces while 89% and 88% mentioned use of gloves and adopting "all in all out" management respectively as preventive measures. The least reported was carcass disposal to competent authorities which was mentioned by 53% of the respondents (Table 14).

Table 14: Knowledge of Avian Influenza preventive measures as reported by live bird sellers in Agege (N=107)

Avian influenza preventive measures	Frequency (n)	Percentage (%)
Clean and disinfect cages and the slaughter surfaces thoroughly and frequently	106	99
Minimize contact with feathers, blood, faecal droppings, etc	99	93
Use gloves and protective wears when handling birds	95	89
Adopt all in/all out management	94	88
Do not trade sick or dead birds	89	83
Do not trade birds of unknown origin	87	81
Leave carcass disposal to competent authorities	57	53

Table 15: Knowledge score of Avian Influenza preventive measures as reported by live bird sellers in Agege.

Variable	Frequency	%
Mentioned seven preventive measures correctly	10	9.3
Mentioned six preventive measures correctly	77	72
Mentioned five preventive measures correctly	16	15
Mentioned four preventive measures correctly	3	2.8
Mentioned three preventive measures correctly	1	0.9
Unable to mention any preventive measures correctly	0	0
Total	107	100

4.7: Current Practice of Live Bird Sellers.

The current practices of the LBS such as method of stocking, cleaning and disinfection of cages, wearing of protective clothing, etc. were tested with the questionnaire and recorded.

4.7.1: Current Practice: Stock Control

The number of Live bird sellers in Agege who reported keeping records of the source of live birds was 96 (89%) while 94% of them had their current source of supplies from

wholesalers. It was also observed from the result that 67% of the respondents practised "all in all out" method of stocking.

4.7.2: Current Practice: Cleaning and disinfection of cage and slaughter places

The study results show that most of the live bird sellers (92%) no longer slaughter birds but amongst those who do, cleaning the slaughter slab & tools was usually done after every slaughter.

All participating live bird sellers confirmed the disinfection of their poultry cages, however the frequency of the disinfection of cages varied, with more than half of the respondents (57%) reporting that they disinfect their cages less than 3 times per week. No live bird seller disinfected cages daily (Table 16). The frequency of cleaning their cages was however influenced by their participation in trainings as the 2 x 2 analysis (table 17) showed an association between the training of LBS and the practice of cleaning and disinfection. The highly significant p value <0.0001 is shown in bold. This indicates that those LBS who received training disinfected their cages more frequently.

Table 16: Frequency of disinfection of cages by participating live bird sellers

Disinfection of cages	**Frequency**	**%**
Daily	0	0
3-4 times per week	10	9
2 times per week	62	58
Weekly	29	27
Once in a while	6	6
Not at all	0	0
Total	107	100

Table 17: Comparison of training of LBS on AI with their practice of disinfection of cages (N=107)

Frequency of cage disinfection	**Training on AI**		**P-value**
	YES	**NO**	
3-4 times per week	8 (7.48%)	2 (1.87%)	**<0.0001**
2-3 times per week	51 (47.66%)	11 (10.28%)	
Weekly	12 (11.21%)	17 (15.89%)	
Once in a while	1 (0.93%)	5 (4.67%)	

4.7.3: Current Practice: Use of protective clothing

This study results showed 100% non-compliance to the prescribed AI preventive measures guidelines of wearing protective clothing such as hand gloves.

4.7.4: Current Practice: Handling sick and dead birds

There was a close agreement in the response to the way LBS will deal with sick birds and how they deal with dead birds. The majority will slaughter and eat sick and dead birds (66% and 57%) respectively while none will slaughter and sell off sick or dead birds. Only 16% and 18% of LBS will report sick or dead birds respectively to relevant authorities (Tables 18 and 19). Those who mentioned disposal of carcasses as a method of handling dead birds also reported doing so by tying up in plastic bags and discarding.

Table 18: Handling of sick birds by participating live bird sellers.

