HEALTH WORKERS' KNOWLEDGE, PERCEPTIONS AND PRACTICES RELATING TO AVIAN INFLUENZA INFECTION IN PERI-URBAN LOCAL GOVERNMENT AREAS OF IBADAN, NIGERIA

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A DISSERTATION IN THE DEPARTMENT OF HEALTH PROMOTION AND EDUCATION SUBMITTED TO THE FACULTY OF PUBLIC HEALTH IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH (HEALTH PROMOTION AND EDUCATION) OF THE UNIVERSITY OF IBADAN

AUGUST, 2012

DEDICATION

Dedicated to God, the Almighty for his abundant grace, mercy and love. I also dedicate this work to the Memory of my late sister Mrs. Oluwatoyin Aina. May the Lord grant her soul eternal rest, Amen.

ACKNOWLEDGEMENTS

I am grateful to God for sparing me and making this stage in my life a reality. I would like to express my gratitude to all those who generously gave their time, resources, experience and insights to facilitate the design and execution of this study. I acknowledge the guidance I received from my supervisor- Dr Frederick, O. Oshiname, who did not only supervise this study, but spent quality times to support me and was meticulous about it too. It has been worthwhile experience learning from his wealth of experience.

Special thanks to the Head of Department- Prof. A. J, Ajuwon for his untiring efforts and professional support over the past few years. I wish to express my gratitude to my other lecturers Prof. Oladimeji Oladepo, Drs. I. O. Olaseha, Oyedunni Arulogun and Oyewole, O. E. for their enormous support and contributions. They spent valuable time to read through my research work and made meaningful contributions. Their support and contributions throughout this study cannot be quantified. I wish to register my appreciation to the other members of staff in the Department of Health Promotion and Education in particular Mr. Musibau Titiloye, Mr. Lanre, K and Mr. Oyeyemi, T.

I would like to say thank you to all my colleagues and classmates (2007/2008 set); they touched my life in special ways. I will never forget all my friends and well wishers; their prayers and encouragement saw me through the conduct of the study.

Last but not the least, to Oluwadarasimi Afuye, my son and Temitope Afuye, my wife, this is for you. I want to say a big thank you for your patience and endurance during the course of this study and for the faith you have in me, thank you for being there for me all the time.

ABSTRACT

Avian Influenza (AI) is a serious public health problem in Nigeria and Primary Health Care (PHC) workers have important roles to play in its control. However, their knowledge and practices relating to AI have not been fully investigated. This study was designed to determine the knowledge, perceptions and practices of PHC workers relating to AI prevention and control in Akinyele, Egbeda, Lagelu, Ido and Oluyole areas of Ibadan.

A total population study was planned. However, only 515 of the 718 PHC workers in the LGAs consented to participate. A semi-structured questionnaire which included a 61- point knowledge scale and questions on perceptions and practices was used for data collection. Knowledge scores of 0-30, 31-45 and 46-61 were rated as poor, fair and good respectively. Data were analyzed using descriptive statistics, Chi-square, t-test, ANOVA and logistic regression with level of significance set at 0.05.

The respondents comprised 32.6% Health Assistants (HAs), 30.7% Senior Community Health Extension Workers (SCHEWs), 12.2% Junior Community Health Extension Workers (JCHEWs), 11.8% Community Health Officers (CHOs), 10.7% nurses/midwives, 1.0% doctors and 1.0% pharmacists. Their mean age was 38.4 ± 8.7 years and 81.9% were females. All respondents had heard about AI, 49.5% were aware that its spread is facilitated by birds and 7.6% were aware that it could easily spread in health care centres. Sources of information about AI included radio (68.3%), television (66.8%) and professional peers (56.5%). Overall mean knowledge score was 37.2 ± 9.4. Mean knowledge scores for males and females were 39.8 ± 8.4 and 36.6 ± 9.6 respectively with a significant difference. Significant differences were also observed in the knowledge scores for different cadres: doctors 54.5 ± 2.1, pharmacists 41.2 ± 6.1, nurses/midwives 39.7 ± 6.9, CHOs 39.5 ± 7.7, SCHEWs 38.0 ± 7.9, JCHEWs 35.8 ± 11.8 and HAs 34.2 ± 11.4. Respondents with poor, fair and good knowledge scores of AI were 21.4%, 60.6% and 18.1% respectively. Consumption of infected birds/fowls (82.1%) was a major mode of transmission of AI to human populations mentioned by respondents. The correctly identified symptoms of AI included coughing (68.9%), shortness of breath (66.8%) and body temperature greater than 38ºC (63.3%). The correctly mentioned medications for managing AI were *Tamiflu* (11.1%) and *Relenza* (2.1%). Only 13.2% perceived themselves to be vulnerable to AI and 56.7% rightly perceived all age groups to be susceptible to it. Respondents with tertiary education were 6.0 times more likely to perceive AI to be serious than those with non-tertiary education (95% CI, 0.5-4.9). Preventive practices adopted by respondents against AI included wearing of gloves (92.2%), equipment sterilization (82.9%) and hand washing using water, soap and disinfectants (70.9%).

Gaps in knowledge and misconceptions relating to vulnerability to avian influenza infection existed among the health workers. However, many of them adopted effective preventive measures. There is need for training to bridge the identified gaps.

Keywords: Avian influenza knowledge, Primary health care workers, Perceived vulnerability, Preventive practices.

Word count: 471

CERTIFICATION

I hereby certify that this study was carried out by AFUYE, Busayo in the Department of Health Promotion and Education, Faculty of Public Health, College of Medicine, University of Ibadan, Nigeria.

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LIST OF ACRONYMS

AI	Avian Influenza
AICP	Avian Influenza Control Program
AHA	American Hospital Association
ANOVA	Analysis of Variance
CDC	Centres for Disease Control
CHOs	Community Health Officers
CHEWs	Community Health Extension Workers
DNA	Deoxyribonucleic Acid
DEFRA	Department of Environmental, Food and Rural Affairs
EU	European Union
FADAMA	The *Hausa* name for irrigable land, flood plains and low lying areas underlined by shallow aquifers and found along Nigeria's river system.
FAO	Food and Agricultural Organization
GCE	General Certificate of Education
GDP	Gross Domestic Products
HAs	Health Assistants
HBM	Health Belief Model
HCWs	Health Care Workers
HPAI	Highly Pathogenic Avian Influenza
HOD	Head of Department
IEC	Information Education and Communication
JCHEWs	Junior Community Health Extension Workers
LPAI	Low Pathogenic Avian Influenza
LGAs	Local Government Areas
MOH	Medical Officer of Health
NAO	National Audit Office
NECO	National Examinations Council
PATH	Programme for Appropriate Technology in Health
PHC	Primary Health Care

PRECEDE	Predisposing, Reinforcing and Enabling Constraints in Ecosystem Diagnosis and Evaluation
PPE	Personal Protective Equipment
PCR	Polymerase Chain Reaction
SARS	Severe Acute Respiratory Syndrome
SCHEWs	Senior Community Health Extension Workers
UN	United Nations
UNICEF	United Nations Children Fund
UNDP	United Nations Development Programme
USA	United States of America
USD	United States Dollar
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
UNSIC	United Nations System Influenza Coordination
VDC	Village Development Committee
WASC	West African School Certificate
WDC	Ward Development Committee
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

Background

Occasionally, completely novel antigenic subtypes of influenza viruses emerge in human populations which result in large-scale global disease outbreaks with high death tolls. The avian flu infection is an example and it has captured considerable international attention in recent years. Avian influenza is caused by a large group of different influenza viruses that primarily infect only birds and sometimes pigs; they infect humans on rare occasions. Since its emergence, the virus, (H5N1) often called Highly Pathogenic Avian Influenza (HPAI) virus has attracted considerable public and media attention. The fact that the virus involved produces fatal disease conditions in humans has given rise to the fear that the virus might acquire the capacity for sustained human-to-human transmission. This is more so because the disease has been disruptive to the poultry industry and threatens human health (Obayelu, 2006; Otte, Hinrichs, Rushton, Rolland-Hoist, and Zilberman, 2008).

Avian influenza viruses which may lead to the emergence of human influenza pandemics are of three types namely A, B and C. They are important pathogens in the poultry industry and are becoming a major global health concern (Liu, Xiao, Lei, Zhu, Qin, Zhang, Zhang, Zhao, Wang, Feng, Ma, Liu, Wang, and Gao, 2005). The HPAI has been caused to date by influenza A viruses of the H5 and N1 subtypes exclusively (Kamps, Hoffman, and Presser, 2006). So far most of the laboratory confirmed cases have been fatal. The disease is one of the most serious public health problems worldwide. The influenza is characterized by sudden onset of chills, malaise, fever, muscular pain and cough (Kamps, et al, 2006; Park, 2007).

The vast majority of avian influenza viruses do not infect humans. However, the avian viral strain H5N1 has pandemic potential in human populations, since it might ultimately mutate into a strain that is contagious among humans (Park, 2007). The outbreak of HPAI is the most severe on record and it began in South East Asia in mid 2003, and spreads to Europe, the Middle East, and Africa (Erin, Coughlan, and Leder, 2006). Avian influenza A virus subtype H5N1 has caused many human fatalities and continues to pose an increasing pandemic threat. According to Park (2007), the H5N1 strain first infected humans in Hong Kong in 1997, resulting in 18 cases, including six deaths.

Highly pathogenic avian influenza virus is considered to have emerged as early as 1996, when it was identified in geese in Guangdong province in Southern China (Otte, et al, 2008). Over 61 countries reported the panzootic between 2003 and February 2009, with 408 cases reported in fifteen countries (Babalobi, 2009). Most cases have occurred in previously healthy children and young adults and nearly every one of the laboratory confirmed cases from the virus has been fatal. People that become infected with bird flu disease acquired it directly from birds although the virus does not "jump" easily from birds to humans or spread readily among humans (Peiris, Menno and Guan, 2007). Avian influenza disease in humans is still a rare disease. However, its occurrence could be severe and so it must be closely watched and studied because of its potential to evolve in ways that could start a pandemic (CDC, 2006). Its effect in many countries is catastrophic to the poultry industry as it has caused huge financial losses among poultry farmers (Olanrewaju, 2006; Paula, 2006; John, 2007).

In Nigeria, the first outbreak of the disease within the poultry population was reported in a commercial poultry farm in Kaduna State, in February 2006 (WHO, 2006a). The infection spread within the poultry population to nearly all parts of the country and resulted in the death of about 1.5 million birds. Nigeria, with an estimated poultry population of 159 million, weak veterinary facilities, and weak surveillance of animal health, is at risk of continuous spread of the disease in animals and to humans (Fatiregun and Saani, 2007). Presently the virus has been confirmed in 97 LGAs in 25 states and the Federal Capital Territory since 2006. The affected areas include 31 farms in Oyo State (Ojo, Ojezele and Okoruwa, 2008; Babalobi, 2009).

In January 2007, a confirmed fatal human case was reported in Lagos State, Nigeria (UNICEF, 2007), a State which is a few miles away from Oyo State. In order to achieve good control of avian influenza infection, there is need for adequate and accurate information on its etiology, symptoms, management, control and prevention, as well as the provision of adequate resources including health infrastructures and training of health workers. Frontline health workers in Nigeria have critical roles to play in the prevention and control of avian influenza infection in health care settings and communities. However, their knowledge, perceptions and practices relating to the infection are yet to be well explored. The study was therefore designed to focus on the knowledge, perceptions and practices of PHC workers relating to Avian Influenza infection in the following peri-urban Local Government Areas (LGAs) in Oyo State Nigeria: Akinyele, Egbeda, Lagelu, Ido and Oluyole.

Statement of the problem

Poultry is the main source of animal protein for many people in Nigeria, and it has a very important role to play in the socio-economic development of Nigeria. The performance of the poultry sector has witnessed some significant growth lately due to a favourable socio-economic environment. This development is however being threatened by the recent outbreaks of the HPAI (Anaeto and Chioma, 2007).

The Avian Influenza situation in the country became even worrisome when the Nigerian government announced the first human fatality of the disease involving a 22 year old lady in Lagos State (Isabella, Tony, Alice, Paola, Laimi, Husseini, Anthony, Poman, Tim, Giovanni, and Ilaria, 2008). The test conducted on the lady was confirmed positive by WHO in February 2007 (UNICEF, 2007).

The threat from avian influenza is viewed as grave considering the limited access to water and basic sanitation facilities, especially in the rural areas including peri-urban areas of Nigeria, inadequate hygiene education, poorly equipped health facilities, the large non-commercial or “backyard” poultry population and the preponderance of human interaction with wild birds both for trading and as pests (UNICEF, 2007). The most vulnerable people are children and young adults who have had contact with infected birds and avian influenza patients. The fatality rate due to avian influenza disease could be as high as 62% and it may even be higher in older adults (Balkhy, 2008).

Seng, Tech, Heow, Yuke, Boon, Gerald, Kin, Sin, and David, (2007) have stated that not much is known about the concerns and level of preparedness for avian influenza pandemic among health care workers. Worst still there is a severe shortage of trained health professionals especially in developing countries (WHO, 2006b) including Nigeria that could be readily mobilized to combat the disease. This shortage, combined with poor training and inadequate knowledge, seriously undermine attempts to come to grips with the possible challenges posed by avian influenza (bird flu).

In order to ensure proper control and prevention of avian influenza disease, health workers particularly in PHC centers located in Local Government Areas would need to have sufficient knowledge of the disease including its prevention and management. The design of any intervention programme aimed at enhancing the capacity of PHC health workers to be involved in the prevention and control of avian influenza would necessarily require baseline information concerning their knowledge, perceptions, and practices. There is dearth of information in this regard in Nigeria especially in peri-urban communities which produce much of the poultry consumed in the Nigerian urban settings. This study was therefore designed to address this gap in knowledge among frontline health care workers in five out of the six peri-urban LGAs in Ibadan land.

Justification of the study

The rationale behind this study was to identify the practices and behavioural antecedent factors such as those related to knowledge and perceptions of avian influenza infection which can be used as baseline to guide the design of an in-service training programme for PHC workers in the study LGAs. The results also have potential for serving as data bank for facilitating the formulation of evidence-based policies for the control and prevention of avian influenza infection in health care settings at the LGA level.

Research questions

The research questions formulated to guide the study were as follow:

(1) What is the level of knowledge of health workers in PHC centres about avian influenza infection?

(2) What are the perceptions, including views and opinions, of health workers in PHC centres concerning the risk of avian influenza infection?

(3) What are the preventive health behaviours related to avian influenza infection among the health workers?

(4) What are the resources in the health care facilities which could be used to prevent avian influenza infection?

Objectives of the study

The broad objective of this study was to determine the level of knowledge, perceptions and practices of PHC health workers concerning the prevention and control of avian influenza infection (bird flu) in five peri-urban LGAs in Ibadan.

The specific objectives were to:

(1) Determine health workers level of knowledge of avian influenza infection in terms of causation, mode of transmission, symptoms, control and prevention.

(2) Determine the perceptions of frontline health workers relating to the risk of avian influenza infection.

(3) Determine the control and preventive practices relating to avian influenza infection among health workers.

(4) Determine the frontline health workers' capacity to prevent avian influenza infection in the health care settings.

Hypotheses

The hypotheses formulated for testing were as follow:

Ho 1. There would be no significant relationship between the knowledge scores of respondents and their gender/sex.

Ho 2. There would be no significant relationship between the knowledge scores of respondents and their age.

Ho 3. There would be no significant relationship between the knowledge scores of respondents and their highest level of education.

Ho 4. There would be no significant relationship between the knowledge scores of respondents and their level of professional affiliation.

Ho 5. There would be no significant relationship between the knowledge scores of respondents and their years of working experience as a health worker.

Ho 6. There would be no significant relationship between the Sex and the perception that all age group are susceptible to AI infection

Ho 7. There would be no significant relationship between the highest level of education of the respondents and the perception that all age groups are susceptible to AI infection.

Ho 8. There would be no significant relationship between respondents' age and their perception that all age groups are susceptible to AI infection.

Ho 9. There would be no significant relationship between the working experience of respondents and their perception that all age groups are susceptible to AI infection.

Organization of the text

The dissertation is organized into five chapters. Chapter one presents a general introduction to the issues and objectives that guided the research. Chapter two focuses on the literature review relating to the various aspects of avian influenza. The chapter ends with the conceptual frameworks that were used to guide the design of the study.

Chapter three explains the design, scope and data collection methods employed in this study. The study area is described and sampling procedures outlined. The variables of interest that arose from the conceptual framework were operation-alised and used to formulate the hypothesis tested. The other components of chapter three include the following: Data collection, management including analysis; validity, reliability, and limitations of the study.

Chapter four contains the results of the research which are organized into four sections as follow:

- Respondents' Socio-demographic Characteristics.
- Respondents' awareness and knowledge of avian influenza infection.
- Respondents' perceptions related to avian influenza infection.
- Prevention and control practices of PHC health care workers against avian influenza infection.

The implications of the results are discussed in Chapter five. The chapter ends with a set of recommendations.

CHAPTER TWO

LITERATURE REVIEW

The Nature and Cause(s) of Avian Influenza

Avian influenza is an infectious disease which threatens public health worldwide. It is usually associated with severe illness and has a high potential for leading to death (CDC, 2007). The avian influenza disease also called bird flu is caused by viruses which occur naturally among birds (Fouchier, Munster, Keawcharoen, Albert, Osterhaus, and Kuiken, 2007). It is an acute, highly fatal disease of chickens, turkeys, and certain wild birds (Anaeto and Chioma, 2007). Avian influenza viruses are now widely recognized as important threats to agricultural bio-security and public health. Human infections with avian influenza viruses of various types have been reported from Asia (H5N1, H5N2, H9N2), Africa (H5N1, H10N7), Europe (H7N7, H7N3, H7N2), and North America (H7N3, H7N2, H11N9). Direct and indirect public health risks from avian influenzas are not restricted to the highly pathogenic H5N1 "bird flu" virus. They include low pathogenic as well as high pathogenic strains of other avian influenza virus subtypes, such as H1N1, H7N2, H7N3, H7N7, and H9N2.

Avian influenza viruses belong to the family *orthomyxoviridae.* Within the family are three types of influenza viruses: A, B and C (Tsung-zu and Li-Min, 2005). Humans can be infected by Types A, B, or C viruses with Type A being the most common cause of human illness. Type A also affects poultry and some mammals and could lead to a pandemic (Tsung and Huang, 2005; Peiris, Menno and Guan, 2007). Influenza A viruses are often classified according to the composition of two surface proteins, *haemagglutinin* (HA) and *neuraminidase* (NA). There are at present, 16 H (H1-H16) subtypes and 9 N (N1-N9) subtypes of the virus (de Jong and Hien, 2006; Ja'afar-Furo, Balla, Tahir and Haskainu, 2008).

The avian influenza viruses can also be categorized into two depending on their pathogenicity as Low Pathogenic Avian Influenza (LPAI) and High Pathogenic Avian Influenza (HPAI). Currently, only viruses of H5 and H7 subtypes have been shown to cause the Highly Pathogenic Avian Influenza (HPAI) in susceptible species of poultry. It should be noted however that not all H5 and H7 viruses are virulent (Anaeto and Chioma, 2007).

After circulating for a short period of time in a poultry population, viruses of low pathogenicity can mutate into highly pathogenic viruses. The incubation period can be as short as 24 to 48 hours with HPAI and as long as 14 days with LPAI. The low pathogenic forms LPAI may go undetected in birds with signs of illness expressed only as ruffled feathers, reduced egg production, or mild effects on the respiratory system. Outbreaks can be so mild that they could escape detection unless regular testing for viruses is in place (WHO, 2005a).

In contrast, the HPAI, which is the far less common form spreads very rapidly and is difficult to miss. Highly pathogenic avian influenza causes deterioration of many internal organs thus leading to sudden onset of severe disease, rapid contagion, and a morbidity and mortality rate that can approach 100% within 48 hours. In this highly pathogenic form of the disease, the virus does not only affect the respiratory tract, as in the mild form, but also invades multiple organs and tissues (Andrez, Rajesh, Thomas, and Larry, 2004; WHO, 2005a).

The spectrum of avian influenza disease in birds varies depending on secondary complications and environmental factors. It ranges from asymptomatic infection, to mild respiratory illnesses then to a severe and rapidly fatal systematic disease (de Jong and Hien, 2006). These spectra of diseases include swelling of the head and eyelids; discharge from eyes and nasal passages could also be observed in affected birds. The combs and wattles may turn purple or blue with marked haemorrhages on leg shanks (Andrez, Rajesh, Thomas, and Larry, 2004).