Variable	**Frequency**	**%**
Sell off to customers as live birds	16	18
Slaughter and sell off	0	0
Slaughter and eat	73	66
Report to veterinarians or relevant authorities	18	16
Total	107	100

Table 19: Handling of dead birds by participating live bird sellers.

Variable	Frequency	%
Slaughter and sell off	0	0
Slaughter and eat	61	57
Report to veterinarians or relevant authorities	19	18
Disposal of carcass	27	25
Total	107	100

Test for association between awareness and human health risks and the current practices of LBS in the use of AI preventive measures reported p-values of no statistical significance. The awareness of human health risks did not seem to have an effect on the current practices of the LBS in the use of preventive measures such as frequency of disinfecting cages, recording of source of birds and handling of sick and dead birds. These data are shown in Table 20.

Table 20: Association between awareness of human health risks and the current practices of LBS in the use of AI preventive measures

Variable	HEARD OF HUMAN HEALTH RISKS		Total	Fisher's exact	Odds ratio	95%CI
	YES	NO				
Frequency of disinfecting cages						
3-4x in wk	8 (8.4%)	2 (12.5%)	10	0.460		
2-3x in wk	40 (12.1%)	22 (25.0%)	62			
Wkly	22 (24.1%)	7 (7.8%)	29			
Once in a while	3 (18.8%)	3 (18.8%)	6			
Records source of birds						
Yes	82 (90.1%)	14 (87.5%)	96			
No	9 (9.9%)	2 (12.5%)	11	0.668	1.3016	0.2541 to 6.6676
What do you do with sick birds						
Sell off as live birds	13 (14.3%)	3 (18.8%)	16	0.8224		
Slaughter and eat	62 (68.1%)	11 (68.8%)	73			
Report to authorities	16 (17.6%)	2 (12.5%)	18			
What do you do with dead birds						
Slaughter & eat	10 (62.5%)	51 (56.0%)	61	0.8217		
Report to authorities	2 (12.5%)	17 (18.7%)	19			
Dispose carcass	4 (25.0%)	23(25.3%)	27			

CHAPTER 5: DISCUSSION

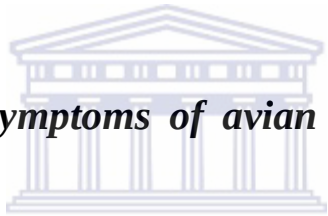
5.1: Discussion

This study describes and quantifies the self reported knowledge and practices of live bird sellers in Agege area of Lagos state Nigeria with regards to avian influenza health risks and preventive measures. Live bird sellers represent an important group in the poultry industry in Nigeria and therefore should be incorporated into activities targeted at AI prevention and control. They are an indispensable channel in the control of zoonotic diseases associated with infected birds. A large percentage (94.4%) of LBS in this study reported that the source of live birds in which they trade is from whole sale suppliers who collect the birds from various farmers. This implies that infected and non-infected birds can be stocked together by LBS resulting in rapid spread of diseases. LBS could therefore play a key role in early recognition and prevention of zoonotic infections such as AI (Van Kerkhove *et al.,* 2009).

5.1.1: Profile of participating Live Bird Sellers

This study sample consisted of 107 LBS drawn from 5 different markets in the Agege area of Lagos whose ages ranged from 33-64 years. A large percentage of them (63.6%) had senior secondary certificate as their highest educational qualification, while their years of experience as LBS varied widely. These socioeconomic factors have been taken into consideration in this study because they are known to influence knowledge and practices (Di Giuseppe *et al.*, 2008). This group of LBS represents an economically active population who are self employed and represent the disadvantaged group in

seeking for formal employment (white-collar jobs) since only 3.7% have tertiary education. It was found from this study that there was an association between educational level and knowledge of symptoms of AI in man such that those with higher education were more likely to have adequate knowledge. This group therefore needs to be given attention and guidance to enable them practice the trade effectively and reduce burdens of zoonotic transmissions of diseases. If there is no adequate intervention in their practices, they risk incurring heavy losses or carrying out practices which could jeopardize their health, with consequent unemployment and other social vices and its attendant negative impacts on the society.



5.1.2: Knowledge of symptoms of avian influenza in man and birds

The pandemic of AI in poultry in Nigeria was severe and received attention nationally and globally such that there was a huge awareness amongst the general public. Subsequently, there were interventions from various concerned bodies. A majority of LBS in this study (65%) reported to have attended training or workshops. It is therefore expected that the knowledge of AI symptoms in man and birds would be high amongst the LBS. The results of this study however indicate that the knowledge of signs in birds was high while knowledge of symptoms in man was poor. This is consistent with results of a previously reported study which indicate an improvement in knowledge of AI signs in birds (Joannis *et al.,* 2006). However, since only 8.4% had adequate knowledge of the symptoms of AI in man which is critical to public health, the LBS can further benefit from tailored educational and awareness programmes directed at improving their

knowledge, since this study showed a positive relationship between training and knowledge of AI symptoms in man. Moreover similar studies have recommended continued education on AI as a way of improving knowledge (Hans, 2006; Maton, Butraporn, Kaewkangwal and Fungladda, 2007; Di Giuseppe *et al.*, 2008). The use of mass media has also been recognized as an important way of improving knowledge of AI (Maton *et al.*, 2007). The findings of a survey on knowledge of avian influenza in an adult population in Italy acknowledged the positive role of mass media (Di Giuseppe *et al.*, 2008). Similarly, a study on determinants of hand washing practices in Kenya revealed a strong relationship between hygiene promotion and mass media (Schmidt et al., 2009).

5.1.3: Knowledge of avian influenza preventive measures

The prescribed FAO guideline on prevention of spread of AI was used to determine the knowledge of the respondents on AI preventive measures. It was necessary to consider the level of knowledge of AI preventive measures in this study because there could be association between knowledge and practice. A cross sectional survey of a representative sample of age 18years and above, conducted in Australia associated the participants' willingness to comply with specific AI preventive measures with their high knowledge (Eastwood *et al.,* 2009). Similarly, Di Giuseppe and colleagues (2008) reported a positive association between knowledge and hygienic practices in a cross sectional survey of 683 randomly selected adults in Italy.

In this study, the level of knowledge of LBS on the different AI preventive measures varied, although the respondents were generally aware of AI preventive measures. This result was similar to the findings of the earlier mentioned study in Lagelu, Nigeria (Fatiregun and Saani, 2008). Cleaning and disinfection of cages and slaughter place was the most frequently reported knowledge as 106 participants (99%) reported it. This is an important parameter for measuring their knowledge because cleaning and disinfection of cages and slaughter place is a crucial preventive measure since AI is mainly spread via contact with contaminated surfaces. Furthermore, the respondents' knowledge on minimizing of contacts with feathers, faeces, etc. was high, with 93% reporting this as a preventive measure. However, 53% considered leaving carcass disposal to the competent authority as a preventive measure. This finding is interesting and can be related with the results in tables 18 and 19 where minorities (18% and 19%) of the respondents considered reporting to veterinarian and relevant authorities respectively as their practice in handling sick and dead birds. This finding seems to suggest the need to encourage and build the confidence of the LBS in collaborating with competent professionals and relevant authorities in their practices. Eastwood *et al.,* (2009) reported that medical practitioners play an important role in the containment of infectious disease and are regarded by the public as reliable source for information and therefore should be included in avian influenza communication plan. Therefore improved collaboration between the LBS and the relevant professionals will most likely result in early response to zoonotic diseases and provide the LBS with adequate and accurate information on preventive measures.