Other clinical signs in birds include profuse watery and frequent diarrhoea and difficulty in breathing and excessive thirst. For the laying stock, there could be decreased or cessation in egg production with soft shelled or misshapen eggs in event they are produced (Ja'afar-Furo et al, 2008). In some cases, the only clinical sign of HPAI is death. Infected birds shed influenza virus in their saliva, nasal secretions, and faeces (Andrez et al, 2004; CDC, 2006). Susceptible birds become infected directly or indirectly when they have contact with contaminated secretions or excretions, feed, water or with surfaces that are contaminated with secretions or excretions from infected birds (Peiris, et al, 2007).

Wild aquatic birds are the natural carriers of the full variety of all subtypes of influenza A viruses (Robert, Yi, Malik, and Honglin, 2006; Juthatip, Debby, Geer, Theo, Walter, Rob, Albert, Ron and Thijs, 2008) and they constitute an extensive reservoir where these viruses perpetually circulate in bird populations. The African continent, in particular its sub-Saharan region, are known to constitute a seasonal shelter for a large number of Eurasian water birds, including an estimated 5.4 million ducks that gather in western and eastern Africa during northern winter (Nicholas, Tim, Alexandre, Gilles, Stephanie, Flavie, Giovanni, François, Ward, and François, 2007).

Results from surveillance programmes have established that avian influenza viruses could be present in migratory water birds in Africa during the northern winter (Nicholas, et al, 2007). The vast majority of these viruses are normally relatively non-pathogenic to waterfowls in which they generally do not cause disease in their natural form (Shih-Cheng, Ying, Shin, 2005). Host and virus seem to exist in a state of a meticulously balanced mutual tolerance, clinically demonstrated by absence of disease and efficient virus replication. The virus however becomes highly contagious among domesticated birds, causing severe diseases and even death (USAID, 2006; Boon, Sandbulte, Seiler, Webby, Songserm, and Guan, 2007; CDC, 2007). When they have arisen in domestic poultry, they can again be transmitted horizontally from poultry back into the wild bird population (Kamps, et al, 2006). From this principal reservoir of aquatic birds, viruses are occasionally transmitted to other animals, including mammals and domestic poultry; this could be through adaptation by mutation and genetic re-assortment causing transitory infections and outbreaks (de Jong and Hien, 2006).

Avian influenza acquired world-wide attention when a highly pathogenic strain of the subtype H5N1, which probably arose before 1997 in Southern China, gained enzootic status in poultry throughout South East Asia and unexpectedly traversed interclass barriers (Kamps et al, 2006). Direct transmission of this subtype of H5N1 from infected poultry is thought to be responsible for virtually all of the human influenza (H5N1) infections since 1997. The influenza (H5N1) has adverse effects on human health and agriculture (Boon, Sandbulte, Seiler, Webby, Songserm and Guan, 2007). The salient characteristics of H5N1 are presented in Table 2.1.

TABLE 2.1: Characteristics of H5N1 that pose the potential for causing a pandemic

(i) It has become progressively more pathogenic in poultry and in the mammalian mouse model.
(ii) It has become harder than before.
(iii) It appears to be expanding its mammalian host range.
(iv) It has been found in its highly pathogenic form in dead migratory birds, and the role of migratory waterfowl in the evolution and maintenance of HPAI H5N1 may be changing.
(v)It has been found in its highly pathogenic form in domestic ducks, which can excrete large quantities of lethal virus without warning signs of visible illness.
(vi) It occurs in concentrated poultry outbreaks in rural areas, where most households maintain free-ranging flocks and ducks and chickens mingle freely.

Adapted from WHO (2007)

The History and Epidemiology of Avian Influenza

An influenza pandemic is defined as a global outbreak of the disease that occurs when a new strain of influenza A virus emerges in the human population, causes serious illness, and then spreads easily from person to person (Ligon, 2005). Influenza experts have consistently warned that pandemic influenza is inevitable and historically has occurred at intervals of 10 to 50 years. Avian influenza pandemic has been documented since the 16th century, and in the last 400 years, at least 31 pandemics have been recorded (Kamps et al, 2006). It was first recorded in Italy over 100 years ago (precisely in 1878) as the cause of massive poultry epidemics, the disease was then known as “Fowl Plague”. During the 20th century, three influenza pandemics caused widespread morbidity and mortality in humans (Table 1.2) (Peiris, et al, 2007). Historically, influenza pandemics have differed from each other in etiology, epidemiology, and severity. Their mortality ranged from devastating to moderate or mild.

The largest most devastating outbreak of the disease in modern history occurred in 1918 when the pandemic influenza A (H1N1) virus of apparently avian origin caused an estimated 50-100 million deaths worldwide based upon a case fatality of approximately 2% with most deaths occurring in developing nations (Snacken, Kendal, Haaheim, and Woods, 1999). The virus was exceedingly virulent, a situation where those who were affected became very sick, many dying the same day as the first symptoms presented. Of those who did not die in the first few days, a high proportion succumbed later to flu-related complications, such as pneumonia. High infection rates and mortalities were especially common among otherwise healthy adults aged 20-50 years. High risk groups, such as the elderly and young children, also had high infection rates and mortalities. No subsequent influenza pandemic has been caused by a virus as virulent as the 1918 influenza A virus (Snacken, et al, 1999).

The 1957 'Asian Flu' (H2N2) occurred about 40 years after the Spanish flu pandemic. It caused an estimated 4 million excess deaths worldwide with most excess deaths confined to infants and the elderly. By this time, science and technology had advanced significantly and it was discovered that HA and NA antigens that caused this pandemic were completely different from the antigens of the 1918 influenza virus. Science and technology advancements also enabled scientists to start developing an appropriate vaccine against this disease in 1957. The virus was believed to have emerged through genetic re-assortment between low pathogenic avian and human influenza A viruses (Peiris, Yu, Leung, Cheung, Ng, Nicholls, Ng, Chan, Lai, Lim, Yuen, and Guan 2004). Attack rates during this pandemic were greater than 50% and it was prominent among school children (aged 5 -19 years) who spread the virus to their classmates. The infected children also carried the virus back to their families. The second wave of the illness occurred in February, 1958 among the elderly. Prolonged illnesses led to reoccurring outbreaks and more deaths (Peiris et al, 2004).

The 1968 'Hong Kong Flu' H3N2 pandemic was milder, and caused an estimated one million deaths (Peiris et al, 2007). The outbreak developed slowly and became a pandemic in early December of 1968. Similar to the previous pandemic, school children suffered the highest attack rate. However, fewer people died during this pandemic compared to the previous attacks. This was due to the following reasons:

(1) Improved medical care that gave vital support to the affected persons.

(2) The availability of antibiotics that was more effective against secondary bacterial infections

(3) The severity of the illness was probably reduced among many people because they retained antibodies against the influenza antigens in their system from the 1957 influenza pandemic.

The 1968 (H3N2) pandemic was believed to have arose through the acquisition of a novel HA (H3) virus from an avian source (Peiris et al, 2007) and both first emerged from South East Asia (Tran-Tinh, Hein, de Jong and Jeremy, 2004; Taronna, Chen, Matsuoka, Chen, Rowe, Orthin, Falcon, Hien, Mai, Sedyaningsih, Harun, Tumpey, Donis, Cox, Subbarao, and Katz, 2006). See Table 2.2 for details.

TABLE 2.2: Antigenic shifts and pandemics in the 20th century

Year	Designation	Resulting Pandemic	Death Toll*
1889	H3N2	Moderate	?
1918	H1N1 (Spanish flu)	Devastating	50-100 million
1957	H2N2 (Asian flu)	Moderate	4 million
1968	H3N2 (Hong Kong flu)	Mild	1 million

*Death toll in human population

Historically, avian influenza viruses rarely occurred in humans. When they did occur, they caused only mild illness, usually viral conjunctivitis, followed by a full recovery (Ligon, 2005). The H5N1 has proven to be an exemption. In May 1997 the Government Virus Unit in Hong Kong isolated influenza A virus from a three year old child who was admitted to a hospital with fever and respiratory symptoms. This child later died of acute respiratory disease. Later, the National Influenza Centre in the Netherlands identified the virus that caused the child's death as an influenza A H5N1 subtype (Porter, 2001). Molecular analysis established that the influenza A viruses were avian in origin and that genetic re-assortment had not occurred. During this time, the same virus was isolated from asymptomatic ducks and geese in local live bird markets (Porter, 2001).

The current HPAI H5N1 virus outbreak occurring after the 1997 case in Hong Kong is unprecedented in scale and geographic distribution. These viruses are panzootic across three continents, leading to huge economic losses, and have affected humans with lethal consequences (Peiris et al, 2007). The possibility of a new type of pandemic influenza due to a mutated strain of influenza, particularly H5N1 is therefore a source of concern because of expansion of intensive poultry husbandry, which is the fastest growing livestock industry globally, with an estimated 16 billion chickens and 1 billion ducks worldwide; the situation is likely to facilitate increased frequency and scale of HPAI virus outbreaks (Malik, Peiris, de Jong, and Guan 2007).

Influenza pandemics circulate around the globe in successive waves, and there is no way to prevent the spread of a new pandemic influenza virus. The new viral strain will eventually reach everywhere, and will infect practically every human being within a period of a few years. The outbreak of avian influenza virus (H5N1) among birds with occasional transmission to human beings is of major concern because of intriguing parallels between the H5N1 virus and the 1918 influenza strain (Kamps et al, 2006).

The threat that highly pathogenic avian influenza virus subtype H5N1 poses to poultry and public health has become heightened. This is so because as the virus becomes established in poultry populations in developing countries the number of human cases increases (Biswas, Jens, Syed, Himel, Ashutosh, Mohammed, Mohammed, Abu, Rahman, and Nitish, 2008). Mortality rate due to avian influenza differs across demographic groups and among strains of influenza virus (Bansal, Babak and Lauren, 2006). According to the WHO, from November 2003 through December 2007, 349 human H5N1 cases occurred and were reported from the following 14 countries; Azerbaijan, Burma, Cambodia, China, Djibouti, Egypt, Indonesia, Iraq, Laos, Nigeria, Pakistan, Thailand, Turkey, and Vietnam. There was an overall case fatality proportion of 62% for the current outbreak of the disease in these countries (Li, Choi, Sly, and Pak, 2008). The cumulative number of cases and deaths from avian influenza disease from 2003 to 2009 is shown in Table 2.3.

TABLE 2.3: Cumulative Number of Confirmed Human Cases of (H5N1) Reported to WHO as at 5 February, 2009.

Country	2003		2004		2005		2006		2007		2008		2009		Total	
	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	8	5
Bangladesh	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Cambodia	0	0	0	0	4	4	2	2	1	1	1	0	0	0	8	7
China	1	1	0	0	8	5	13	8	5	3	4	4	7	4	38	25
Djibouti	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Egypt	0	0	0	0	0	0	18	10	25	9	8	4	3	0	54	23
Indonesia	0	0	0	0	20	13	55	45	42	37	24	20	0	0	141	115
Iraq	0	0	0	0	0	0	3	2	0	0	0	0	0	0	3	2
Lao PDR	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2	2
Myanmar	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Nigeria	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1
Pakistan	0	0	0	0	0	0	0	0	3	1	0	0	0	0	3	1
Thailand	0	0	17	12	5	2	3	3	0	0	0	0	0	0	25	17
Turkey	0	0	0	0	0	0	12	4	0	0	0	0	0	0	12	4
Viet Nam	3	3	29	20	61	19	0	0	8	5	6	5	0	0	107	52
Total	4	4	46	32	98	43	115	79	88	59	44	33	10	4	405	254

Source: WHO (2009).

Note: Total number of cases includes number of deaths.
WHO reports only laboratory-confirmed cases.

Human H5N1 cases have been observed to increase towards the end of the year and during the early months of the subsequent year, during periods of relatively cooler temperatures and lower humidity, and in association with increases in H5N1 poultry outbreaks. However, this observed seasonality of human H5N1 cases does not apply to some countries with H5N1 viruses circulating widely among backyard poultry (Timothy, 2008).

The epidemiological characteristics of the H5N1 virus have changed significantly since the time of the 1997 Hong Kong epizootic (Chotpitayasunondh, Ungchusak, Hanshaoworakul, Chunsuthiwat, Sawanpanyalert, Kijphati, Lochindarat, Srisan, Suwan, Osotthanakorn, Anantasetagoon, Kanjanawasri, Tanupattarachai, Weerakul, Chaiwirattana, Maneerattanaporn, Poolsavatkitikool, Chokephaibulkit, Apisarnthanarak, and Dowellet, 2005). A review of 256 H5N1 cases by WHO found that the median age was 18 years (range 3 months to 75 years), 89% of cases were aged < 40 years old, the median duration from illness onset to hospitalization was 4 days, mortality was highest among cases aged 10 to 19 years, and the median duration from illness onset to death was nine days (range 2–31 days) (Timothy, 2008). The reasons for the variation in nature and severity of the disease by age are unclear (Endang, Siti, Vivi, Lutfah, Syahrial, Wilfred, Sardikin, Patrick, Shanon, Timothy, and Soendoro, 2007). It is not known whether, and to what extent, genetic composition plays a role in the susceptibility and resistance to infection with H5N1 influenza virus (Kamps et al, 2006).

Indonesia and Vietnam have the highest number of human cases and deaths in the world, with Indonesia having 87 deaths out of 108 cases (or a case fatality rate of 80%) and Vietnam with 46 deaths out of 100 cases; a case fatality rate of 46% (Balkhy, 2008).
Mortality rates have been highest among infants and young children. A case fatality rate of 89% was reported among patients aged 15 years or younger in Thailand, with death occurring approximately within 9-10 days following onset of illness (range 6-30 days) (Beigel, Farrar, Han, Hayden, Hyer, de Jong, Lochindarat, Nguyen, Nguyen, Tran, Nicoll, Touch, Yuen, and WHO, 2005). The cause of death is usually respiratory or multi-organ failure. The cases had a history of close contacts with poultry or wild birds, and they live in some of the poorest areas of the world (Simona, Livia, Concetta, Laura, Maria, Marco, Ilaria, Jean, Maria, and Isabella, 2005).

Influenza viruses are normally highly species-specific, meaning that viruses that infect an individual species (humans, certain species of birds, pigs, horses, and seals) stay "true" to that species, and only rarely spill over to cause infection in other species. Since 1959, instances of human infection with an avian influenza virus have occurred on only 10 occasions. Of the hundreds of strains of avian influenza A viruses, only four are known to have caused human infections. They are H5N1, H7N3, H7N7, and H9N2. In general, human infections with these viruses have resulted in mild symptoms and very little severe illnesses, with the highly pathogenic H5N1 virus being a notable exemption (CDC, 2007).

Widespread outbreaks of avian influenza in domestic fouls throughout Eastern Asia have re-awakened concern that the disease may again cross species barriers to infect the human population and so cause a pandemic with the continuous occurrences of bird- to-human transmissions increasing the opportunity of the virus to adapt to humans and acquire the ability to spread between humans (de Jong and Hien, 2006). Of all influenza viruses that circulate in birds, the H5N1 virus is of greatest concern for human health for two main reasons. First, the virus has caused by far the greatest number of human cases of very severe disease and the greatest number of deaths. It has crossed the species barrier to infect humans on many occasions in recent years (Park, 2007).

The second implication for human health is the risk that the H5N1 virus will develop the characteristics it needs to start influenza pandemic if given enough opportunities (Altiok, Taylan, Yemen, Demirkeesser, Bozaci, and Onel, 2006). In order to become a pandemic strain, an influenza virus must comply with a series of requirements and H5N1 virus has met all the prerequisites for the start of a pandemic. The only criterion it has not met is the ability to spread efficiently and sustainably among humans (WHO, 2005a). The prerequisite for success is good adaptation to human cells, the capability to take over the production machinery of the host cell to produce new off-springs; as well as making the individual cough and sneeze to spread the off-spring viruses. Unfortunately, the capability for efficient human-to-human transmission requires only a single mutation by a virus that is notoriously genetically unstable (Donald and Craig, 2004).

While H5N1 is presently the virus of greatest concern, the possibility that other avian influenza viruses, known to infect humans, might cause a pandemic cannot be ruled out because the viruses are known to have an unstable character, with the ability to acquire new genetic material from other influenza viruses of similar or different serotypes, thus giving rise to new strains of influenza viruses with different genetic material. Such phenomena has been recognised for many years, and it is known to be responsible for the cyclical episodes of trans-continental outbreaks of influenza that have taken place (Andrez, Rajesh, Thomas and Larry, 2004; Hanan, 2008). The H5N1 bird flu incident in Hong Kong in 1997 was the first known instance of a purely avian virus causing severe human disease and death, with 18 human cases and 6 deaths (Lin, Shaw, Gregory, Cameron, Lim, Klimov, Subbarao, Guan, Kraus, Shortridge, Webster, Cox and Hay, 2000). The slaughter of all (1.5 million) poultry in the farms and markets in Hong Kong aborted this outbreak. This virus was in fact a reassortant virus (Peiris et al, 2007).

A limited number of possible human-to-human transmissions of avian influenza H5N1 have been reported, which involved prolonged, close and unprotected contact with infected patients (Peiris et al, 2007). Similar to human influenza, droplet and contact transmissions are probably the most effective means of transmission of avian influenza virus between humans, should the virus acquire the ability for efficient spread, but airborne transmission remains a possibility (de Jong and Hien, 2006).

At this junction the avian influenza disease outbreak in Nigeria will be reviewed. Ducatez et al, (2006) observed in a study that as the avian influenza H5N1 virus swept from Asia through Russia to Europe Africa seemed to have been spared until January 2006. In January 2006 a commercial poultry farm with a bird population of 40,000 in Jaji town, Kaduna State (Northern Nigeria), reported high mortality of birds due to the highly pathogenic AI virus. After then, the disease has spread within the poultry population to nearly all parts of the country (26 of the 36 States) (Aiki-Raji, Aguilar, Kwon, Goetz, Suarez, and Jethra, 2008; Joannis, Meseko, Oladokun, Ularamu, Egbuji, Solomon, Nyam, Gado, Luka, Ogedengbe, Yakubu, Tyem, Akinyede, Shittu, Sulaiman, Owolodun, Olawuyi, Obishakin, and Fashina, 2008; Isabella, Tony, Alice, Paola, Lami, Husseini, Anthony, Poman, Tim, Giovanni, and Ilaria, 2008). The details of the avian influenza outbreak distributions are contained in appendix 1.

The avian influenza outbreak resulted in the death or depopulation of about 1.5 million birds, threatening to destroy poultry farming which is one of the most important industries in the country that provides both high quality animal protein for human consumption and secure jobs for an impoverished population (Fatiregun and Saani, 2007). The clusters of avian influenza outbreaks in birds in Nigeria included areas where humans live in close proximity to poultry. In theses affected areas in Nigeria live poultry markets and backyard chicken farming are particularly prevalent. Situations such as these make direct transmission from birds to humans more likely (Jang-Pin, 2005).

It has been speculated that illegal trade in poultry or poultry products, the trade in wild birds, movement of free-grazing domestic ducks or irregular movements of wild birds may have led to the introduction of the virus into Nigeria (Kilpatrick, Chmura, Gibbons, Fleisher, Marra, and Daszak, 2008; Milan, 2006). The peculiarity of the geographical location of Nigeria calls for concern with respect to the spread of the virus. In addition, major wetland and Fadama sites exist in the country where free-flying wild birds nest and or rest, and live poultry markets flourish (Baba, 2006).

The Avian influenza situation in Nigeria became very worrisome when the Nigerian government announced the first human fatality case of the disease involving a 22 year old lady in Lagos State (South West Nigeria) in January 2007 (Fatiregun and Saani, 2007).The test conducted on the lady confirmed positive by WHO in February 2007 (UNICEF, 2007). After the initial outbreaks of avian influenza in poultry in 2006, Nigerian authorities adopted aggressive control measures in their response to the detection of H5N1 by quarantining affected farms, destroying suspected infected birds, and testing poultry and people who have close contact with poultry on commercial farms. Officials also launched public information campaigns providing safety and education messages about bird flu and advising the public to report bird deaths. The government reportedly compensated some farmers for losses due to H5N1 control measures (Erin, et al, 2006).

In addition to the aforementioned measures, United States Agency for International Development (USAID) worked with the United State Department of Agriculture (USDA) and other organizations to respond to H5N1 in Nigeria and deployed thousands of Personal Protective Equipment (PPE) sets for surveillance and culling purposes and also supported communications or public awareness efforts in the country (Emma, Susan, Thomas, Hannah, Hussein, Kim, George, Mari-Jana, Oboroceanu, and Barbara, 2007). The USAID disseminated more than 25,000 public awareness tool kits and supported the reproduction of these kits in sub-Saharan Africa. The kits included key messages and educational materials for preventing the spread of H5N1 in animals and for limiting human exposure (Emma, et al, 2007)

The threat of avian influenza is grievous in Nigeria considering the limited access to water and sanitation facilities, especially in the rural areas, inadequate hygiene education, the large non-commercial or backyard poultry population and the preponderance of human interaction with wild birds both for trading and as pests (UNICEF, 2007). The outbreak in Nigeria is also notable because Nigeria is the most populous country in Africa and because health authorities view it as the likely source of H5N1 detected in poultry in Niger and Cameroon (Emma, et al, 2007).

The nutritional consequences of avian influenza can be devastating (Obayelu, 2006). This is the case in Nigeria as the outbreak of HPAI threatened to destroy poultry farming which has an estimated poultry population of 159 million birds (60% backyard); and one of the most important industries in the country. The severity of this disease in affected individuals varied from moderate to very high with a ceiling of between 75 and 100 % mortality in chickens and turkeys respectively (Kazeem, Adene, Saidu, Abdu, Wakama, Kwanashie, Mamman, Adamu, Fatihu, and Joannis, 2008).

The challenges of avian influenza infection outbreak

The challenges posed by avian influenza infection can be categorized, for convenience into health, economic and social challenges. The actual and potential challenges of the disease will be reviewed in this section starting with the health-related consequences.

Health- related challenges

The bulk of human cases so far due to HPAI are thought to be the result of transmission of the virus from animals to humans. There is great concern however that genetic changes will allow the H5N1 virus to achieve the capacity for efficient and sustained transmission among humans, leading to a human influenza pandemic (World Bank, 2005; Claudia and Gustavo, 2005).

A major potential health challenge resulting from the direct natural infections of humans with avian influenza viruses is that pandemic viruses could emerge without an intermediate host (Andrez, Rajesh, Prabhu, Thomas, Smith and Larry, 2004; Lain and Jane, 2006). There are two mechanisms by which this could occur: by genetic re-assortment or by progressive adaptation. The first case would occur if a person is simultaneously infected with an avian influenza virus and a human influenza virus. In this case, through genetic re-assortment the potential emergence of a virus fully capable of spread in the human population, could occur, resulting in a true human influenza pandemic (WHO, 2008). The second mechanism by which the generation of a pandemic virus may occur is through progressive adaptation of a virus entirely of avian origin whereby the capability of the virus to bind to human cells increases during subsequent infections of humans (Capua and Alexander, 2006). Further, mutation of such circulating influenza (H5N1) viruses might enhance their adaptation to other hosts.

Due to the fact that all influenza viruses have the ability to change, scientists are concerned that H5N1 virus might one day be able to infect humans and spread easily from one person to another. Since these viruses do not commonly infect humans, there is therefore little or no immune protection against them in the human population (Monto, Lorraine, David and William, 2006). If H5N1 virus were to gain the capacity to spread easily from person to person, an influenza pandemic could begin (Balkhy, 2008).

Given the current high level of virulence of the H5N1 virus in humans, human mortality worldwide from a pandemic strain of the H5N1 virus could reach levels as high as 180–360 million people (Osterholm, 2005). Although there appears to be marked parallels in the clinical presentations of fatal cases of the H5N1 bird flu and 1918 Spanish Flu, the age-specific mortality profiles for these two viruses is markedly different. The peak mortality from the 1918 Spanish Flu was concentrated among infants, the elderly, and individuals in the 25–35-yr age range (Taubenberger and Morens, 2006), whereas peak mortality among victims of the H5N1 bird flu occurs among individuals in the 10–19 year age cohort.

Taubenberger and Morens, (2006) observed that this difference in age-specific mortality rates is significant in view of the potential differences in terms of the generally higher relative and absolute numbers of individuals within younger age cohorts of developing countries of Asia and Africa, where the highest rates of human mortality from avian influenza infections have been recorded.

The signs and symptoms of avian influenza are extremely variable. In many patients, H5N1 induced influenza follows an unusually aggressive clinical course with rapid deterioration and high fatality (Guan, Poon, Cheung Ellis, Lim, Lipatov, Chan, Sturm-Ramirez, Cheung, Leung, Yuen, Webster and Peiris, 2004). Symptoms have ranged from typical human influenza-like symptoms such as fever, cough, sore throat and headache to eye infections, pneumonia and severe respiratory diseases (Acute Respiratory Distress Syndrome) (Mo and Espinoza, 2006; WHO, 2008).

All patients in South-East Asia have had a high fever greater than 38ºC (Abdel-Ghafar, Chotpitayasunondh, Gao, Hayden, Nguyen, de Jong, Naghdaliyev, Peiris, Shindo, Soeroso, and Uyeki, 2008); watery diarrhoea (without blood) has been described in 25-70% of cases. Indeed, gastrointestinal complaints may precede respiratory symptoms by up to one week complicating early clinical diagnosis (Erin et al, 2006).

Severe lower respiratory symptoms tend to develop within about five days from the onset of first symptoms necessitating mechanical ventilations within days of admission to hospital (Ilaria and Capua and Alexander, 2007). Respiratory distress, tachypnoea, and inspiratory crackles are common findings on examination. Other severe and life-threatening complications like diarrhoea, vomiting, abdominal pain, chest pain, and bleeding from the nose and gums occur in some patients. Watery diarrhoea without blood appears to be more common in H5N1 avian influenza than in normal seasonal influenza (Kamps, et al, 2006).

Respiratory distress, a hoarse voice, and a crackling sound when inhaling are commonly seen. Sputum production is variable and sometimes bloody. Most recently, blood-tinted respiratory secretions have been observed in Turkey. Almost all patients develop pneumonia. During the Hong Kong outbreak, all severely ill patients had primary viral pneumonia, which did not respond to antibiotics (WHO, 2008).

The spectrum of clinical symptoms may, however, be broader. Most cases so far identified have been in previously healthy children and young adults (Sardikin, Rismali, Sri, Dewi, Fitryani, Ib-sila, Adria, Sondang, Susi, Tuti, Rinaldi, Tony, Elly, and Iman, 2008).

The incubation period for H5N1 avian influenza may be longer than for normal seasonal influenza, which is around two to three days. Current data for H5N1 infection indicate an incubation period ranging from two to eight days and possibly as long as 17 days (Peiris et al, 2007). However, the possibility of multiple exposures to the virus makes it difficult to define the incubation period precisely. Viral shedding of influenza in adults can extend for seven days after symptom onset and for weeks in infants and immunecompromised individuals (Anucha, David and Victoria, 2007). The WHO (2007b) has therefore recommended that an incubation period of seven days be used for field investigations and monitoring of patient contacts. On presenting evidence, difficulty in breathing develops around five days following the first symptoms.

The H5N1 virus has been recovered from many different body tissues, such as the lungs, brain, large intestine, small intestine, cerebrospinal fluid, kidney, spleen, liver, pharynx, blood, and placenta. The in-utero transmission of H5N1 from mother to fetus has also been reported (de Jong and Hien 2006; Gu, Xie, Gao, Liu, Korteweg, Ye, Lau, Lu, Gao, Zhang, McNutt, Anderson, Gong, Yu, and Lipkin, 2007; Ng and To, 2007). Fatal atypical human H5N1 infections involving only gastrointestinal and neurological symptoms have been documented from patients in Vietnam and Thailand (Apisarnthanarak et al. 2004; de Jong, Bach, Phan, Vo, Tran, Nguyen, Marcel, Le, Truong, Nguyen, Tran, Do, and Jeremy, 2005). Asymptomatic human infections with H5N1 have been reported from China, Vietnam, Japan, and Korea.

In view of the non-specific nature of avian influenza illness, the disease cannot be diagnosed by symptoms alone. Specialized laboratory confirmation through Polymerase Chain Reaction (PCR) testing is required for early detection of an outbreak (Hanan, 2008). Avian influenza is usually diagnosed by collecting a swab from the nose or throat during the first few days of illness. This swab is then sent to a laboratory, where laboratory scientists either look for avian influenza virus or grow the virus (Tran Tinh, Menno, and Jeremy, 2004). It may be difficult to find an avian influenza virus directly from the swab if it is taken late in the illness. When assessing possible cases of avian influenza, the level of clinical suspicion should be heightened for persons showing influenza-like illnesses, especially those with fever and symptoms in the lower respiratory tract, who have a history of close contact with birds in an area where confirmed outbreaks of highly pathogenic avian influenza are occurring (Andrew, Park, and Kathryn, 2007).

Livestock represents an important source of high quality animal proteins, providing about 36.5% of the total protein intake of Nigerians (Barwa, 2009). Despite this level of contribution, it is still very deficient in playing the primary role of satisfying the protein requirements of Nigerians. There is gross animal protein malnutrition in the country, which is quite evident among infants and pregnant women (Orewa and Charles, 2010). One of the quickest ways to attain the minimum protein requirement is to raise poultry since chicken are easy to raise among the animals producing protein, because of their short generation interval, fast growth rate and the efficiency in converting feed to meat and egg (Anaeto and Chioma, 2007).

Current estimates indicate that the daily animal protein consumption of Nigerians that is considered necessary for overall good health is far below the amount recommended by the Food and Agricultural Organization (FAO) (Omotesho, Joseph, Apata and Muhamma-lawal, 2009). An average Nigerian consumes only about seven grams of animal protein per day as against the minimum requirement of 28 grams per day. This represents a gross short fall of 75% (Anaeto and Chioma, 2007).

Economic Challenges

The accurate assessment and mapping of the potential economic and public health risks associated with avian influenza outbreaks is currently constrained by uncertainties regarding key aspects of the ecology and epidemiology of avian influenza viruses in birds and humans (Dudley, 2008). One main set of economic effects result from the morbidity and mortality among humans and the impact of this phenomenon on the potential output of the economy (Karima, Nigmatulina and Richard, 2009; Verne, Vanessa, Drake, Shirley and Theresa, 2010). The mortality resulting from influenza could be very huge (Verbiest, and Castillo, 2004; Fasina, Sirdar, and Bischop, 2008). A World Bank report has stated that a severe flu pandemic may cost the world a whooping 1.2 million US Dollars and may also result in the death of about 70 million people (Anaeto and Chioma, 2007).

The livestock sector, especially poultry, plays a very important economic role within the resource poor populations of the developing nations of the world. It provides food (animal protein), income, employment and foreign exchange for countries that trade their animals and animal products (Sonaiya, Branckaert and Gueye 1999; McDermott, Coleman & Randolph 2000; FAO 2002).

Several types of economic impact or cost of avian influenza outbreak can be distinguished. The impact of HPAI is generally felt throughout the chain from producer, processor to consumer (Jonathan, Rommy, Emmanuelle and Anni, 2006). Highly pathogenic avian influenza, like other highly contagious animal diseases, affects animal production via three main pathways. Firstly, the disease causes direct losses to producers and other actors connected to the production and marketing of poultry through morbidity and mortality of birds and the private costs associated with risk mitigation (e.g. investment in animal housing) and coping measures during periods of downtime and the need to reinvest in replacement birds (Capua and Alexander, 2006).

Secondly, animal diseases that are 'notifiable' can have severe impacts through government intervention, which carries a cost borne by the public at large and affects producers (and associated up and downstream actors), irrespective of the disease status of their flocks. These costs include public investment in animal health infrastructure and epidemic preparedness (Otte et al, 2008).

Thirdly, disease impacts arise through market reactions, which can be particularly severe on the demand-side in the case of diseases that are associated with a public health risk. Market reactions can occur, irrespective of whether or not avian influenza has actually occurred in the country (Otte et al, 2008). During the avian influenza disease outbreak in Nigeria, egg and chicken sales declined by >80% within two weeks after the announcement of the outbreak; 4 months later, sales were still <50% of baseline (Breiman, Nasidi, Katz, Njenga, and Vertefeuille, 2007). This situation undoubtedly has implications for the nutritional status of affected areas.

According to FAO, over 200 million poultry have died or been culled since the end of 2003, mostly in East Asia (Milan, 2006). Culling birds in order to eradicate or control the spread of the disease has negatively affected the livelihoods of all classes of poultry owners and producers. Such an impact is most serious on the smaller family operated commercial producers for whom poultry production is their sole source of income generation (United Nations Development Programme, (UNDP) Nigeria, 2006). Effect of avian influenza on the economy, where market is lost through the reduced ability to export, restriction of movement of birds and the closure of some domestic markets is especially the constraint which affects the income generating ability of smaller producers (Meltzer, Cox and Fakuda, 1999).

The reduction in the consumption of poultry meat as well as its products has also affected animal protein intake of a large sector of the population. The most pronounced effect is the sharp decline in demand as people avoided eating poultry products out of fear of being infected, (WHO, 2004). In Romania, for example, which suffered over 100 avian influenza outbreaks, domestic poultry sales fell by 80%, bringing many producers to the verge of bankruptcy.

In France, Europe's leading poultry producer, those hit by lower poultry demand reportedly lost 40% of their income in the first quarter of 2006. The German poultry industry was reported to have lost more than 140 million Euros since 2005 autumn. The poultry feed sector in Europe, which accounts for a turnover of 42 billion USD, has been hit by the avian influenza crisis, with a 40% reduction in demand for poultry feed in some European Union countries (Milan, 2006).

In the six most severely affected countries, like China, Cambodia, Indonesia, Lao Peoples Democratic Republic, Thailand and Vietnam, direct economic costs have included losses of poultry due to the disease and to control measures such as culling birds, with impacts extending not only to farmers but also to upstream and downstream sectors such as poultry traders, feed mills and breeding farms (World Bank, 2005; FAO, 2009b). The largest declines have occurred in Vietnam and Thailand, where they were equal to 15-20% of the stock of poultry (Milan, 2006).

The size of the poultry sector in the national economies of the region before the epidemic ranged from around 0.6 percent of GDP at the low end in countries like Vietnam and Thailand, to a high of a little over 2 percent in the Philippines, with most countries centering a little over 1 percent of GDP. In an economy like Vietnam, where poultry output was down by around 15 percent, this part of economic loss was worth about 0.1 percent of GDP (Milan, 2006).

Additional losses have occurred because of lower egg production and reduced activity in distribution channels. The costs of prevention and control also need to be taken into consideration, including costs to the government of purchase of poultry vaccines, medications and other inputs, hiring workers for culling, cleanup, surveillance and diagnosis, and so on. These direct losses may likely cost 0.1-0.2 percent of GDP in an economy like Vietnam (Milan, 2006).

Early estimates in Thailand suggested that as much as 1.5% of GDP growth over a year was lost to the outbreak (FAO, 2005). Of the worst infected countries, only China and Thailand are notable poultry meat exporters. As a result of HPAI, Thailand lost its position as the world's 5th largest exporter of poultry meat. By switching to processed poultry meat, the country has however regained most of its export value, but it is at a risk of permanently losing the export market for fresh poultry meat (NaRanong, 2007).

Bans on the importation of poultry products from countries affected by Avian influenza outbreaks since 1997 have resulted in economic losses that may be as high as U.S. $50 billion, and reports by Dudley, in 2008 indicate that at least one billion domesticated fowl, such as, chickens, ducks, geese, turkeys, ostriches, quail, pheasants, and peafowl, have been killed or culled in conjunction with outbreaks of highly pathogenic avian influenza (HPAI) outbreaks in poultry worldwide since 1997 (Dudley, 2008).

Impact of the 2003-2004 outbreaks varied along the market chain. Industrial chains suffered mainly from export loss. Large commercial producers specializing in poultry serving domestic markets suffered from temporary loss of consumer confidence and preference for other types of protein (Obayelu, 2006). Small commercial and backyard producers lost the least in absolute terms but the most relative to their assets and income.

The cost of compensation which does not represent a separate disease 'cost' but is a transfer payment, which, 'redistributes' disease costs between affected and non-affected farmers and between the private and public sector, is an important factor in persuading poultry owners not to conceal outbreaks of avian flu infections in their farms. This cost is borne by the Government (Federal Republic of Nigeria, 2006). The cost of compensation has been estimated to lead Nigeria government to reductions of GDP between 0.1-0.2 percent where N250 was paid as compensation for every culled chicken by government to affected poultry keepers (Anaeto and Chioma, 2007; UNDP Nigeria, 2006). See details in Table 2.4.

TABLE 2.4: Rates of compensation approved for poultry farmers in Nigeria.

	Type of Birds	**Compensation paid/bird (Naira)**
1.	Ostrich	20,000
2.	*Emu**	10,000
3.	Turkey	2,500
4.	Duck	1,000
5.	Goose	1,000
6.	Chicken	250

Source: UNDP NIGERIA, 2006.

**Dromaius novachollandiae*

The cost of prevention and control, including costs to the government of purchase of poultry vaccines, medications and other inputs, hiring of workers for culling, cleanup, surveillance, and diagnosis, can be very enormous (Milan, 2006). Strong control measures, like culling of infected birds have resulted in huge economic costs in many countries though it has also reduced further outbreaks of the disease. Export markets are usually lost during the outbreak of avian influenza. For example Thailand, which is the only large exporter of poultry in East Asia, experienced a sharp 40% fall in poultry exports in 2004 due to import restrictions in foreign markets on its uncooked, poultry exports (Council for Agricultural Science and Technology (CAST), (2006).

On tourism, avian influenza outbreak could have a much bigger macro-economic impact if there is a fall in international tourism to infected countries because of travel restrictions, as happened during Severe Acute Respiratory Syndrome, (SARS) (Kuo, Chang, Huang, Chen and McAleer, 2007). A World Bank study assumes 20% declines in demand for tourism, transportation and other key services could lead to a loss of 2% of GDP for the world as a whole which represents about 800 billion dollars over a whole year (Fawzi, 2007).

There are also secondary impacts related to sharp shifts in market demand which results primarily from spontaneous efforts by consumers to reduce their subjective or perceived probability of becoming infected, as well as from trade restrictions on poultry trade imposed by governments seeking to prevent the transmission of the disease (Anni, Nancy, Adam, Jan and FAO, 2007).

Poultry production in developing countries is usually heterogeneous, with the use of different species, different production and marketing systems and the provision of a range of products and services. Typically, poultry is an integral feature of smallholder agriculture, where the majority of households keep a small flock of “indigenous’, dual-purpose (meat and eggs) birds to meet household consumption needs, social obligations and minor cash expenses (UNDP Nigeria, 2006).

In order to appreciate the grave danger posed by uncontrolled avian influenza infection to the well-being of humans in Nigeria, it is pertinent to highlight the importance of poultry products to the Nigerian population and economy before examining the impact of a likely epidemic. The estimated net worth of the poultry sector is about N30 billion and its contribution to the livestock sub sector is put between 9 and 10 percent. Nigeria has the biggest national poultry population in Africa estimated to be about 104 million (Bourn, Wint, Blench and Woolley, 1994) of which only 10% is of exotic breeds kept on commercial farms, mostly around cities in the southern parts, and smaller flocks throughout the country. The rest constitute village chickens of local breeds as free roaming backyard poultry which are of scattered populations and typically are non-descript in type because of indiscriminate interbreeding, although they are hardy and well adapted to their local environment (Baba, 2006).

Majority of Nigerians reside in the rural areas and are engaged in one form of agricultural practice or another, including poultry. The agricultural sector generates employment for over one third of the labour force, contributes about 30% of the GDP and contributes around 80% of non-oil exports (Central Bank of Nigeria, 2004). The Nigerian poultry industry thus ranks second in importance to petroleum, the country’s major source of income (Ducatez, Olinger, Owoade, Delandtsheer, Ameerlaan, Niesters, Osterhaus, Fouchier and Muller, 2006). Apart from providing important occupation and hence a great source of income, poultry is a major source of protein for the entire population (UNDP Nigeria, 2006). Thus, both the productive and consumptive patterns of the rural and urban poor in Nigeria are at risk in the event of a virulent outbreak of avian influenza disease (Obayelu, 2006).

In Nigeria, the outbreak of bird flu has thrown the poultry industry into a crisis as poultry farmers have been affected negatively by the outbreak (Obayelu, 2006). The flu outbreak brought an abrupt surge in illness and deaths of more than 400,000 birds in Nigeria (Obayelu, 2006). Even this number represents an under-estimation of actual bird loss.

Currently, the layer industry has lost about $60 million as a result of H5N1 between January and August, 2006. Nigeria's gross national income was $55.9 billion and the gross domestic product was $72.1 billion as at 2004 (World Bank, 2006). This figure is a huge economic loss by any assessment. An epizootic of high magnitude in poultry would have negative economic and nutritional effects on Nigeria because Nigeria's poultry sector accounts for 30% of its gross domestic product and a substantial proportion of the protein ingested by its 132 million people (Obayelu, 2006).