5.1.4: Practice of avian influenza preventive measures

The practices of LBS in general are of considerable importance both to human health and the poultry industry since they are a link in the poultry food chain. Live bird markets have been associated with AI outbreaks (Yee *et al.*, 2008; Van Kerkhove *et al.,* 2009) and though their precise role in the spread of HPAI remains unclear, there is a high risk of human exposure to HPAI (Obi *et al.*, 2007) thus the need to evaluate the practice of avian influenza preventive measure by the LBS. The results of this study have shown that LBS do not practice all the prescribed preventive measures adequately despite their relatively good knowledge of these measures. Although 99% of the participants reported cleaning and disinfection of cages frequently as AI preventive measures, only 9% disinfects at least 4 times per week while none of them disinfects daily. Moreover, 89% of the respondents described the use of gloves and protective clothing as an AI preventive measure but surprisingly none of them reported the usage of this practice. Other studies have also reported such poor practice of LBS (*AICP NIGERIA,* 2008). Similarly, a qualitative study which explored hand hygiene practices amongst health care workers in a Canadian hospital reported non-adherence and incomplete adherence by respondents (Jang *et al.,* 2010). Reasons given by these Canadian health workers for non adherence to hygienic guidelines include-; the nature of work load which involves emergency responses, non- availability of hygiene products and the conservative guidelines. A possible explanation for the poor practice of LBS in this study could be because they want to avoid being stigmatized by others not involved in the trade who see their wearing of gloves as a indication of presence of AI infection amongst their birds and the LBS

themselves or they are simply reluctant to change from their traditional methods. More over the cost of acquiring the protective clothing or access to it might contribute to the non adherence of LBS to this measure.

Another important finding in the practice of AI preventive measure by LBS is their handling of sick or dead birds. While the vast majority (83%) of the respondents reported that not trading in sick or dead birds is an AI preventive measure, 66% and 57% of the respondents will rather slaughter and eat sick or dead birds respectively. Similar behavior was reported in a community cluster survey in Thailand despite wide spread knowledge of AI and preventive measures (Oslen *et al.*, 2005). This action may be related to food security aspects, i.e unavailability of poultry meat, which might motivate the LBS to eat dead and sick birds. Their knowledge of pathogens being killed by heat might also influence the practice. More over all the LBS in this study were female and this might reinforce this behaviour as their primary concern might be one of household food security hence cannot throw away food. Despite apparent knowledge of preventive measures, all these practice, point to the poor understanding of the importance and or resistance to behavioral change.

The gap between knowledge and practice is a well known phenomenon in the health sector, for instance medical doctors who smoke or diabetic patients who still eat sweets despite knowing the hazardous effect. A cross-sectional study conducted to evaluate the knowledge, attitude and practice of 97 food workers in four meat processing plants in Fars province, Southern Iran, reported a significant negative association between

knowledge and practice, revealing that high level of knowledge in food safety does not necessary result in positive change in food handling practices (Ansari-Lari, 2010). In an earlier mentioned study conducted in Thailand (Olsen *et al.,* 2005), a gap between knowledge and practice was also reported where knowledge of AI did not result in positive behavioural change. This study on LBS confirms a discord between knowledge and practice, the result also showed that high level of knowledge of use of gloves and protective clothing while handling birds did not improve their use as there was 100% non-compliance (Table 14). The current practices of LBS therefore present a challenge and indicate the need for their education regarding the danger of non-adherence to these preventive measures. To address this challenge, an exploration of the LBS attitude and risk perception of AI will provide an insight on the reasons for their practice and thus provide direction for the required intervention. Perhaps a holistic approach to AI preventive measures involving advocacy for behavioural change will go a long way towards addressing the situation. Although the training of LBS did not seem to greatly influence their practice, further training and workshops geared at engaging the LBS in interactive discussions on AI risk perception and limitations to good practice should also be important. The training should particularly target the LBS. Thirty three (33%) of the respondents in this study have not participated in any form of training or workshops on AI hence their knowledge of AI preventive measures may not be comprehensive enough so would make them continue in their poor practices.