An assessment conducted by UNDP Nigeria, (2006) showed that the greatest adverse effect of avian influenza was in impoverished areas like rural and semi-urban Nigeria, affecting especially backyard and medium-scale farmers. Poultry is important to the rural poor since it is the most widespread form of livestock in Nigeria that the poor rural individuals can afford to keep as a source of income and assets (UNDP Nigeria, 2006).

Interestingly, the most immediate economic impact arose not from actual deaths or sickness of birds but from the uncoordinated efforts of people to avoid becoming infected. Thus, the socio-economic effects of avian influenza were not limited to disease affected farms; non affected farms also suffered from demand shock in terms of consumer's reactions to the announcement. This was shown by an immediate decline in chicken consumption as many people would rather eat fish or beef causing the price of beef and other livestock to escalate, to avoid being exposed to the risk of contracting the disease, even in areas where the disease was not reported among poultry (UNDP Nigeria, 2006; Robert, Nasidi, mark, Katz, Kariuki and Vertefeuille, 2007).

In addition, the closure of affected farms resulted in unemployment especially among many small scale poultry operators and medium sized commercial chicken producers who constitute the bulk of poultry producers in the country (UNDP Nigeria, 2006). Many people who had borrowed money to fund their poultry production business went bankrupt due to the reduction in the prices of poultry products and destruction of suspected birds. There was excess supply of poultry products compared to demand which lead to a drop in prices of poultry products. The flu outbreak also affected investor's confidence which will have a long-term consequence on national economic growth (Obayelu, 2006). Even though the large commercial farmers have suffered greater losses in terms of mortality of birds and generally reduced income, they appeared to be better placed to withstand the shocks of this epidemic and to rebuild their businesses faster than the poor subsistence farmers and the small or medium backyard producers (Milan, 2006). For most rural households, the bird mortalities and the price crash arising from the HPAI outbreaks are likely to have a deep and long lasting impact (Robert et al, 2007; Otte, et al, 2008).

Social Challenges

The threats posed by infectious diseases are being amplified by social, behavioural and environmental factors (David, 2005). In the rural areas, poultry is the most important source of quick money for addressing emergencies, for meeting family education needs, medical expenses, and for meeting a variety of social needs such as hospitality to visitors, clothing needs, social and religious festivities, prestige, and psychological, values (Timothy, Obi, Olubukola and Ahmed, 2008; Moreki, Dikeme, and Poroga, 2010).

Avian influenza appears to cause extreme forms of anxiety because of its high potential to be fatal, with no known cure and with its etiology still not fully understood (WHO, 2008). In Nigeria for example, the incidence of a human death due to avian influenza created a disruption in social order and in the well being of farmers (stress, altered livelihood and trauma) due to losses incurred (Oludato, Godman, Victoria, Yurim, Sara and Vhiara, 2010). The incidence of avian influenza in Nigeria has also led many poultry farmers into psychological breakdown due to losses incurred (Augustine and Ene, 2010).

Culling birds in other to eradicate or control the spread of the disease have negatively affected the livelihoods of all classes of poultry owners, producers and their employees (Tom, Chair, Robert, Max, Bill, Jan, and Ronora, 2007). Such an impact is most serious on the smaller family operated commercial producers for whom poultry production is their sole source of income generation (David, Carolyn and Wantanee, 2006). It was noted that poultry farm workers in some affected farms refused to turn up for medical screening for possible HPAI infection for fear of stigmatization (UNDP Nigeria, 2006). Those that turned up said their colleagues stayed away for fear of being detained by the authorities if found positive (UNDP Nigeria, 2006).

In a UNICEF survey carried out in Georgia in 2006, 88% of respondents believed that households confirmed to have an avian influenza infected person would be highly stigmatized by local community members (UNICEF, 2006). There is a loss of social capital as economic losses due to avian influenza outbreak may prevent the household from meeting social obligations and participating in cultural/religious ceremony (Geerlings, Albrechtsen, Rushton, Zahra, Ferial El-Kader, Soad, Nawal, Aida, Hanaa, Mervat, Emel, Afaf Said, Nawal, Abeer, Amira, Ahlam, Mohamed, Mona, Mostafa, Shaakem and Hazan, 2007).

The avian influenza disease is thus a concern for the consuming households because as long as the virus continues to circulate in animals, there is the tendency for the virus to infect and adapt to human, worsen case of malnutrition, poverty and food security and eventually death (Obayelu, 2006).

Knowledge, perceptions and prevention practices relating to avian influenza in endemic communities

In order to effectively control avian influenza, knowledge, perceptions and practices concerning avian influenza play important roles (Rochelle, Feonagh, Robert, Raina, and Ralf, 2007). A lay person's knowledge about a specific risk may help him engage in appropriate and preventive responses to the risk (Stuart and Alison, 2005). This applies to avian influenza.

Research findings on the role that knowledge plays in responding to risk are not consistent, but most of these researches describe the public's level of factual information about specific risks (Hye-Jin, Karen, Vicki, Kevin and Michele, 2008). Most research has attempted to relate knowledge of risk(s) to three types of outcomes or issues: (a) public support or opposition to facilities (b) individual attitudes, or (c) behaviors. These studies produced mixed results. Some found that those who were more knowledgeable about risk factors supported risk-related actions, whereas others found no difference between those who were more and less knowledgeable about the facts (Hye-Jin, et al, 2008). Understanding the relationship between knowledge levels about avian flu and a flu pandemic and attitudes is an important first step toward being aware of what moves people to support taking preventive actions during flu pandemic (Hye-Jin, et al, 2008).

It is possible that those who are more knowledgeable about what avian flu is, how it might evolve from bird flu to become a problem in humans, and how it can or cannot be prevented may be alarmed enough to be more supportive of taking preventive actions (Hye-Jin, et al, 2008). In a study conducted in Australia on the general population, it was noted by Rochelle, et al, (2007) that 40% of participants in their investigation believed that pandemic influenza was likely to become a significant health issue in the country in the near future. Other surveys have tried to examine knowledge, attitudes, belief, and perception related to avian influenza in communities where avian influenza outbreaks have occurred (Abbate, Di-Giuseppe, Marinelli, Angelillo, 2006; Tavorn, Piyarat, Jaranit and Wijitr, 2007; Arzu, Pemra, Hande, İrem, Murat, Elif, and Akbar, 2008).

A study carried out by Toby, Julie, Jawad, Lais, and Sam in Afghanistan in 2008, suggests that the overall knowledge about avian influenza was high in two affected and three unaffected provinces. The survey also revealed that greater knowledge about reducing exposure was associated with higher socioeconomic status in contrast to lower socioeconomic groups among whom the risk of exposure is higher. In another study carried out in Thailand by Tarvon et al, (2007), it was revealed that there was association between knowledge, attitude, and practice variables with socioeconomic variables. The target audience in this study was aware that avian influenza was a dangerous disease with respondents possessing high school education having higher avian influenza knowledge than those who had only primary school education. Most of them did not clearly recognize some symptoms of severe avian influenza infections (Tarvon et al, 2007). Due to this lack of appropriate knowledge of symptoms of the disease, the target population might not respond to externally perceived symptoms, including high fever, chill, headache, cough, and pneumonia that indicate severe H5N1 virus infection.

The occurrence of mild symptomatic and asymptomatic H5N1 infections have been observed during the outbreak of avian influenza disease in Hong Kong by sero-epidemiological studies among family members of avian influenza infected patients and health care workers (de Jong and Hien 2006). In a cohort study, 8 of 217 exposed and 2 of 309 unexposed health workers were sero-positive for H5N1-specific antibodies. These data indicated that nosocomial person-to-person transmission had occurred between patients and health workers, albeit limited to a few cases (Apisarnthanarak, Kitphati, Thongphubeth, Patoomanunt, Anthanont, Auwanit, Pranee, Malinee, Siriphan, Sunthareeya, Piyaporn, Gregory, Linda, and Victoria, 2004).

Nosocomial infection or hospital-acquired infection is applied to any clinical infection that was neither present nor was in its incubation period when the patient entered the hospital (Krishna, 2000). Nosocomial infections may also make their appearance after discharge from the hospital, if the patient was in the incubation period at the time of discharge (Krishna, 2000). Non-compliance with the basic infection control precautions, such as hand hygiene, appropriate use of facial protection (nose, mouth and eye protection) masking, cough etiquettes, cleaning and disinfection of contaminated equipments and surfaces, have resulted in nosocomial infections, thus putting health care workers and others at risk (WHO, 2007b).

It is therefore critical to limit this type of infection in order to protect health care workers, prevent the hospital from being a disease amplifier and to protect non-flu patients from infection because these hospital acquired infections poses very real and serious threat to both patients and health service providers alike (Creedon, 2005). Caring for victims of influenza could endanger health care workers. The risks involve exposure to H5N1, a virus to which unvaccinated people are considered universally immunologically naïve. Health care workers and their families need to receive the highest priority for vaccination, assuming a vaccine exists, and for access to antiviral agents that are active against the epidemic strain (Kamps et al, 2006). The knowledge of avian influenza disease is a key factor in reducing exposure and enhancing reporting because of the importance and possibility of hospital acquired infection. Prompt reporting of the presence of suspected or confirmed cases of H5N1 is essential. Clinicians must be aware of how to inform appropriate hospital authorities and relevant governmental bodies in order to facilitate early initiation of health prevention and control mechanisms (Hanan, 2008).

Risky practices and other factors relating to avian influenza

The spread of HPAI among poultry is traditionally thought to occur by transportation of infected poultry, equipment, feed, and cages, as well as contaminated vehicles, equipment, and persons associated with the industry (Juthatip, Debby, Geer, Theo, Walter, Rob, Albert, Ron, and Thijs, 2008). According to Kamps et al, (2006) an analysis of the Italian HPAI epizootic in 1999/2000 revealed the following risks for transmission:

(1) Movements of infected flocks (1%).

(2) Mediated contacts during transport of poultry to slaughter houses (8.5%).

(3) Neighborhood within a one kilometer radius around infected premises (26.2%).

(4) Lorries used for transport of feed, bedding or carcasses (21.3%).

(5) Other direct contacts through exchange of farm staff, working machines, and so on (9.4%).

All evidence to date indicates that close contact with dead or sick birds is the principal source of human infection with the H5N1 virus (Anthony, Heston, Hector, Yuk-yin, Tak-kwong, Miranda, Carolyn, Seymour, Kwok, Jacqueline, William, Nancy, and Keiji, 1998). Risky behaviours particularly identified included the slaughtering, de-feathering, butchering and preparation for consumption of infected birds (de Jong and Hien, 2006).

In a few cases, exposure to chicken faeces used as fertilizers in an area frequented by free-ranging poultry could be a source of infection. Swimming in water bodies where the carcasses of dead infected birds have been discarded or which may have been contaminated by faeces from infected ducks might be another source of exposure (Erin, et al, 2006). In some cases, investigations have been unable to identify a plausible exposure source (Mohan, Trevor, Fernandez and Mohammed, 2008).

The consequences of the environment and interspecies transmission of microbes are most clearly demonstrated in the case of influenza virus. Intensive farming practices in Asia have placed humans in close proximity to domestic animals in densely populated areas. In 1997 in the Hong Kong special administrative region of China, it was observed that crowded conditions and live poultry markets adjacent to residential areas facilitated the transmission of highly pathogenic avian influenza (David, 2005).

The exposure risk of avian influenza disease to humans is considered substantial during slaughter, de-feathering, butchering and preparation of poultry for cooking (John, 2007). Plucking and preparing of diseased birds; handling fighting cocks; playing with poultry, particularly asymptomatic infected ducks; and consumption of duck's blood or possibly undercooked poultry have all been implicated. Transmission has also been observed in mammals by feeding raw infected chickens to tigers and leopards in zoos in Thailand and to domestic cats under experimental conditions (www.njem.org, September, 2005).

In bird-to-human transmission, the likely portal of viral entry is via the respiratory tract, the gastrointestinal tract, or the conjunctiva especially among poor people where living conditions and hygiene are sub-standard and where overcrowding occurs. Exposure to an environment that may have been contaminated by faeces from infected birds is a second though less common source of human infection (Jang-Pin, 2005). Aside from being difficult to control, outbreaks in backyard flocks are associated with a heightened risk of human exposure and infection (Pham, Long, Tien, Hien, Mai, Phong, Tuan, Tan, Nguyen, Tu, and Phuong, 2006). Birds usually roam freely as they scavenge for food and often mingle with wild birds or share water sources with them. Such situations create abundant opportunities for human exposure to the virus, especially when birds enter households or are brought into households during adverse weather, or when they share areas where children play or sleep (Seng, 2007).

As deaths of birds in backyard flocks are common, especially under adverse weather conditions, owners may not interpret deaths or signs of illness in a flock as a signal of avian influenza and a reason to alert the authorities. This tendency may help explain why outbreaks in some rural areas have smoldered undetected for months. The frequent absence of compensation to farmers for destroyed birds further works against the spontaneous reporting of outbreaks and may encourage owners to hide their birds during culling operations (John, 2007).

There is increasing evidence that a thriving international trade in smuggled poultry, including live birds, chicks and meat is helping the spread of bird flu. Poultry smuggling is a huge business that poses a unique threat. Live poultry smuggling can easily pass the disease on to other birds in other countries. For example there is extensive smuggling of poultry products between China and Nigeria. This is because in the developing world, the illegal trade often has economic routes, to avoid duties. Many experts are convinced that the illegal import of infected live chicks introduced the virus into Nigeria (Vannier, 2007).

Highly pathogenic viruses can survive for long periods in the environment, especially when temperatures are low (i.e. in manure-contaminated water) (Webster, Guan, and Chen, 2006). In water the virus can survive for up to four days at 22 degrees centigrade, and more than 30 days at zero degrees centigrade (Kamps et al, 2006). In frozen materials, the virus probably survives indefinitely. The highly pathogenic H5N1 virus can also survive in bird droppings for at least 35 days at low temperature (4^oC). At a much higher temperature (37^oC), H5N1 viruses have been shown to survive, in faecal samples, for six days (Kamps et al, 2006).

As a result of its ability to survive in cold temperatures avian influenza virus is robust enough to be transported in frozen meat, feathers, bones and even on cages. The virus is however killed by heat at (56˚C for 3 hours or 60˚C for 30 minutes) and by common disinfectants, such as formalin and iodine compounds. Poultry parts can also spread the disease to birds when used as raw feed or in fertilizer on farms (FAO, 2008).

The spread of avian influenza viruses from an ill person to another via intimate contact without the use of barrier precautions has been reported very rarely, and transmission has not been observed to continue beyond one person (www.njem.org, September, 2005; Anucha, David and Victoria, 2007). Human-to-human transmission has been documented for H5N1 and H7N7 avian influenza viruses (Bridges, Katz, Seto, Chan, Tsang, Ho, Mak, Lim, Tam, Clarke, Williams, Mounts, Breese, Conn, Rowe, Hu-Primmer, Abernathy, Lu, Cox, and Fukuda, 2000), and human-to-human transmission of an H7N2 avian influenza virus may have occurred during a May 2007 outbreak in the United Kingdom (DEFRA, 2007a).

The transmission from one human to another of H5N1 HPAI virus was first documented during the 1997 outbreak in Hong Kong, and subsequent instances of probable human-to-human transmission of H5N1 viruses have been reported from Thailand, Vietnam, Indonesia, and Pakistan (Chan 2002; Parry, 2004; Beigel, Farrar, Han, Hayden, Hyer, de Jong, Lochindarat, Nguyen, Nguyen, Tran, Nicoll, Touch, Yuen, and WHO, 2005; Ungchusak, Auewarakul, Dowell, Kitphati, Auwanit, Puthavathana, Uiprasertkul, Boonnak, Pittayawonganon, Cox, Zaki, Thawatsupha, Chittaganpitch, Khontong, and Simmerman, 2005; Kandun, Wibisono, Sedyaningsih, Yusharmen, Hadisoedarsuno, Purba, Santoso, Septiawati, Tresnaningsih, Heriyanto, Yuwono, Harun, Soeroso, Giriputra, Blair, Jeremijenko, Kosasih, Putnam, Samaan, Silitonga, Chan, Poon, Lim, Klimov, Lindstrom, Guan, Donis, Katz, Cox, Peiris, and Uyeki. 2006; Wong and Yuen 2006; WHO 2008b).

In 2004, Thailand reported a probable spread of this disease in a family resulting from prolonged and very close contact between an ill child and her mother. In June 2006, WHO reported evidences of human-to-human spread in Indonesia. In this situation, 8 people in one family were infected. The first person was thought to have become ill through contact with an infected poultry. This person then infected other six members. One of those six people (a child) then infected another family member (his father). No further spread outside of the exposed family was documented or suspected (CDC, 2007).

Although most human infections by avian influenza viruses are attributable to exposure to infected poultry, human infections resulting from exposure to avian influenza viruses from wild birds have been documented from Eurasia (H5N1: Azerbaijan), North America (H1N9: United States), and Africa (H1N7: Egypt) (PAHO 2004 ; Gill, Webby, Gilchrist, and Gray, 2006; Gilsdorf, Boxall, Gasimov, Agayev, Mammadzade, Ursu, Gasimov, Brown, Mardel, Jankovic, Pimentel, Amir Ayoub, Maher Labib Elassal, Salvi, Legros, Pessoa da Silva, Hay, Andraghetti, Rodier, and Ganter, 2006) .

Human-to-human transmission of highly pathogenic H7N7 virus was also documented in conjunction with a widespread series of outbreaks of a highly pathogenic H7N7 virus among poultry farms in the Netherlands during March to May 2003, in which there was at least one human fatality from this virus among the 89 cases diagnosed at the time of the outbreak (du Ry-van, Meijer, Koopmans and de Jager, 2005). Subsequent serological investigations documented at least 33 instances of human-to-human transmission among the families of infected poultry workers. It was estimated that at least 1000 individuals and possibly as many as 2000 people in the Netherlands were infected by the H7N7 virus over the course of the 2003 outbreak (Bosman, Meijer and Koopmans 2005; van-Boven, Koopmans, van-Beest, Meijer, Klinkenberg, Donnelly, and Heesterbeek, 2007).

Epidemiological investigations were undertaken to determine whether human-to-human transmission of an H7N2 avian influenza virus occurred during an outbreak in the United Kingdom in May 2007 involving at least four confirmed human cases, three of whom were hospitalized for treatment prior to their diagnosis as human avian influenza cases (National Public Health Service for Wales, 2007; DEFRA, 2007c). This probable human to human transmissions involved close contact during the critical phase of the illness and were inefficient without additional chains of transmission (Fredrick and Alice, 2005).

In Nigeria, a number of risk factors, could according to Baba, (2006) facilitate the spread and continued presence of HPAI. These risk factors include:

- The structure of the poultry industry in Nigeria which consist predominantly of family poultry with little or no bio-security and peri-urban and urban commercial poultry production with minimum to moderate bio-security and constant introduction of new birds from relatively unknown and unverifiable sources.
- The rearing together of poultry flocks of different species and different ages.
- The uncontrolled livestock and poultry movement within the country as a result of lack of enforcement of animal disease control laws and regulations in the country.
- The lack of organized poultry marketing and existence of open live poultry markets characterized by interspecies mixing and poor sanitary conditions.
- The lack of registration and licensing of poultry farms/hatcheries and related establishments as provided by the law.
- The inadequate early warning and early reaction capabilities including inadequate experiences of most animal health workers in the recognition and diagnosis of HPAI.
- The Nigerian long porous borders and informal livestock movement/ trading across border especially at border markets and
- The inadequate quarantine facilities and manpower.

A history of poultry consumption in an affected country is however not a risk factor, provided the food is thoroughly cooked and the person is not involved in food preparation (Pham, et al, 2006).

Avian influenza control approaches

The fatality rate due to avian influenza is as high as 62%. However, there is no standard approach towards the management of the disease and currently no good evidence for effective therapy or prophylaxis exist (Donald and Craig 2004). The WHO (2005) has recognized some defense lines as effective in combating the disease that could only be met through concerted and prudent actions from scientists, politicians and the public (Ducatez, 2007). The main objective is to manage the risks to human health and to minimize transmission within poultry and the human population. Options for the control remain an enhanced community- based surveillance and early warning systems, and large scale vaccination and containment through culling, movement controls, enhanced bio-security of farms, and measures based on a general capacity for health care in the control of avian influenza. However reservation against vaccination, socio-economic and political hurdles compromise avian flu control measures (Ducatez, 2007).