5.1.5: Regulation of Live Bird Sellers

The live bird sellers who participated in this study were those registered in their association (FSA), however their practice is not regulated by any regulatory arm of the government but get advisory input from the Lagos State Ministry of Agriculture. They also have some weak control through the leadership of the association.

The results of this study have shown that the practices of LBS as regarding AI preventive measures are unsatisfactory. These findings reiterate the need for a proper regulatory control and supervision of LBS and their activities.

There are currently no guidelines and minimum requirements to trade in live birds, yet LBS practises occupy a critical role in the control of zoonotic diseases such as AI. Regulating the activities of LBS is necessary and would encourage optimal implementation of prescribed AI preventive guidelines.

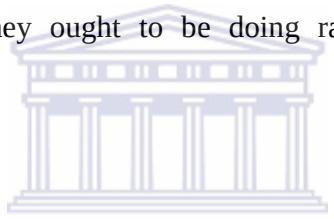
5.2: Limitations of study

- The study was done in an urban setting so the result does not give any indications on the knowledge and practice of LBS in the rural areas which may be different. A study sample including both urban and rural settings could give information in this regard.

- Only LBS registered with FSA were considered in the study. The freelance LBS who were not part of the association did not participate even when they trade

within the vicinity of the same market. The knowledge and practice of this group were not captured in the study. Their educational qualification and participation in trainings which might influence their practise may differ significantly from those participants in this study.

- A further limitation was the use of measures emanating from self reported practice. Such measures are known to produce information bias. More over, some of the questions were considered personal by the respondents so it is possible that some responses particularly regarding practice would not be accurate as they may have reported what they ought to be doing rather than what they actually practiced.



- The fairly small sample when compared to the population of LBS in the entire Lagos state and Nigeria may be considered a limitation to the study. The study methodology also has its own limitations as associations in cross sectional studies cannot be assumed to be causal.

- This quantitative study was largely limited to the identification of the knowledge and practice of LBS on AI preventive measures, and investigation of some of their associations. These findings can further be made more meaningful by a qualitative study to explore the understanding and attitude of the LBS towards AI preventive measures.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6:1: *Conclusions*

The results of this study show that LBS knowledge of avian influenza infection in birds was high but their knowledge of human infection was low. Surprisingly, the findings also indicate that the high knowledge of AI in birds did not always translate to a good practice of AI preventive measures. A large proportion of LBS are engaged in poor practices such as infrequent disinfection of cages, slaughtering and eating of sick and dead birds, not wearing of gloves or other protective clothing etc., which are contrary to the prescribed guidelines. However, since the results show a strong relationship between LBS knowledge of AI symptoms in birds and training of LBS on AI, further sensitization and training to improve their knowledge and understanding of the importance of AI preventive measures would be necessary to improve their practice of these measures.

The results of this study have also shown that there is high level of awareness of AI preventive measures amongst LBS but their degree of compliance is unsatisfactory and showed poor understanding and low level of acceptance of the prescribed preventive measures thus there is need for further exploration of the LBS practices to get more insight on their attitudes towards the AI preventive measures.

The findings of this study also indicate that there is a deficiency in the monitoring and supervision of the practices of LBS. This is counterproductive to the controlling of AI

infections. To address this issue, an adequate regulatory framework may be required to control the activities of this group in order not to hamper the efforts of government and international organizations involved in the control of AI.

6.2: *Recommendations*

Based on the findings of this study, the following recommendations are relevant to ensure improved knowledge and practices of LBS regarding avian influenza health risks and preventive measures;

- Government needs to urgently put in place a regulatory control mechanism, probably by empowering self-regulation by the LBS Association. The government may however support regulatory activities as follows- ;
    i) Provide national guideline that may incorporate the existing perceptions of the LBS to standardize their practices.
    ii) Supervise and monitor the activities of LBS and that of others persons involved in live bird food chain from farmers to the consumers.
    iii) Ensure compliance and adherence to formulated guidelines on practices of AI preventive measures.
    iv) Provide adequate infrastructure and an enabling environment for live bird markets.