Health workers who are the frontline troops in health care provision are often at the fore-front of danger in infectious disease outbreaks and therefore need more information to enable them diagnose avian influenza disease early and to start the therapy which would reduce fatality and prevent the spread of the virus. This observation is supported by Carolyn, Katz, Seto, Chan, Tsang, Ho, Mak, Lim, Tam, Clarke, Williams, Mounts, Breese, Conn, Rowe, Hu-Primmer, Abernathy, Lu, Cox, and Fukuda, (2000). A study carried out in three hospitals where a cohort of avian influenza patients had been admitted, showed susceptibility of health workers to avian influenza. A significantly higher rate of sero-positivity for avian influenza virus was observed among exposed health workers than among non-exposed health workers, which provides evidence of avian influenza transmission from infected patients to healthcare workers (Apisarnthanarak, et al, 2004).

Control measures against HPAI depend on the epidemiological situation of the region affected as fighting H5N1 at the source would help reduce pandemic risks posed by the virus (FAO, 2011). Outbreaks of HPAI in poultry are expected to be conspicuous due to the clinically devastating course of the disease (Bello, Bala and Mohammed, 2008). The quarantining of infected and contact farms, rapid culling of all infected or exposed birds, and proper disposal of carcasses, are standard control measures to prevent lateral spread to other farms. It is pivotal that movement of live poultry and also, possibly, poultry products, both within and between countries, are restricted during outbreaks (FAO, 2011).

During the Italian outbreak of 1999/2000 not only infected or contact holdings were destroyed, but flocks with a risk of infection within a radius of one kilometer from the infected farm were preemptively killed. Nevertheless, eradication required four months and demanded the death of 13 million birds (Capua and Alexander, 2004). The creation of buffer zones of one to several kilometers around infected farms completely devoid of any poultry was behind the successful eradication of HPAI in the Netherlands in 2003 and in Canada in 2004 (Timm and Ortrud, 2005).

The application of such measures, aimed at the immediate eradication of HPAI may be feasible on commercial farms and in urban settings. However, this can afflict the poultry industry significantly and also prompt ethical concerns from the public against the culling of millions of healthy and uninfected animals in the buffer zones (Kamps, et al, 2006).

Agricultural Intervention approach

For this highly pathogenic disease, the most important control measures are rapid culling of all infected or exposed birds, proper disposal of carcasses, the quarantining and rigorous disinfection of farms, and the implementation of strict sanitary measures (Al-Azemi, Bahl, Al-Zenki, Al-Shayji, Al-Amad, Chen, 2008).

Another key component to preventing the introduction and spread to susceptible poultry populations is bio-security. This according to Kathleen, Lisa, Greg, John, John, and Max, (2008) includes but not limited to the following:

(1) Restrictions on the movement of live poultry, both within and between countries.

(2) Prohibiting farm workers from visiting other farms or personally owning birds or poultry.

(3) Poultry production with birds of the same age obtained from a single source.

(4) Confinement housing, which limits contact with wild birds and animal populations,

(5) Rodent and insect control.

(6) Strict disinfection and waste disposal.

(7) Ongoing avian influenza virus monitoring and surveillance in poultry flocks

The logistics of recommended control measures are most straightforward when applied to large commercial farms, where birds are caged indoors, usually under strictly controlled sanitary conditions. Control is far more difficult under poultry production systems in which most birds are raised in small backyard flocks scattered throughout rural or sub-urban areas (Timm and Ortrud, 2005; Stephen and Nick, 2008).

Poultry Vaccination approach

Mass vaccination of poultry in the veterinary world is aimed at four goals:

(i) Protection from clinical disease, (ii) Protection from infection with virulent virus, (iii) protection from virus excretion, and (iv) Serological differentiation of infected from vaccinated animals (Kamps et al, 2006). In the field of influenza vaccination, neither commercially available nor experimentally tested vaccines have been shown so far to fulfill all of these requirements (Lee, Suarez, Tumpey, Sung, Kwon, Lee, and Yuan, 2005). The first aim, which is the protection from clinical disease induced by HPAI, is achieved by most vaccines. The risk of infection and excretion of virulent field virus is usually reduced but not fully prevented. This may cause a significant epidemiological problem in endemic areas where if exhaustive vaccination is carried out vaccinated birds which appear healthy may well be infected and excrete the field virus under cover of the vaccine (Lee, et al, 2005).

The effectiveness of reduction of virus excretion is important for the main goal of control measures; that is, the eradication of virulent field virus (Kamps et al, 2006). When dealing with vaccination against the potentially zoonotic H5N1 virus, reduction of virus excretion also reduces the risks of transmission to humans, since a significant dose of virus seems to be required to penetrate the species barrier between birds and humans (Capua, Terregino, Cattoli, Mutinelli and Rodriguez, 2003).

Human Vaccination approach

Apart from agricultural interventions to reduce the number of infected birds, the major three weapons for controlling person to person spread of AI are vaccines, agents and social distancing. As with all viruses of rapidly changing antigen, the hope for developing an effective avian influenza vaccine is a major challenge (Jocelyn, 2006). One part of the WHO global influenza program is the development of representative H5N1 candidate vaccines. Since it is not known which specific H5N1 virus will become the pandemic virus, efforts are in place to prepare for the most likely influenza viruses (WHO, 2007b).

Human vaccination is likely to remain the principal means of combating pandemic avian influenza (WHO, 2007c). This is because vaccines, even those of moderate efficacy, are effective public health intervention to mitigate the impact of an influenza virus pandemic. The bulk of human influenza vaccines are produced from inactivated viruses grown in embryonated eggs (Laura and Subbarao, 2006).

Vaccine production against highly pathogenic avian influenza viruses is complicated because of the requirement for high bio-safety containment facilities, and the difficulty, in some cases, to obtain high virus yields in embryonated eggs because of the virus' pathogenicity (de Jong and Hien, 2006). Several approaches have been used to overcome these obstacles. These include reverse genetic techniques, generation of recombinant hemagglutinicity, DNA vaccination and the use of related apathogenic H5 viruses with or without different adjuvant. Since conventionally killed subunit vaccines have relatively narrow cross reactivity, it is important to match the vaccine candidate to the eventual pandemic virus. A number of vaccine candidates may need to be developed so that the overall diversity can be encompassed. Alternatively, vaccine strategies that include broad cross-immunity within the subtype need to be considered (Peiris et al, 2007).

These vaccines rely on a production method that uses embryonated eggs which only produce vaccines against a specific strain of virus. In the United States, the CDC has begun developing an egg-independent strategy (Catherine and Kanta, 2006). This technique could accelerate production of vaccine, induce an immune response without the need for adjuvant and may even be effective against multiple genetic drift variants (Catherine and Kanta, 2006). However, these vaccines are not yet commercially available and research continues to determine their clinical usefulness, particularly in children and adults.

Due to the fact that it is not possible to predict in advance the makeup of a particular strain that will cause a pandemic, vaccines cannot be developed before the emergence of a pandemic strain (Peiris et al, 2007). Consequently, it is estimated that once a pandemic strain evolves and is detected, there will be an effective vaccine against it within 4 to 8 weeks. However, it may take time to produce adequate quantities to protect a population (Catherine and Kanta, 2006). Once a vaccine becomes available, it is likely that healthcare workers would be among the first to receive the vaccination.

Antiviral Treatment approach

There is evidence that early treatment (usually within 48 hours) of definitively documented avian influenza diagnosis is associated with better outcomes and increased survival rates compared to late intervention (Tran-Tinh, de Jong, and Jeremy, 2004). Early detection, therefore, can be lifesaving (Hanan, 2008).

Currently, *Oseltamivir* (*Tami flu*) and *Zanamivir* (*Relenza*) are medications with antiviral activity against influenza viruses (de Jong and Hien, 2006). Both have proven efficacy in the treatment of human influenza when started early during the course of illness, and are particularly effective as seasonal or post-exposure prophylaxis to unprotected health care workers and close contacts of infected patients (Samson and Yuen, 2008). *Oseltamivir*

(*Tamiflu*) can be administered orally (de Jong and Hien, 2006). *Zanamivir (Relenza)* has poor oral availability and is therefore administered by inhalation which has limited its use in the elderly. The development of drug resistance during treatment has been reported for both drugs. The recommended duration for both drugs is 5 days (Kamps, et al, 2006).

Educational Intervention approach

Timely, simple and incessant communication with the people is vital for the prevention of avian influenza. Giving people the right information will alleviate the likelihood of pandemic flu, prevent unnecessary panic and mitigate the economic and social impacts of a pandemic (UNICEF, 2006b). The media, government and the private sector were actively involved in disseminating educational messages using several materials on AI produced for both the print and electronic media. This created awareness on the signs and symptoms of AI in humans and animals in other to elicit appropriate actions against AI infection. Changing knowledge, attitudes and practices were clearly at the centre of public awareness campaigns to control and prevent AI (FAO, 2009).

Avian influenza communication programmes have raised awareness levels significantly in many places that there is a new deadly chicken disease that can affect humans. Specifically, most often domestic behaviours such as cooking procedures and hand washing, have proved relatively easy to influence through public health education (Scoones and Forster 2008). This is because public information and education programmes including use of the mass media (print, radio and television) have often been aggressive in reporting new cases and deaths due to AI in both humans and poultry in affected countries (WHO, 2008b). In over 20 countries where knowledge, attitude and practice (KAP) surveys were conducted in 2006 and 2007, it was discovered that knowledge and awareness of AI was high in the general population and among high-risk groups due to massive public enlightenment (Chitnis, and Mansor, 2007).

Based on the research in Thailand, related to how to protect oneself from poultry with avian influenza, behavior changed significantly after the respondents heard about avian influenza (Olsen, Laosiritaworn, Pattanasin, Prapasiri and Dowell, 2005). These changes in human behavior, which included those related to food handling, can reduce the opportunity to be infected by avian influenza (INFOSAN, 2004).

Health promotion relating to avian influenza prevention and control in the mass media often focus on the signs and symptoms of infected poultry, preventive behavior regarding avian influenza, and reporting when there are signs and symptoms of avian influenza in poultry and humans (Leslie, Billaud, Mofleh, Mustafa, Yingst, 2008). Preventive behaviours that were recommended in the advertisement were not to touch sick or dying birds, or if they did, they have to immediately wash their hands and report to the local authority, washing hand and utensils with soap and water before eating or cooking, cooking all poultry and egg well, and separating birds and humans. Although the major source of information in most of the study areas was television, in Afghanistan, leaflets were also used to inform people about avian influenza. Both sources of information significantly increased the people's awareness (Leslie, et al, 2008).

Following the first confirmed case of avian influenza outbreak in Nigeria in January 2006, intense advocacy by UN agencies and bi-lateral donors resulted in an early response by the government. As a first step, a multi-sectoral National Steering Committee was established to provide policy direction to control the spread of AI. The Nigerian government developed an Avian Influenza Control Program (AICP) with support from the UN and the World Bank. Under the AICP, the National Public Enlightenment Committee was tasked with the planning, coordination, implementation and monitoring of AI outbreak communication and behaviour change communication/social mobilization activities (ALIVE, 2006).

A communication structure similar to the National Public Enlightenment Committee was established in all the 36 states including the Federal Capital Territory. The objective was to ensure that there is sufficient technical capacity at the national and the sub-national level to implement mass awareness campaigns, to design and roll out inter-personal communication packages for health workers, to establish a community surveillance system, and to carry out training of trainers at the Local Government and community levels in promoting AI preventive behaviors (ALIVE, 2006).

In order to address this issue, emphasis has been placed on community level partnerships with key influential groups such as traditional rulers, religious groups, community development associations, educational institutions, and women's groups. These leaders and opinion makers are being encouraged through training and continued engagement to use their networks to re-enforce preventive behaviors promoted through the mass media. A risk communication strategy has also been developed for avian influenza (Links Media, 2009).

Routine Clinical Practices and Precautions for Preventing the Transmission of Avian Influenza Infection

Routine preventive practices entail hand washing with water, soap and disinfectants before and after caring for patients (Omaima, Amal, Amal and Affaf, 2003). There is the need to use gloves, masks/eye protection/face shields, and gowns when splashes or sprays of blood, body fluids, secretions or excretions are possible (PIDAC, 2010).

Other preventive practices include cleaning of patient-care equipment and the patient's physical environment and soiled linen in order to reduce health care workers' exposure to blood-borne pathogens (WHO, 2004). These routine practices are the infection prevention and control practices for use during the routine care of all patients at all times in health care settings (Calgary Health Region, 2005).

The use of Personal Protective Equipment (PPE) by healthcare professionals, support staff, medical aides, laboratory professionals and family members, reduces but does not completely eliminate the likelihood of infection (Chia, Koh, Fones, Qian, Ng, Tan, Wong, Chew, Tang, Ng, Muttakin, Emmanuel, Fong, Koh, and Lim, 2005). The PPE will only be effective if used correctly during all contacts with infected patients. Each pre-hospital or emergency healthcare service should have regulations for the use of PPE that should be adhered to by all staff during the transport and treatment of patients with suspected or confirmed avian influenza (WHO, 2007b). These regulations will include the use of standard universal precautions such as the use of masks, gloves, eyewear and protective overalls or uniform covers. Respiratory protection (masks) can significantly reduce the danger of infection by viruses provided they are used and worn correctly or appropriately (WHO, 2008a).

Additional and specific precautions are required when routine practices are not sufficient to prevent transmission of infections (WHO, 2008b). These include the following: keeping the patient in an isolated room; promoting good hygiene; use of disposables, single use toiletries for wiping noses; covering of the nose and mouth when sneezing or coughing; washing of hands with antiseptics after coughing, sneezing or using tissues; and, keeping hands away from mucous membranes of the eyes and nose by patients who have the physical and cognitive abilities to do so (Fredrick and Alice, 2005; WHO, 2006b).

Preventive regulations should include procedures for disposing of wastes, sharps and disposable uniform covers, handling linen and uniforms, and cleaning and disinfecting both equipment and the ambulance interior (WHO, 2008b). Since the virus is killed by heat at 56˚C for three hours or 60˚C for 30 minutes, proper cooking of poultry meat or products can prevent the spread of the disease (Kamps, et al, 2006).

Conceptual framework

Two theoretical constructs have been adapted to guide the design of the study. These are the PRECEDE framework and the Health Belief Model (HBM). The PRECEDE framework was adopted to provide a clear explanation of how important variables are linked to capture the concepts being studied. The acronym PRECEDE stands for Predisposing, Reinforcing, Enabling Constructs in Educational Diagnosis and Evaluation (|Green and Kreuter, 1992). This framework which was developed by Green, Kreuter, Deeds, and Patridge, in the early 1970s helps to unravel the wide spectrum of determinants of a particular health problem and the quality of life associated with it. They propounded that most health problems are behaviourally related and for such problems to be solved, the behaviour of the individuals must be modified. It is based on the premise that health/social problems are determined by multiple factors like epidemiological, behavioural, and educational factors.

The PRECEDE conceptual model has four phases: social, epidemiological, behavioural, and educational. The process of social assessment is concerned with investigating issues deemed problematic to particular groups of people. The frequency or rate of these particular problems is examined by investigating their epidemiology, which in turn may be affected by human behaviour and environment. The concept of behaviour is dependent on factors that pre disposes an individual to engage in a particular behaviour (Brieger, 2002). Any behaviour exhibited as a response to a direct request or wish of an influencing source may be defined as compliance (Creedon, 2005).

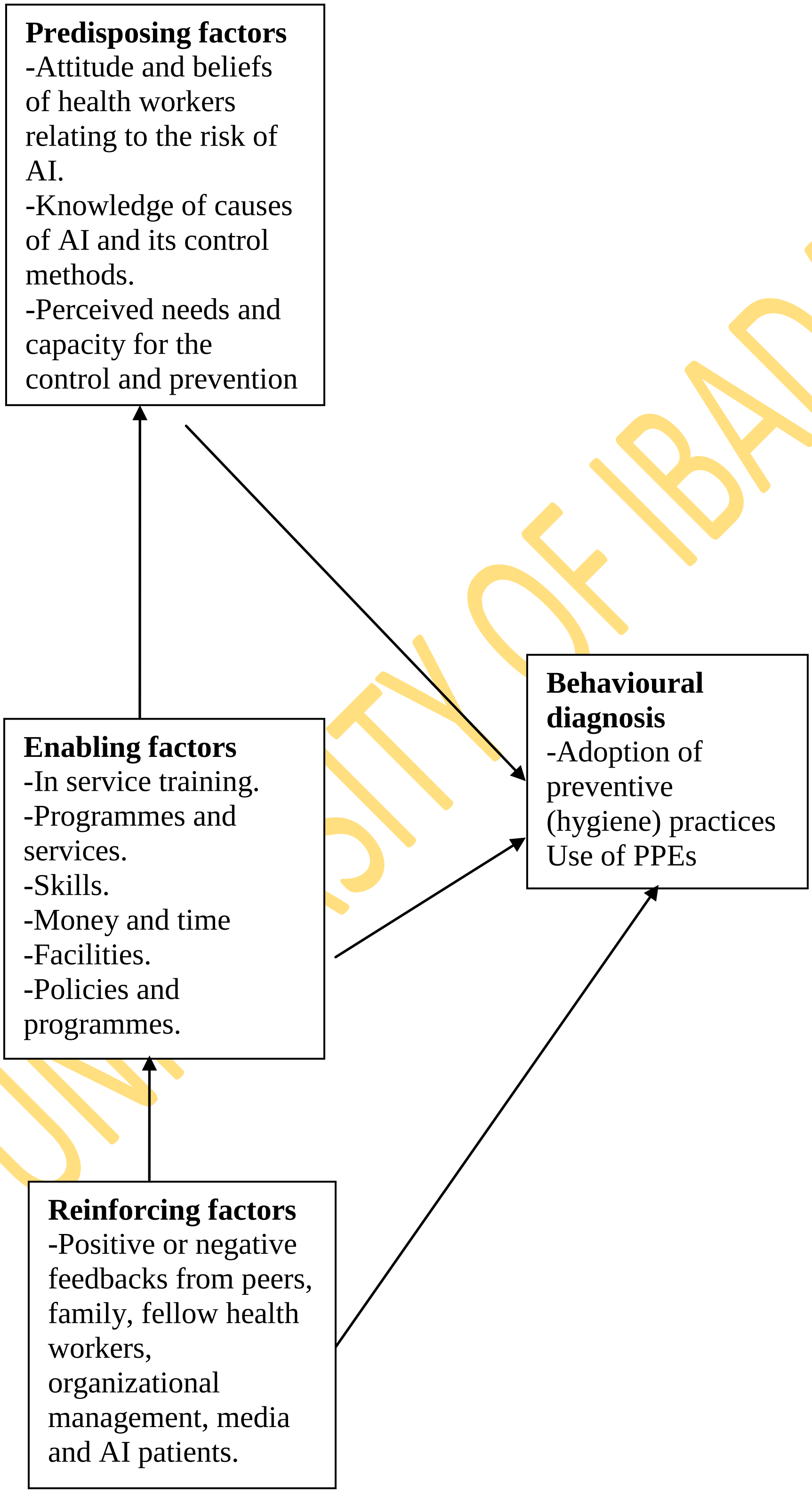
The PRECEDE framework outlines the antecedent factors which influence behaviour. These factors are categorized as Pre disposing, Enabling and Reinforcing factors.

1. Pre disposing factors: Encompass antecedents to behaviour that provide rationale for the behaviour. These include knowledge, beliefs, values, attitudes, perceptions and behavioural intensions, norms and values. Most primary health care workers do not have adequate knowledge about the causes of avian influenza infection and its prevention (Brenda, Micheal, James and Daniel, 2006). Predisposing factors have the potential to influence a given health behaviour, either by encouraging the behaviour to occur or by inhibiting it from occurring.

2. Enabling factors: These are also antecedents to behaviour because they influence the realization of motives and aspirations. These include skills, personal resources as well as community resources like availability of health resources, accessibility to health resources, ability to perform some health related skills. Government policies on health will also influence the behaviour of PHC health workers in the control and prevention of avian influenza infection.

3. Reinforcing factors: This comprises the feedback or influence of significant others or people that influence the continuance or discontinuance of behaviour. This includes pressure from siblings, co-workers, policy makers, patients, peer groups, and other social support groups (Breiger, 2002). They are also factors subsequent to behaviour that provide the perpetual reward or incentive for the behaviour and contribute to its persistence or extinction (Green and Kreuter, 1991).

Figure 1: The PRECEDE framework adopted for assessing the knowledge and perceptions of primary health care workers relating to the prevention and control of avian influenza infection



Health belief model

The Health Belief Model (HBM) is a tool that behavioural scientists use to predict health behaviours. Originally developed in the 1950s, and updated in the 1980s, it is based on the theory that a person's willingness to change their health behaviours is primarily due to factors such as Perceived susceptibility, Perceived severity, Perceived benefits and Perceived barriers. The HBM was useful in the selection of the following variables for measurement during the study; knowledge, perceptions and AI prevention and control practices.

Perceived Susceptibility

Perceived susceptibility refers to one's belief about the likelihood of personal harm from a disease. People will not change their health behaviours unless they believe that they are at risk. For example those who do not think that they are at risk of acquiring AI from improperly cooked poultry meat are unlikely to cook their poultry products properly.

Perceived Severity

Perceived severity refers to perception of the seriousness of risks or threats, such as the consequences of contracting a disease. The probability that a person will change his/her health behaviours to avoid a consequence depends on how serious he or she considers the consequence to be.

Perceived Benefits

It is difficult to convince people to change their behaviour if there is no gain in it for them.

Perceived Barriers

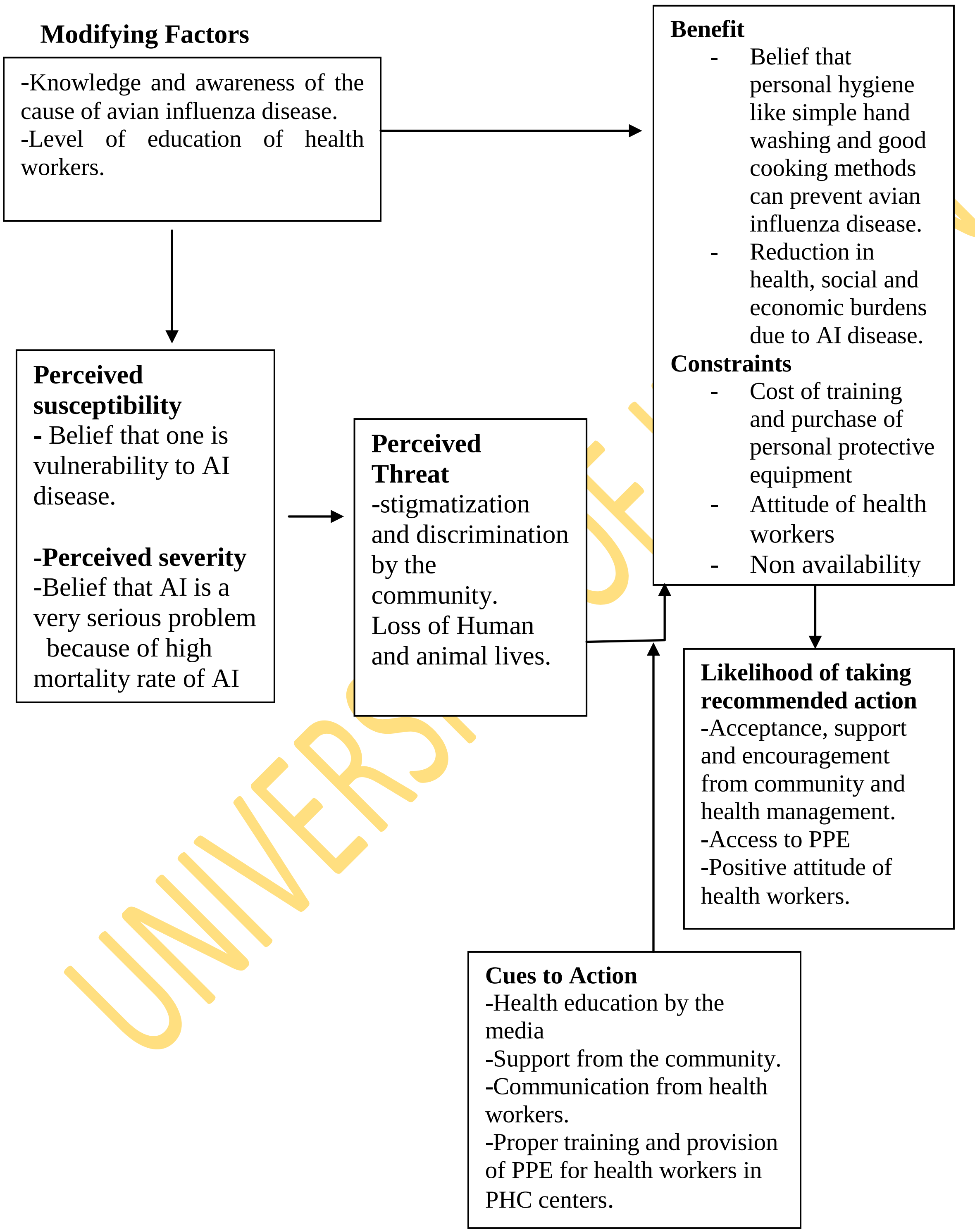
One of the major reasons people do not change their health behaviours is that they think that doing so is going to be hard. Sometimes it is not just a matter of physical difficulty, but social difficulty as well. Changing ones health behaviour can cost effort, money and time.

The HBM, however, is realistic as it recognizes the fact that sometimes wanting to change health behaviour is not enough to actually make someone do it, and incorporates two more elements into its estimations about what it actually takes to get an individual to make the leap. These two elements are *cues to action* and *self efficacy*.

Cues to action are external events that prompt a desire to make a health change. They can be anything from advertisement about the dangers of avian influenza in the media both print and electronic, to having a relative die of avian influenza disease. A cue to action is something that helps move someone from wanting to make a health change to actually making the change.

Self efficacy looks at a person's belief in his/her ability to make a health related change.

Figure 2: Using the health belief model to assess the knowledge and perceptions of primary health care workers in the prevention and control of avian influenza infection.



CHAPTER THREE

METHODOLOGY

Study Design and Scope

This is a cross-sectional survey which is limited in scope to the determination of knowledge, perceptions and practices of PHC workers in the peri-urban LGAs of Ibadan relating to Avian Influenza prevention and control.

Description of Study Site

The study was carried out in the following five out of the six peri-urban LGAs in Ibadan where health authorities agreed to be involved in the study. They are Akinyele, Egbeda, Ido, Lagelu and Oluyole. The profile of the LGAs is summarized in Table 3.1

Table 3.1: LGA Profile

LGA	Area Covered	Estimated Population Males/Females*		Wards	PHCs	State Hospitals	Tertiary Hospitals	Private Hospitals	Poultry farms
Akinyele	464, 892 sq km	109,013	109,109	12	36	2	0	0	46
Egbeda	410 sq km	142,742	147, 859	11	17	2	0	52	62
Ido	1010.95 sq km	53,406	53, 159	10	20	0	0	25	95
Lagelu	310,850 sq km	76,693	75,999	14	28	2	0	29	68
Oluyole	635, 384 sq km	105,491	103,721	10	25	0	0	35	56

*Source: National Population Commission, 2006.

In each of the communities in the LGAs, fowls are reared by the people using the traditional free range method.

Study Population and Sample Size Determination

The study population consisted of all PHC frontline workers who attend to patients in all Primary Health Care Centres (PHC) in the five LGAs. The population and the categories of the frontline health workers in the LGAs were determined during a community diagnosis. This involved the identification of the resources of various types in each LGA. All the PHC facilities in the five LGAs were visited to recruit respondents for the study. Permission was however obtained from the PHC coordinators/Medical Officers of Health of all the LGAs (see appendix I for letter written by the Head of Department of Health Promotion and Education, Faculty of Public Health to facilitate the process). In all the PHC facilities, approval was obtained from the head of the facilities before recruiting PHC health workers in their health care centres for the study.

The study population consisted of the following categories of health workers Doctors, Pharmacists, Nurses, Midwives, Community Health Officers (CHOs), Senior Community Health Extension Workers (SCHEWs), Junior Community Health Extension Workers (JCHEWs), and Health Assistants. Altogether there were 718 frontline PHC health workers. However, only persons who volunteered to participate in the study were eligible to be interviewed. The study was designed to be a whole population study. This implies that all the 718 PHC workers constituted the sample size.

The distribution of the study population is presented in Table 3.2a while Table 3.2b presents the distribution of target population (i.e. population that participated in the study).

Table 3.2 a: Distribution of Study Population by LGA

Category of Health Staff	Akinyele	Egbeda	Ido	Lagelu	Oluyole	Total
Medical Doctors	1	1	1	1	1	5
Nurses/Midwives	21	17	12	5	13	68
Pharmacy Technicians	4	3	2	1	2	12
Comm. Health Officers.	20	30	13	8	14	85
Community Health Extension Workers. (SCHEWs, CHEWs, JCHEWs).	30	64	47	56	56	253
Health Assistants.	25	70	47	91	62	295
TOTAL	**101**	**185**	**122**	**162**	**148**	**718**

Table 3.2 b: Distribution of Target Population by LGA

Category of Health Staff	Akinyele	Egbeda	Ido	Lagelu	Oluyole	Total
Medical Doctors	1	1	1	1	1	5
Nurses/Midwives	15	15	11	5	9	55
Pharmacy Technicians	1	1	1	1	1	5
Comm. Health Officers.	16	14	10	8	13	61
Community Health Extension Workers. (SCHEWs, CHEWs, JCHEWs).	30	49	40	52	50	221
Health Assistants.	23	42	28	45	30	168
TOTAL	**83**	**114**	**105**	**103**	**110**	**515**

Method and Instrument for Data collection

Information gathered from the reviewed literature was used to guide the design of the self-administered semi-structured questionnaire used in the study. The semi-structured questionnaire consists of both open-ended and closed-ended questions. It was designed such that it could be self-administered or interviewer-administered.

The questionnaire consists of six sections labeled A, B, C, D, E and F. Questions in section A were used to document the personal data of the respondents, while section B was used to assess the workplace information of respondents. Level of knowledge of avian influenza infection was assessed using questions in section C. This section contains knowledge questions that attracted scores ranging from 1 to 2 each. Section D was used to determine health workers perceptions of avian influenza infection. Section E assessed the health workers practices relating to avian influenza infection. The last section (section F) was used to determine health workers' capacity to prevent avian influenza infection (See appendix II for details of the questionnaire).

Validity and Reliability

Validity

Validity of the instrument was ensured through a comprehensive review of related literature. The salient variables of interest were teased out from the literature relating to knowledge, perceptions and practices for measurement. The result of the literature review was used to develop the questionnaire for the study. The Instrument was subjected to peer review by specialists in health education and epidemiology who are vast in the field of avian influenza at the Faculty of Public Health, University of Ibadan to ensure its content validity.

The instrument was pre-tested among frontline health workers in Ibarapa East and Ibarapa Central LGAs. The exercise was carried out with the assistance of trained field assistants.

Reliability

. Reliability refers to the consistency of a measure. A measure is said to have a high reliability if it produces consistent results under consistent conditions. Copies of pre-tested questionnaire were coded, entered into a computer and analyzed. Reliability was determined through the use of the Cronbach's Alpha coefficient. Any coefficient >0.5 is said to be reliable. A coefficient of 0.937 was obtained before it was

Data Collection Process

The key steps involved in the data collection were as follows:

1. The research assistants were trained for 3 hours/day for 4 days.
2. Visits were made to all the heads of health facilities by the researcher in company of the five research assistants to intimate them of the study objectives and to obtain permission from them prior to the interview.
3. Rapport was established with each of the PHC workers to secure his/her consent to voluntarily participate in the study.
4. Research assistants and investigators moved round the LGAs one by one to administer copies of the questionnaire starting from Egbeda, Akinyele, Oluyole, Lagelu and ending at Ido LGA. Copies of the questionnaire were self-administered.
5. The research assistants reviewed each questionnaire in each facility carefully for accuracy; problems noted were resolved immediately before leaving each health facility.
6. A total of eight weeks was spent moving round the health facilities in the LGAs to conduct the study in 2009.

Data Management and Analysis

The efforts made to manage the data include the following:

(a) The administered questionnaires were reviewed once again for accuracy.

(b) Serial numbers were written on the questionnaires for easy identification and recall.

(c) A coding guide was designed to facilitate the entry of the responses into a computer.

(d) Questionnaires were coded by the researcher and entered into a computer facilitated by the use of the SPSS soft ware Version 15.

(e) The analysis of the data was done using descriptive statistics, Chi- square, t-test, ANOVA and logistic regression.

(f) Copies of the questionnaires then stored in a place that is safe from destruction by water or fire. They are kept in a place where unauthorized persons would not have access to them. They would be destroyed one year after the defense of the dissertation

Knowledge score for AI was computed for each respondent using a 61- point knowledge scale. The scores for each knowledge question varied from 1 to 2 points. The scores were then summed up to give a composite knowledge score for each respondent. The higher the score, the higher the knowledge. Scores ranging from 46-61 were categorized as good; scores ranging from 31-45 and 0-30 were categorized as fair and poor respectively.

Ethical Considerations

Ethical approval was sought from the Oyo State Ethical Review Committee (see appendix IV). Approval to conduct the research was also sought from the PHC coordinators/Medical Officers of Health of the five LGAs where the research took place. The purpose of this was to ensure that the research conformed with accepted scientific principles and international ethical guidelines needed for conducting researches involving human subjects.

Informed consent was sought before the administration of questionnaire on any respondent. The respondents were assured of the confidentiality of their responses and that participation in the study was voluntary. No names of respondents or any identifiers whatsoever were written on questionnaires in order to ensure that it would not be possible to link responses to any of the respondents. In addition, respondents were told that they could participate or withdraw from participating at any stage without any penalty whatsoever.

Limitations of the study

The study focuses on very sensitive issues such as the capacity of the health workers to prevent Avian Influenza infection in their health centres. Some subjects may therefore not have given all information required by the researcher for one reason or the other. Efforts were made to establish rapport with the health workers before the study started. This included briefing them about the nature of the study with special reference to the anonymity of the study and the measures put in place to ensure confidentiality of the respondents.

Ascertaining the authenticity of responses provided by study participants is often a challenge in survey research because some study participants could deliberately tell researchers what they feel they (researchers) want to hear. In order to ameliorate this problem, participation was made voluntary and participants were provided with detailed information about the study which include the need to be as honest as possible as confidentiality of responses would be guaranteed.

CHAPTER FOUR

RESULTS

The findings from this study are presented in this section. They are organized into the following four sections: Respondents' socio-demographic characteristics; respondents' knowledge of avian influenza infection; respondents' perceptions related to avian influenza infection; and preventive practices of PHC workers against avian influenza.

Respondents' Socio-demographic Characteristics

The socio-demographic characteristics of the respondents are presented in Table 4.1. Majority (81.9%) of them were females, 89.7% were married, 6.6% were singles, 2.7% were widows and 1.0% were separated. Their highest levels of education included School of Health Technology (61.4%), Community Health Officers Certificate Programme (11.8%), School of Nursing/Midwifery (10.6%), Secondary School (8.3%), University Education (5.5%) and Primary School (2.1%).

Christianity (75.9%) topped the list of religions practiced by the respondents, followed by Islam (23.7%).

Respondents within the 35-39 years age bracket constituted 17.9% of the respondents, while those aged 60-64 years were 0.2%. The respondents' ages ranged from 20-64 years with a mean of 38.4 ± 8.7 years. Most respondents (98.1%) were Yoruba; few were Igbo (1.2%), and Hausa (0.2%). The official designations of the respondents are presented in Figure 3.

Less than a quarter (32.6%) were Health assistants, 42.9% were Community health extension workers, 11.8% were Community health officers, 10.7% were Nurses/midwives, 1.0% were Medical officers of health, and 1.0% were Pharmacists. Respondents' working experiences are highlighted in Table 4.2. Respondents whose working experiences ranged from 11-15 years topped the list (18.4%), followed by those with working experiences of 1-5 years (18.3%), 6-10 years (17.7%) and 16-20 years (12.2%). Respondents' mean working experience in years was 13.1±7.9 years (See Table 4.2 for more details).

Table 4.1: Respondents' sex, marital status, level of education, religion and age.

	No	%
Sex: (N=515)		
Female	422	81.9
Male	93	18.1
Marital status: (N= 515)		
Married	462	89.7
Single	34	6.6
Widowed	14	2.7
Separated	5	1.0
Highest level of education: (N=515)		
*School of Health Technology	316	61.4
Diploma	61	11.8
CHO Certificate Programme	55	10.7
School of Nursing/Midwifery	43	8.3
Secondary School	29	5.5
University Education**	11	2.1
Primary School		
Religion: (N=508)* **		
Christianity	391	75.9
Islam	117	22.7
Age of Respondents: (N=451)* **		
20-24	21	4.1
25-29	51	9.9
30-34	91	17.7
35-39	92	17.9
40-44	71	13.8
45-49	74	14.4
50-54	30	5.8
55-59	20	3.9
60-64	1	0.2

*These are recipients of CHEW certificates 222 (43.1%) and Health Assistant certificates 94 (18.3%).

**These include 2 (0.3%) doctors, 5 (1.0%) pharmacists and 22 (4.2%) holders of non-professional university degrees.

***Non responses were excluded

N=399

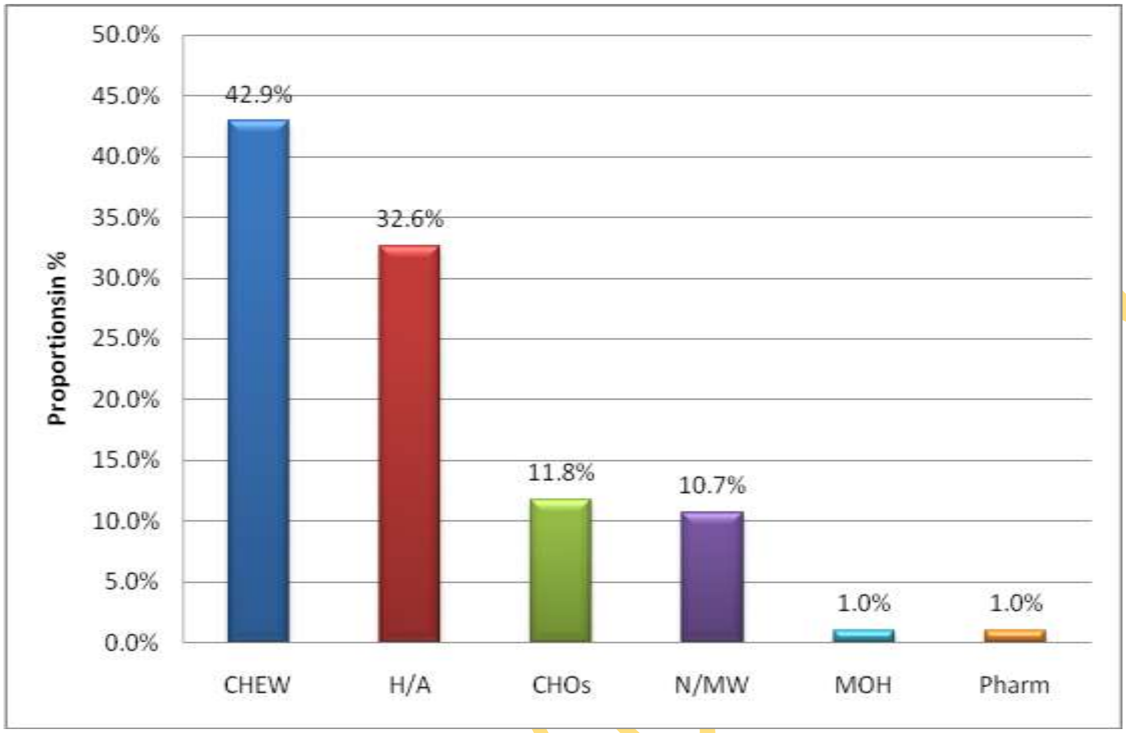


Figure 3: Respondents' official designations

Key:

CHEW= Community health extension worker

HA= Health Assistant

N/MW= Nurse/midwife

CHO= Community health officer

MOH= Medical officer of health

Pharm. = Pharmacist

Table 4.2: Respondents' years of experience as a health worker.

N=411

Years of experience in years	No	%
1-5	94	18.3
6-10	91	17.7
11- 15	95	18.4
16- 20	63	12.2
21-25	32	6.2
26-30	41	8.0
31-35	5	1.0

Mean = 13.1±7.9 years

Median = 12.0

Range = 1-35 years

Respondents' awareness and knowledge of avian influenza infection.

The health care workers were asked to list infections that could be easily spread in health care facilities. The listed infections included HIV/AIDs (28.5%), Malaria (18.3%), Tuberculosis (17.5%), Cholera (11.8%), Poliomyelitis (9.5%), Cough (9.3%) and Avian Influenza (7.6%) (See Table 4.3 for details). Few respondents (34.0%) listed contact with infected patients as a means of spreading infections in health care settings. Other listed factors or conditions which can facilitate the spread of infections included lack of necessary precautions (26.5%), overcrowding (17.2%) and use of un-sterilized needles (13.8%). Sexual intercourse (4.5%) and mosquito bites (4.0%) were mentioned by an insignificant number of the respondents.