In the mean-time, government bodies and institutions like FLD, Lagos State Ministry of Agriculture who have an over sight function over the LBS should continually advocate for behavioural change of the LBS for improvement in their practices.

- Programmes on community health education geared towards educating the customers of LBS and the general public on AI health risks and preventive measures should be continued and prioritized by state and local governments.
- Further qualitative studies should be conducted on LBS to explore the reasons for non adherence to guidelines on AI preventive measures despite a good knowledge and awareness of AI preventive measures.

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APPENDICES

APPENDIX 1: DATA COLLECTION TOOL

QUESTIONAIRE

Thesis Title: Knowledge and Practices of Live Bird Sellers on Health Risks and Preventive measures of Avian Influenza in an urban area in Lagos, Nigeria.

Name of Interviewer: …….. Date……. Questionnaire No:

A. **DEMOGRAPHIC INFORMATION:**

(1) Sex : (1) Male ☐ (2) Female ☐

(2) Age (in years) ☐

(3) What is your highest level of education completed?

(i). Tertiary. ☐ (ii). Senior Secondary School ☐

(iii). Primary School ☐ (iv). No formal Education. ☐

(4) How long have you traded as a LBS (in years)? ☐

(5) Do you still wish to continue the trade despite AI health risks and other infections that can be transferred from poultry to man. Yes ☐ No ☐

(5a) If yes, for what reason

(i) Trade is lucrative ☐ (ii) No knowledge of alternative trade ☐

(iii) AI and other poultry diseases do not affect man ☐

(iv) Others ……. (Specify)

(6) Did any of your birds die as a result of AI infection? Yes ☐ No ☐

(7) Were there any bird culled or depopulated from your stock due to AI infection?

Yes ☐ No ☐

(8A) Have you had any training/workshop/seminar as a live bird seller?

Yes ☐ No ☐

(8B) If yes give detail;

Name of the course attended	Date attended.	Duration of training (hours or days)	Topics covered	Training Organizers

(9a) Have you attended any training/workshop/seminar on AI in the past 3 years?

Yes ☐ No ☐

(9b) If yes give detail;

Name of the course attended	Date attended.	Duration of training (hours or days)	Topics covered	Training organizers

B. **Knowledge of Signs and Symptoms of AI:**

(10). What do you think are the major signs of AI in birds? (multiple codes allowed).

		Yes	No.
i.	Ruffled feathers	1	2
ii.	Severe depression	1	2
iii.	Sudden death	1	2
iv	Staggering gait	1	2
v.	Bluish discoloured comb & wattle	1	2
vi.	Nose bleeding	1	2
vii.	Difficult breathing	1	2
viii.	Others (specify)	……	
ix.	Don't know	1	

(11). How do you know when a bird has AI (multiple codes allowed)

	Yes	No.
i. Difficult breathing	1	2
ii. Nose bleeding	1	2
iii Staggering gait	1	2
iv Ruffled feathers	1	2
v Bluish discoloured comb & wattle	1	2
vi. Others (Specify) ……		

(12) In what condition do you think a bird suspected of AI should be reported to the authorities?

	Yes	No
Manifesting suspected symptoms	1	2
Sudden death	1	2

Others (specify) ……

(13). What do you think are the major symptoms of AI in humans? (multiple codes allowed).

	Yes	No.
i. Cough	1	2
ii. Sore throat	1	2
iii. Fever	1	2
iv. Muscle ache	1	2
v. Conjunctivitis	1	2
vi. Diarrhoea	1	2
vii. Others (specify) ……		
viii. Don't know	1	

C. **Knowledge of AI human health risks and Preventive measures.**

(14a) Have you heard of Preventive measures against AI infection?

Yes ☐ No. ☐

(14b) If yes, where did you get the information?