Respondents' knowledge relating to the causes of avian influenza infection is shown in Figure 4. Several respondents (35.7%) defined avian influenza as a contagious disease caused by a virus. Nearly half (49.5%) of them identified birds as the common vectors of the infection. Table 4.4 shows that majority (86.8%) stated correctly that the mixing of infected and healthy birds was one of the practices that could favour the transmission of avian influenza. Other situations that can encourage the transmission included uncontrolled poultry movement in live poultry markets (85.6%), poor sanitary conditions in poultries (84.3%), contact with infected eggs (76.3%), inadequate quarantine services (75.0%) and mixing of free roaming birds with caged birds/chickens/fowls (70.5%) (See Table 4.4 for further details).

The potential modes of contracting avian influenza by humans listed by respondents included the following practices; eating of improperly cooked birds/chickens/fowls (89.1%), eating of improperly cooked eggs (82.7%), touching or handling sick birds (76.9%) and using knife or cutlery used for cutting infected birds in cutting food items without sterilization (74.0%). Only 55.0% of the HCWs recognized the possibility of human to human transmission of avian influenza infection through caring for patients with avian influenza infection (See Table 4.5 for details). Majority (87.2%) of the respondents said they would report a suspected case of avian influenza. A total of 71.5% would report such a case to the disease surveillance and notification officer, while 15.7% indicated that they would only report a case of avian influenza infection to their primary health care coordinators.

Respondents' responses relating to the signs and symptoms of avian influenza infection are presented in Table 4.6. Signs and symptoms of avian influenza infection correctly mentioned by majority of the respondents included cough (68.9%); shortness of breath (66.8%); elevated body temperature > 38ºC (63.3%), headache (62.3%), running nose (62.5%), sore throat (59.0%), vomiting (53.6%), and diarrhoea (51.3%). Signs and symptoms listed by less than half of the respondents included muscle ache (myaglia) (48.7%), pneumonia (48.2%), conjunctivitis (46.4%), excessive decrease in white blood cells (43.5%) and low blood platelets (43.1%).

Respondents' knowledge about the temperature at which H5N1 virus, the causative organism of avian influenza, can be killed is shown in Table 4.7. Majority (55.5%) of the respondents mentioned 78ºC. Only 16.5% stated the correct temperature at which H5N1 could get killed or destroyed.

Details of respondents' knowledge of the period when therapy for avian influenza is most effective is shown in Table 4.8. Only a few respondents (12.8%) were able to indicate the correct time at which the treatment of avian influenza is most effective to be within two days after infection.

Table 4.9 contains a list of both correct and incorrect medications for the management of avian influenza infection. Only a few of the respondents (11.2%) correctly mentioned *Tamiflu* and *Relenza* (2.1%) as the recommended drugs for the management of avian influenza infection. Respondents' knowledge of the incubation period for avian influenza infection in humans is shown in Figure 5. Only 24.5% of the respondents correctly stated that 2-8 days was the incubation period for avian influenza infection.

The radio (97.5%) topped the list of respondents' general sources of health information. Other sources mentioned by respondents included fellow health workers (92.6%), television (89.1%), posters (85.6%), newspapers (85.4%), training programmes (83.1%), friends (74.4%), workshops/seminars (74.8%) and pamphlets (71.1%). Billboards (47.6%) and the internet (2.5%) are not very common sources of information (See Table 4.10 for details).

Respondents' pattern of using sources of information on avian influenza is depicted in Table 4.11. Respondents received information about avian influenza most frequently through the electronic media (Radio 68.3%; Television 66.8%) and News- papers (55.1%). The sources of information sometimes used by respondents included billboards (44.1%), pamphlets (40.4%) magazines (40.0%), friends (39.4%), journals (39.0%), training opportunities (36.3%), workshops/seminars (35.1%), posters (35.0%), memo/circulars (34.9%) and fellow health workers (30.5%). Most respondents did not use the internet as a source of information about avian influenza; only three of them used it sometimes (see details in Table 4.11).

Respondents' overall mean knowledge score was 37.2 ± 9.4. Majority of the respondents (60.6%) had fair knowledge of avian influenza; 18.1% had good knowledge while the knowledge of 21.4% was poor.

A comparison of the mean knowledge scores of respondents by sex, age, highest level of education, profession and years of experience was made.

The mean knowledge score for the males was 39.8 ± 8.4 while that of the females was 36.6 ± 9.6; with a statistically significant difference $P < 0.05$. Respondents in the age group 20-29 years had a mean knowledge score of 36.7 ± 10.1 while those in the age group 50 years and above had a mean knowledge score of 38.1 ± 8.3. The difference in the mean knowledge scores was not statistically significant $p > 0.05$.

The comparison of the mean knowledge scores of the respondents by highest level of education shows that University graduates had a higher mean knowledge score of 42.1 ± 8.7, closely followed by school of nursing /midwivery graduates who had a mean knowledge score of 39.7 ± 6.9. The CHOs and school of health technology diploma holders had mean knowledge scores of 39.5 ± 7.7 and 36.5 ± 10.0 respectively while respondents with secondary and primary education had the lowest mean knowledge scores of 34.2 ± 8.8 and 32.5 ± 7.6 respectively. The differences in the mean knowledge scores were found to be statistically significant ($p<0.05$). In addition, the mean knowledge score for professionals was 37.6 ± 9.5 while that of non-professionals was 33.6 ± 8.4. The difference in the mean knowledge scores was statistically significant ($p<0.05$).

Respondents with 11-20 years working experience had a mean knowledge score of 39.0 ± 8.2, closely followed by respondents with 21 years and above working experience with a score of 38.6 ± 9.0. Respondents with 1-10 years working experience had the lowest mean knowledge score of 36.0 ± 10.7. The difference in the mean knowledge scores was not statistically significant ($p< 0.05$).

Table 4.3: Respondents' knowledge of infections that can be spread easily in health facilities.

N= 515

Infections*	**No**	**%**
HIV/AIDs***	147	28.5
Malaria***	94	18.3
Tuberculosis***	90	17.5
Cholera***	61	11.8
Poliomyelitis*	49	9.5
Cough***	48	9.3
Measles***	42	8.2
Avian influenza**	39	7.6
Cerebrospinal meningitis*	37	7.2
Sexually transmitted diseases┼	15	2.9
Yellow fever***	14	2.7
Hepatitis***	13	2.5
Leprosy***	9	1.7
Pertusis*	3	0.6
Tetanus**	2	0.4

*Multiple responses included

**Can spread

** *Can spread readily

┼Cannot spread

N= 488

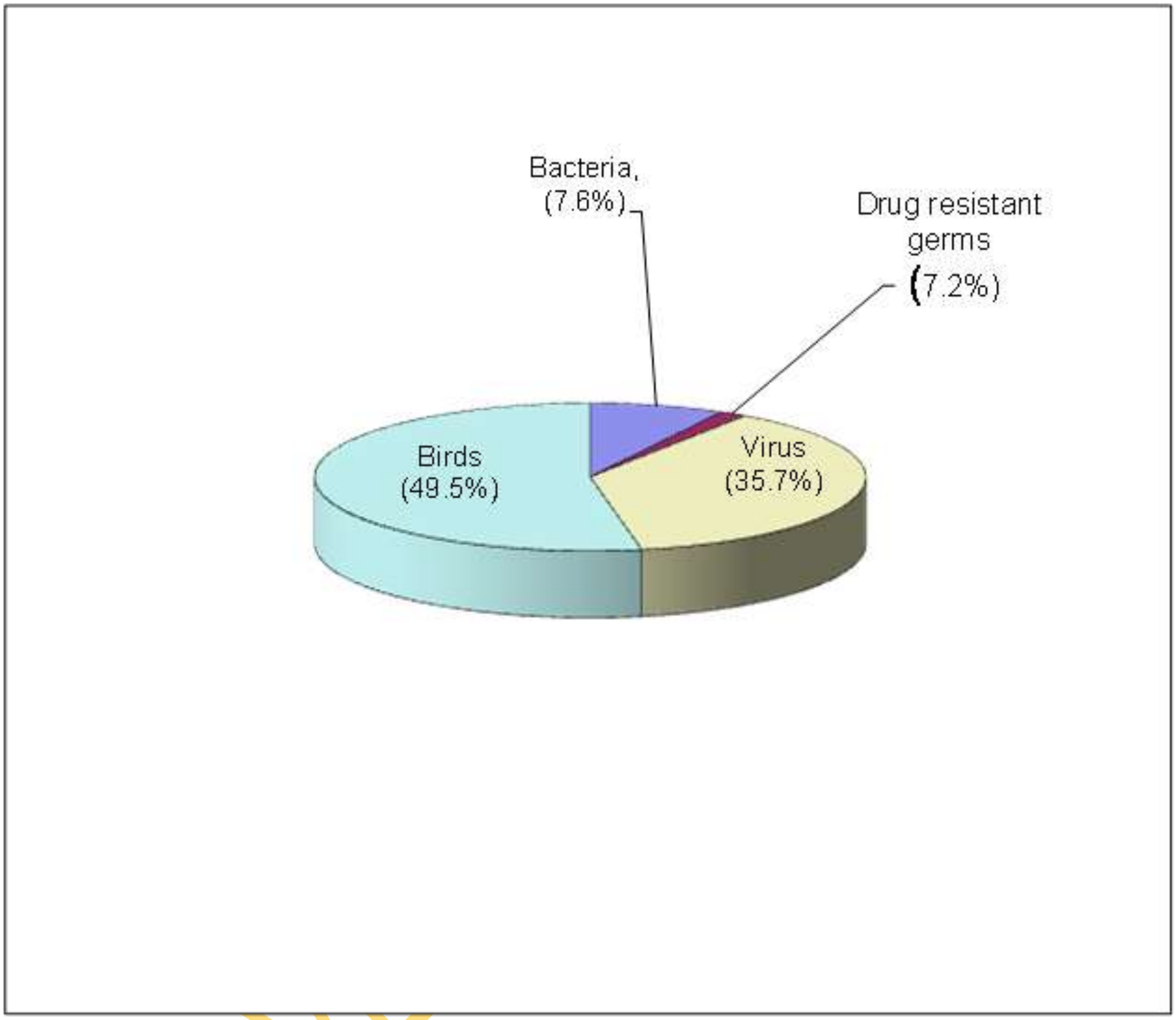


Figure 4: Respondents' knowledge of the causes of avian influenza.

Table 4.4: Situations or practices which can lead to the spread of avian influenza.

Situations that can lead to the spread of avian influenza infection.	Yes (%)	No (%)	Don't know (%)	Total
Mixing of infected and healthy birds	447(86.8)	22(4.3)	26(5.0)	495
Uncontrolled poultry movement in live poultry markets	441(85.6)	32(6.2)	21(4.1)	494
Poor sanitary conditions in poultries	434(84.3)	64(12.4)	5(1.0)	503
Contact with infected eggs	393(76.3)	91(17.7)	13(2.5)	497
Inadequate guidelines on poultry rearing	386(75.0)	90(17.5)	24(4.7)	500
Inadequate quarantine services	378(75.0)	90(17.5)	24(4.7)	492
Mixing of free roaming birds with caged birds/chickens/fowls	363(70.5)	84(16.3)	42(8.2)	489
Entry of infected staff into a non infected poultry farm	350(68.0)	101(19.6)	43(8.3)	494
Indiscriminate sale of poultry and poultry products	312(60.6)	118(22.9)	59(11.5)	489
Exchange of farm staff between infected and non-infected poultry farm	305(59.2)	136(26.4)	51(9.9)	492
Rearing different species of birds together	254(49.3)	195(37.9)	44(8.5)	493

Table 4.5: Potential modes of contracting avian influenza by humans.

Ways of contacting avian influenza**	True (%)	False (%)	Don't know (%)	Total
By eating improperly cooked birds/chickens/fowls**	459(89.1)	37(7.2)	6(1.2)	502
By eating improperly cooked eggs**	426(82.7)	61(11.8)	15(2.9)	502
By touching or handling sick birds/chickens/fowls**	396(76.9)	70 (13.6)	31 (6.0)	497
Using knife or cutlery used for cutting infected birds in cutting food items without sterilization**	381(74.0)	81(15.7)	32(6.2)	494
Mixing healthy and infected persons**	347(67.4)	126(24.5)	16(3.1)	489
By touching or handling dead birds/chickens/fowls**	323(62.7)	142(27.6)	31(6.0)	496
By touching infected poultry feeds**	313(60.8)	128(24.9)	44(8.5)	485
While providing care for people with avian influenza infection**	283(55.0)	137(26.6)	55(10.7)	475
Allowing fowls or poultry to live in residential houses**	262(50.9)	179(34.8)	40(7.8)	481
By eating wild birds/chickens/fowls**	121(23.5)	280(54.4)	91(17.7)	492
Through mosquito bites*	9(1.7)	463(89.9)	31(6.0)	503

*Wrong response

**Correct responses

Table 4.6: Respondents' knowledge about the signs and symptoms of avian influenza

Signs and symptoms	Responses			
	Wrong (%)	**Correct (%)**	**Don't know (%)**	**Total**
Body rash	108(21.0)	239(46.4)	124(24.1)	471
Conjunctivitis	98(19.0)	239(46.4)	120(23.3)	457
Pneumonia	91(17.7)	248(48.2)	124(24.1)	463
Muscle ache(myaglia)	87(16.9)	251(48.7)	124(24.1)	462
Running nose	78(15.1)	322(62.5)	80(15.5)	480
Sore throat	76(14.8)	304(59.0)	114(22.1)	494
Low blood platelets	79(15.3)	222(43.1)	167(32.4)	468
Excessive decrease in white blood cells	73(14.2)	224(43.5)	164(31.8)	461
Cough	69(13.4)	355(68.9)	61(11.8)	485
Vomiting	68(13.2)	276(53.6)	120(23.3)	464
Shortness of breath	67(13.0)	344(66.8)	66(12.8)	477
Diarrhoea	65(12.6)	264(51.3)	134(26.0)	463
Headache	60(11.7)	321(62.3)	98(19.0)	479
Elevated body temperature more than 38°C	51(9.9)	326(63.3)	99(19.2)	476

Table 4.7: Respondents' knowledge of the temperature at which H5N1 (causative agent of avian influenza) can be killed.

N=515

Temperature at which H5N1 can be killed	**No**	**%**
78◦C	284	55.1
>46◦C*	85	16.5
56◦C	76	14.8
37◦C	70	13.6

*****Correct response

Table 4.8: Respondents' knowledge of the period when therapy for avian influenza is most effective.

N=478

Period when therapy is most effective.	**No**	**%**
Don't know	218	45.6
Within 24 hours	154	32.2
Two days after infection*	61	12.8
Within two weeks after infection	45	9.4

*Correct response

Table 4.9: Respondents' knowledge of the medication used for the treatment of avian influenza infection.

N=437

Medication	No	%
Antibiotics	207	47.4
Avianfluciline	164	37.5
Tami flu*	49	11.2
Relenza*	9	2.1
Paracetamol	8	1.8

*Correct response

N=481

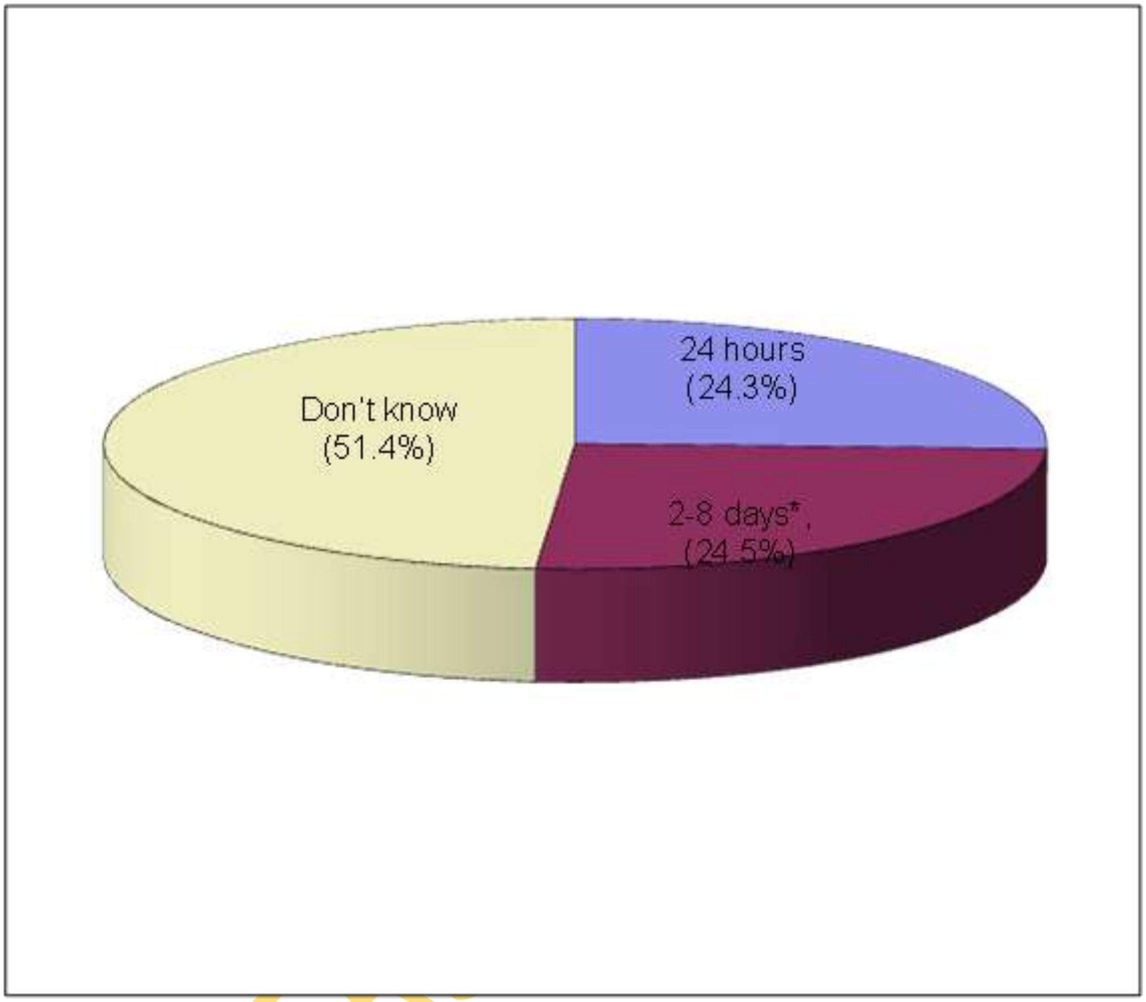


Figure 5: Respondents' knowledge of the incubation period of avian influenza infection.

*Correct response

Table 4.10: Respondents' sources of health information.

N=515

Sources	Yes (%)	No (%)	Not at all (%)	Total
Radio	502(97.5)	13(2.5)	0(0.0)	515
Fellow health workers	477(92.6)	22(4.3)	16(3.1)	515
Television	459(89.1)	49(9.5)	7(1.4)	515
Posters	441(85.6)	52(10.1)	22(4.2)	515
Newspapers	440(85.4)	72(14.0)	3(0.6)	515
Training programmes	428(83.1)	67(13.1)	20(3.8)	515
Workshops/seminars	385(74.8)	103(20.0)	27(5.2)	515
Friends	383(74.4)	95(18.4)	37(7.2)	515
Pamphlets	366(71.1)	118(22.9)	31(6.0)	515
Magazines	315(61.2)	160(31.1)	40(7.7)	515
Journals	295(57.3)	164(31.8)	56(10.9)	515
Billboards	245(47.6)	211(41.0)	59(11.4)	515
Internet	13(2.5)	502(97.5)	0(0)	515

Table 4.11: Respondents pattern of using sources of information on avian influenza.

N=515

Sources of information		**Pattern of use**		
	Frequently (%)	**Sometimes (%)**	**Not at all (%)**	**Total**
Radio	352(68.3)	126(24.5)	37(7.2)	515
Television	344(66.8)	123(23.9)	48(9.3)	515
Fellow health workers	291(56.5)	157(30.5)	67(13.0)	515
Newspapers	284(55.1)	165(32.0)	66(12.9)	515
Posters	219(42.5)	180(35.0)	116(22.5)	515
Friends	209(40.6)	203(39.4)	103(20.0)	515
Workshops/seminars	188(36.5)	181(35.1)	146(28.4)	515
Training	186(36.1)	187(36.3)	142(25.6)	515
Pamphlets	174(33.8)	208(40.4)	133(25.8)	515
Journals	169(32.8)	201(39.0)	145(28.2)	515
Magazines	158(30.7)	206(40.0)	151(29.3)	515
Memo/circular	113(21.9)	195(37.9)	207(40.1)	515
Billboards	100(19.4)	227(44.1)	188(36.5)	515
Internet	0(0)	3(0.6)	512(99.4)	515

Respondents' perceptions related to Avian Influenza infection.