(i) Government sources ☐
(ii) Veterinarians ☐
(ii) Fowl Sellers Association ☐
(iv) Mass media ☐
(iv) others ☐

(15a) Have you heard of AI human health risks? Yes. ☐ No. ☐

(15b) If yes, where did you get the information?

(i) Government sources ☐

(ii) Veterinarians ☐

(ii) Fowl Sellers Association ☐

(iv) Mass media ☐

(iv) Others (specify) ☐

(16) Do you think humans can get infected with AI from handling birds?

Yes. ☐ No. ☐

(17) How do you think AI is transmitted to humans from birds? (multiple codes allowed)

	Yes	No.
i. Contact with infected surfaces	1	2
ii. Contact with infected birds	1	2
iii. Contact with infected feaces	1	2
iv. Others (specify)	……	
v. Don't know	1	

(18) Are you aware of any prescribed guidelines on preventive measures against AI infection transmission from birds to humans.

Yes. ☐ No ☐

(19) What do you think are these AI preventive measures? (tick the correct ones)

	Yes	No
(i) Do not trade birds of unknown origin……	1	2
(ii) Adopt all in/all out management……..	1	2
(iii) Do not trade sick or dead birds…….	1	2
(iv) Minimize contact with feathers, blood,	1	2
intestines, faecal droppings, etc……..	1	2
(v) Clean & disinfect cages and the slaughter surfaces		
thoroughly and frequently……..	1	2
(vi) Use gloves and protective wears when handling birds…….	1	2
(vii) Leave carcass disposal to competent authorities …….	1	2
(viii) Others (specify)……...	1	2

(20) What determines which AI preventive measures you practice?

(i) To protect yourself ☐

(ii) To prevent spread of AI infection ☐

(iii) Government policy ☐

(iv) Availability of facilities and equipment ☐

(v) Others (specify) ……..

D. **Current Practices of LBS In The Use Of AI preventive measures**

(21**)** How frequently do you disinfect your cages?

(i) Daily ☐

(ii) 3-4 times per week ☐

(iii) 2 times per week ☐

(iv) weekly ☐

(v) Once in awhile ☐

(v) Not at all ☐

(22) How frequently do you clean your slaughter slab & tools?

(i) Before and after every slaughter ☐

(ii) After every slaughter ☐

(iii) Everyday at the close of business ☐

(iv) When you consider it necessary ☐

(v) Others (specify) …… ☐

(23) Do you wear any protective clothing such as hand gloves while handling birds?

Yes ☐ No ☐

(24) Do you keep a record for the source of your live birds?

Yes ☐ No ☐

(25) What is your current source of live birds?

(i) Specific poultry farm ☐

(ii) Any poultry farm ☐

(iii) Wholesale suppliers ☐

(iv) Others ☐

(26) Do you practice an "all in all out" method of stocking?

Yes ☐ No ☐

(27) What do you do with sick birds?

(i) sell off to customers as live birds ☐

(ii) Slaughter and sell off ☐

(iii) Slaughter and eat ☐

(iv) Report to veterinarians or relevant authorities ☐

(28) What do you do with dead birds?

(i) Slaughter and sell off ☐

(ii) Slaughter and eat ☐

(iii) Report to a veterinarians or relevant authorities ☐

(iv) Dispose off carcass ☐

(29) How do you dispose off carcasses?

(i) By burning ☐

(ii) By burying ☐

(iii) By tying up in plastic and discarding ☐

(iv) By contacting relevant authorities to pick off ☐

(v) Others ☐

APPENDIX 2

AVIAN INFLUENZA HEALTH RISK COMMUINCATION ACTIVITIES AND FOOD SAFETY MEASURES PRESCRIBED BY FAO (2003) FOR THOSE WHO HANDLE AND SLAUGHTER POULTRY

□ Do not trade birds of unknown origin (only trade birds that are certificated or from a trusted source).

□ Adopt all in/all out management: sell all animals at the same time and buy animals in one single batch.

□ Do not trade poultry that look sick but report sick or dead birds immediately to the veterinary authorities (or local equivalent).

□ Do not leave dead animals lying around or throw dead animals into rivers, lakes or other bodies of water.

□ Use of hand gloves, nose and mouth face mask (PPE if available) while handling poultry.

□ Minimize contact with feathers, blood, intestines, faecal droppings, etc.

□ Wash hands thoroughly after culling.

□ Clean the slaughter place and surfaces thoroughly.

□ Place carcass in the bag or take carcass away from the rest of the flock and out of reach of children and others.

□ Leave disposal of bird carcasses to the veterinary authorities (or local equivalent) and help only if they ask. If you must dispose it yourself, Get rid of carcasses safely by burning them or burying them deeply enough that dogs, cats and other scavengers cannot reach them.

□ Do not sell or eat the carcass of a dead bird.

□ Collaborate with the veterinarian authorities and respect poultry movement ban.

APPENDIX 3

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-959 2809, Fax: 27 21-959287

http://www.uwc.ac.za/comhealth/soph

PARTICIPANTS INFORMATION SHEET

Project Title: Knowledge and Practices of Live Poultry Sellers on Health Risks and Preventive measures of Avian Influenza in an urban area in Lagos, Nigeria.

What is this study about?

This is a research project being conducted by Chinyere Ilonze, a MPH student at the University of the Western Cape, South Africa. We are inviting you to participate in this research project because you are a live poultry seller in this community registered under Fowl Sellers Association. The purpose of this research project is to determine your knowledge of AI health risks and Preventive measures.

What will I be asked to do if I agree to participate?

You will be asked to provide some information about your background such as your level of education, length of time in the trade, your knowledge of AI and your current practices when handling poultry.

Would my participation in this study be kept confidential?

Yes! The information contained in the questionnaire may not personally identify you. The result of the survey will be presented in an aggregated form which will not be traceable to any participant.

Are there any harm from this research?

There are no harm whatsoever associated with participating in this research project.

What are the benefits of this research?

The results of this survey and recommendations will be presented to policy makers in the Federal Ministry of Agriculture and the Avian Influenza Control Project. The benefits of the research will therefore include information material on AI and Preventive measures (if required) in order to help contain Avian Influenza.

Do I have to be in this research and may I stop participating at any time?

Your participation in this research is entirely voluntary. You may choose not to participate at all. If you decide to participate in this research, you may withdraw your participation at any time without any reason. There is no penalty or loss of any benefits whatsoever if you decide not to participate in this study or if you stop participating at any time.

Is any assistance available if I am negatively affected by participating in this study?

Since this study is not invasive, I do not anticipate any adverse effects of this study on you.

What if I have questions or need further clarifications?

This research is being conducted by Chinyere Ilonze, School of Public Health, at the University of the Western Cape. If you have any questions about the research study itself, please contact Chinyere Ilonze at: Drug Registration Division, R&R Directorate, NAFDAC, Lagos Nigeria, +2348033187349, chyplusiyke@yahoo.com. Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Professor Rina Swart
University of the Western Cape
Private Bag X17, Belville 7535
Telephone: +2721 959-2237
Cell: +27 834824113

Email: rswart@uwc.ac.za

APPENDIX 4

INFORMED CONSENT FORM

Title of Research Project: Knowledge and Practices of Live Poultry Sellers on Health Risks and Preventive measures of Avian Influenza in an urban area in Lagos, Nigeria.

I believe I have been properly informed and that I understand the nature and goals of the study. I freely and voluntarily agree to participate. My questions about the study have been answered. I understand that my identity will not be disclosed and that I may withdraw from the study without giving a reason at any time and this will not negatively affect me in any way.

Participant's name……..

Participant's signature……

Date……

Should you have any questions regarding this study or wish to report any problems you have experienced related to the study, please contact the study coordinator:

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