Respondents' perception of the likelihood of a patient dying of avian influenza infection is shown in Figure 6. Only 33.4% of the respondents were of the view that it is very likely for an avian influenza patient to die of the infection; 31.3% thought it is likely, while (12.9%) of them had a misconception that an avian influenza patient is unlikely to die of the infection. Overall, majority of the respondents (64.7%) were of the perception that avian influenza infection could lead to death. Perceived situations/conditions of a patient that are suggestive of avian influenza infection are shown in Table 4.12. A majority (82.1%) of the study population were of the view that a patient that had eaten sick or dead birds/chickens/fowls and then developed fever and shortness of breath may be infected with avian influenza. Similarly, a majority (72.4%) of them were of the view that if a patient had handled sick birds/chickens/fowls and then developed cough, fever and shortness of breath, then the patient may have contracted avian influenza. The other details are shown in Table 4.12.

Many (66.4%) of the respondents had a positive perception that avian influenza infection is a serious infection. Very few (3.1%) did not perceive it to be serious while 13.4% could not whether it is serious or not (Table 4.13).

Figure 7 shows respondents' opinion relating to whether avian influenza infection can be prevented. Only 9.1% of the respondents were of the view that avian influenza infection cannot be prevented and majority (78.1%) were of the opinion that avian influenza infection can be prevented.

Respondents were asked about their perceived degree of vulnerability to avian influenza infection in their places of work. Their responses are presented in Figure 8. Majority (61.2%) were of the opinion that they were unlikely to get infected with avian influenza in their places of work. Only 13.2% were of the perception that the probability of their getting infected with avian influenza was very likely (Figure 8).

Table 4.14 shows respondents' opinion about how common avian influenza is in their community. Slightly over half (51.5%) of the respondents stated that avian influenza had not been reported in their community. Some (28.0%) respondents said the infection was not common in their community. Only nine respondents (1.7%) said that avian influenza was very common in their community. Most (96.3%) of them were of the view that avian influenza infection outbreak was not possible in their community.

Table 4.15 contains community beliefs relating to avian influenza infection in the community where they work. Some (10.5%) stated that avian influenza was perceived to be a reality in their community. The other community beliefs related to avian influenza are contained in the Table.

Table 4.16 highlights details of respondents' perception of age groups at most risk of contracting avian influenza infection. The proportion of respondents who did not know the age group at most risk of avian influenza infection was 13.7%. Overall, half (56.7%) of the respondents rightly perceived all age groups to be at most risk of avian influenza infection.

Table 4.17 shows that slightly more males (44.1%) than females (43.1%) perceived all age groups to be susceptible to avian influenza infection but the difference was not statistically significant ($p>0.05$). Table 4.18 highlights respondents' perception that all age groups are at risk of contracting avian influenza by highest level of education. Majority of the respondents with primary education (81.9%) perceived all age groups to be more susceptible to avian influenza infection than the nurses/midwives (78.2%) and university graduates (55.2%). The difference was statistically significant ($p<0.05$) (See Table 4.18 for details). Respondents' perceptions relating to whether all age groups are at risk of contracting avian influenza by age group are presented in Table 4.19. Younger respondents within the age group 20-29 years (58.6%) perceived all age groups to be more susceptible to avian influenza infection (See details in Table 4.19). The difference was statistically significant ($p<0.05$). Table 4.20 shows respondents' perception that all age groups are at risk of contracting avian influenza by work experience in years as a health worker. As shown in the table more respondents with work experience 1-10 years (47.3%) than those with work experience 11-20 years (37.9%) and work experience 21 years and above (32.1%) perceived all age groups to be susceptible to avian influenza infection. The difference however was not statistically significant ($p>0.05$).

Table 4.21 shows the regression analysis of the perceived seriousness of avian influenza infection by sex, level of education, age and work experience. Female respondents were 1.0 times more likely to have positive perception of the seriousness of avian influenza infection (95% CI, 0.8-3.4) than males. This implies that female respondents perceived avian influenza infection to be more serious than male respondents. Respondents with tertiary education were 6.0 times more likely to have positive perception of the seriousness of avian influenza infection (95% CI, 0.5-4.9), while respondents with no tertiary education were 1.3 times more likely to have positive perception of the seriousness of avian influenza infection (95% CI, 1.2-2.7). Respondents above 40 years old were 1.1 times more likely to have positive perception of the seriousness of avian influenza infection (95% CI, 0.5-2.1) than those aged ≤40 years. Respondents with 1-10 years work experience were 1.0 times more likely to have positive perception of the seriousness of avian influenza infection (95% CI, 0.1-6.6). Respondents with 11-20 years work experience as a health worker were 0.5 times more likely to have positive perception of avian influenza (95% CI, 0.1-7.5).

N=489

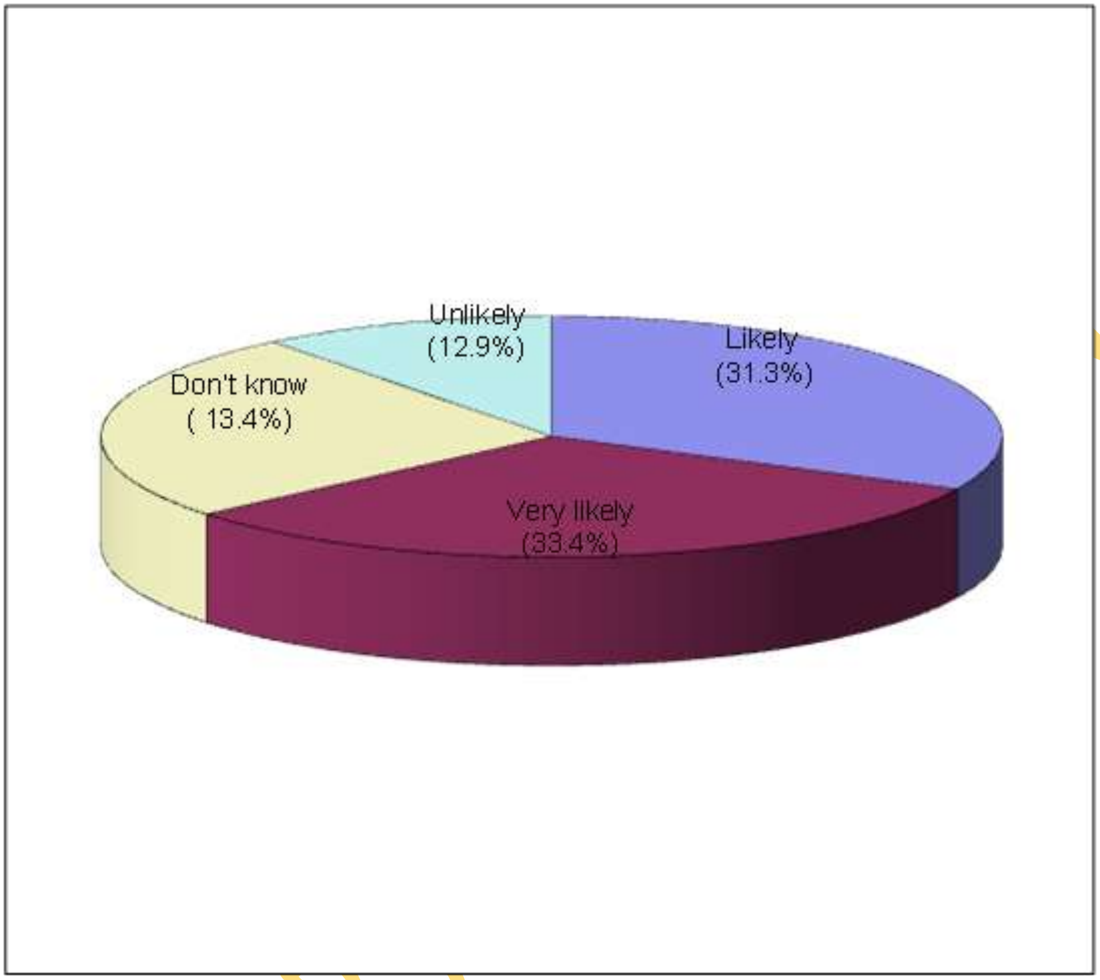


Figure 6: Respondents' perception of the likelihood of one dying of avian influenza infection.

Table 4.12: Situations/conditions of a patient that were perceived to be suggestive of avian influenza infection. **N=515**

Situations/conditions	No (%)	Yes (%)	Don't know (%)
If a patient says he/she had taken care of another patient suspected of having avian influenza*	106(20.6)	350(68.0)	32(6.2)
If a patient had butchered sick birds/chickens/fowls and then developed fever, cough and shortness of breath *	81(15.7)	348(67.6)	64(12.4)
If a patient says he/she had eaten cooked eggs and developed fever and shortness of breath*	73(14.2)	373(72.4)	40(7.8)
If a patient had handled sick birds/chickens/fowls and then developed cough, fever and shortness of breath*	69(13.4)	378(73.4)	45(8.7)
If a patient had eaten sick or dead birds/chickens/fowls and then developed fever and shortness of breath*	42(8.2)	423(82.1)	28(5.4)

*Correct responses

Table 4.13: Respondents' perceived seriousness of avian influenza infection.

N=487

Perceived seriousness of avian influenza	**No**	**%**
Very serious	342	66.4
Don't know	69	13.4
Somehow serious	60	11.7
Not serious	16	3.1

N=485

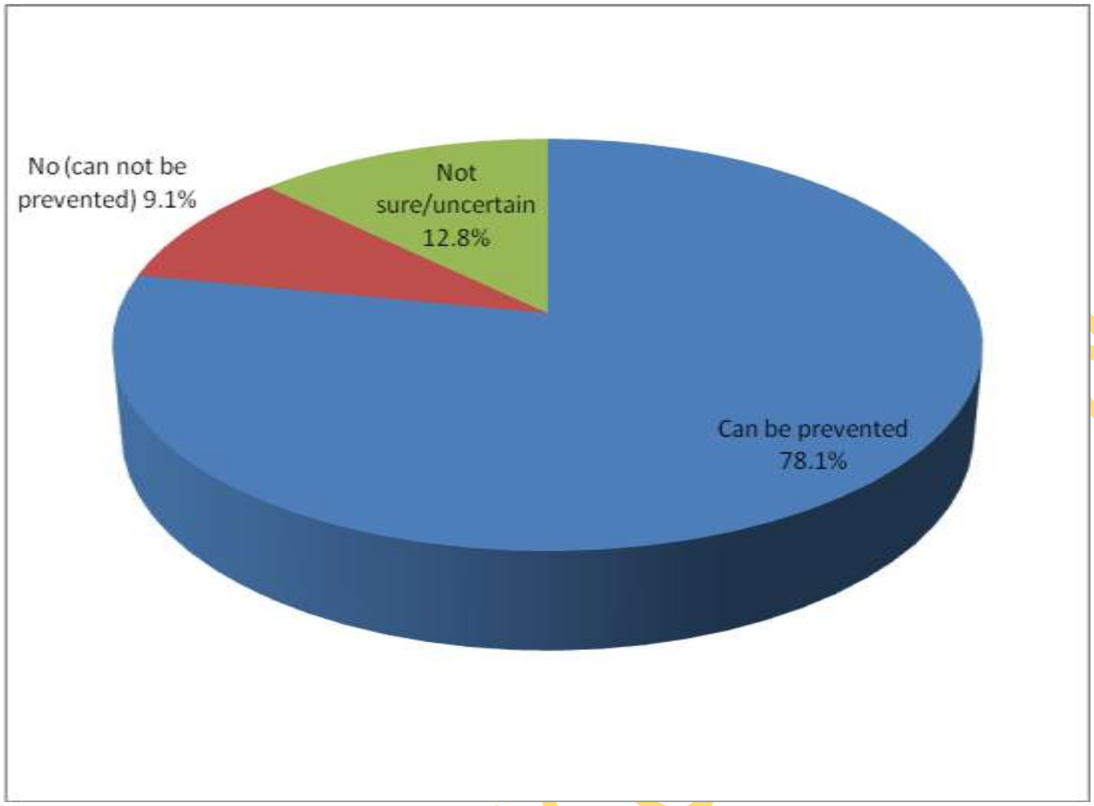


Figure 7: Respondents' opinion about whether avian influenza infection can be prevented.

N= 473

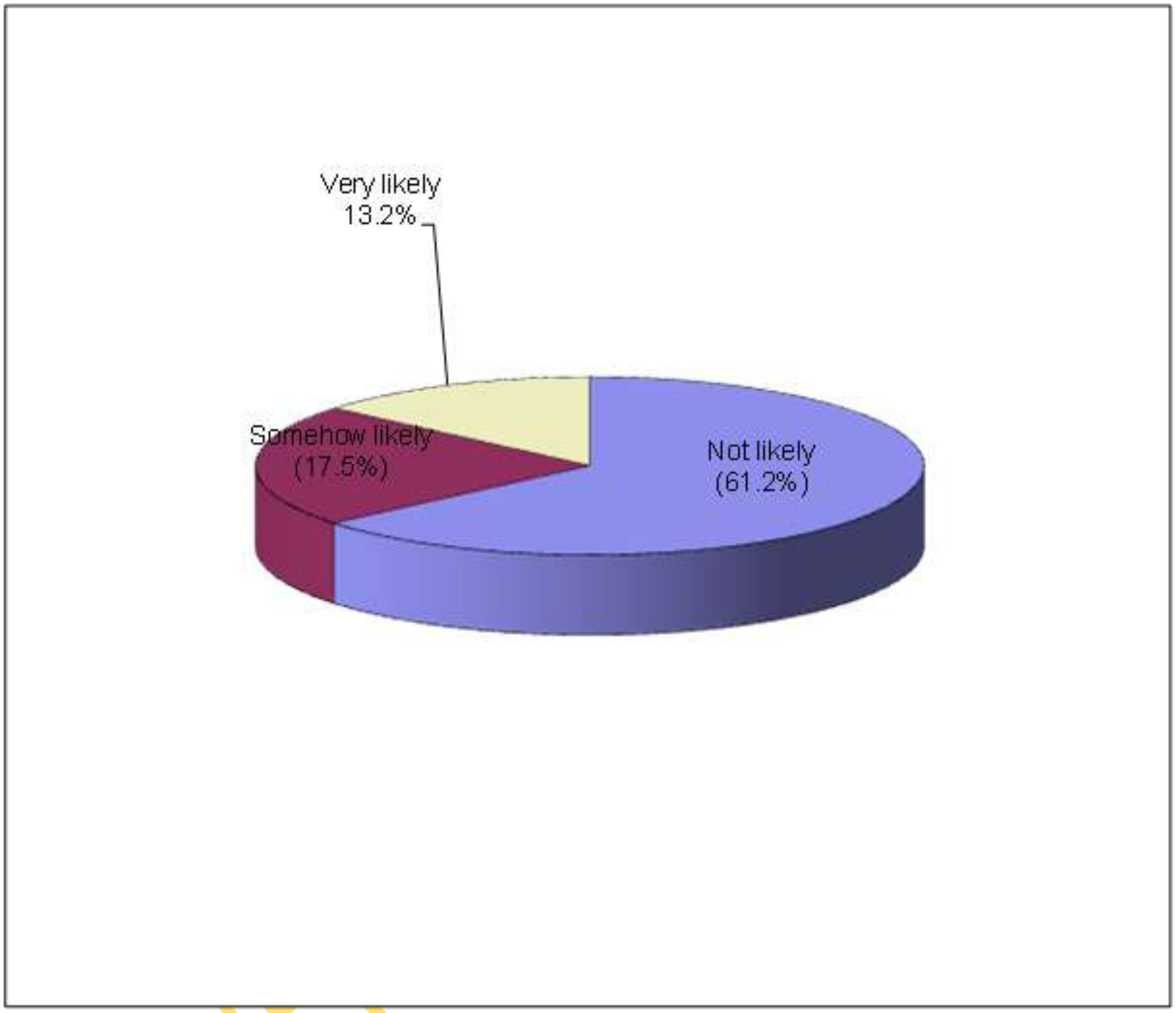


Figure 8: Respondents' perception of the likelihood of their getting infected with avian influenza infection in their work places.

Table 4.14: Respondents' opinion about how common avian influenza was in their communities.

N=463

Opinion about how common avian influenza is in the community	**No**	**%**
Never been reported	265	51.5
Not common	144	28.0
Don't know	26	5.0
Somehow common	19	3.7
Very common	9	1.7

Table 4.15: Respondents perceived community believes related to avian influenza infection. **N=198**

Beliefs relating to avian influenza in the communities.*	No	%
Avian influenza is real	54	10.5
It is a contagious disease	29	5.6
It is a disease which affects both birds and humans	21	4.3
It can be contacted through eating of infected birds/eggs	20	3.9
People don't believe in its reality	18	3.5
It affects only birds	17	3.3
It is an imported disease	15	2.9
It has not yet manifested in my community	13	2.5
People don't know about the disease	11	2.1

*Non responses excluded

Table 4.16 Respondents' perception of the age group at most risk of getting avian influenza infection

N=487**

Age group	**Frequency**	**%**
*All age groups	276	56.7
Don't know	67	13.7
Children aged 5-17 years	49	10.1
Adults aged 18-60 years	36	7.4
Children aged less than 5 years	33	6.8
Adults over age 60 years	26	5.3

*Correct response

**Non responses excluded

Table 4.17: Respondents' perception of age groups at risk of contracting avian influenza infection by sex.

N=515

Sex	**Perception**		**Total**	**df**	**X^2**	**p- value**
	All age groups are susceptible to avian influenza infection					
	Yes (%)	**No (%)**				
Male	41 (44.1)	52(55.9)	93(100.0)	1	0.02	0.3
Female	182 (43.1)	240(56.9)	422(100.0)			
Total	223(43.3)	292(56.7)	515(100.0)			

$p > 0.05$

Table 4.18: Perception that all age groups are at risk of contracting avian influenza infection by highest level of education

N=515

Highest level of education	**Perception: All age groups are susceptible to avian influenza infection**		**Total**	**df**	**X^2**	**p-value**
	Yes (%)	**No (%)**				
Primary school	9(81.9)	2(18.1)	11(100.0)	5	20.9	0.01
Secondary school	18(41.9)	25(58.1)	43(100.0)			
School of Nursing/midwives	12(21.8)	43(78.2)	55(100.0)			
University	13(44.8)	16(55.2)	29(100.0)			
School of health technology	137(43.4)	179(56.6)	316(100.0)			
CHO	34(55.7)	27(44.3)	61(100.0)			
Total	223(43.3)	292(56.7)	515(100.0)			

$P<0.05$

Table 4.19: Perception that all age groups are at risk of contracting avian influenza infection by age group

N=515

Age group	**Perception**		**Total**	**df**	**X^2**	**p-value**
	All age groups are susceptible to avian influenza infection					
	Yes (%)	**No (%)**				
20 - 39 years	41 (58.6)	29(41.4)	70	3	11.6	0.02
30 - 39 years	77(41.8)	107(58.2)	184			
40 - 49 years	69(47.6)	76(52.4)	145			
50 years and above	39(33.6)	77(66.4)	116			
Total	226(43.9%)	289(56.1%)	515			

P<0.05

Table 4.20: Perception that all age groups are at risk of contracting avian influenza infection by work experience.

N=421

Years of work experience	**Perception**		**Total**	**df**	**X^2**	**P- value**
	All age groups are susceptible to avian influenza infection					
	Yes (%)	**No (%)**				
1 – 10 years	89(47.3)	99(52.6)	188	2	6.9	0.2
11– 20 years	60(37.9)	98(62.0)	158			
21 years and above	25(32.1)	53(67.9)	78			
Total	174(41.0)	250(58.5)	424			

$p > 0.05$

Table 4.21: Perceived seriousness of avian influenza infection by sex, level of education, age and work experience.

Variable	Odds ratio	95% CI
Sex:*		
Female	1.0	0.8-3.4
Education:		
Tertiary Education	6.0	0.5-4.9
Non tertiary education	1.3	1.2-2.7
Age:**		
>40 years	1.1	0.5-2.1
Work experience:		
1-10 years	1.0	0.1-6.6
11-20 years	0.5	0.1-7.5
21-30 years	0.7	0.1-6.2

*Males constitute the reference group

**Persons aged ≤40 years constitute the reference group

PHC health workers preventive practices against Avian Influenza

Respondents' level of awareness relating to effective general clinical measures for preventing infections is highlighted in Table 4.22. Hand washing before and after performing medical procedures or examinations (97.2%) topped the list, followed by sterilization (94.5%). Some respondents (26.5%) were not aware that putting sharp objects in separate plastic boxes or containers could be used to control infections in health centres (see Table for details).

Table 4.23 contains guidelines listed by respondents for preventing diseases. These include washing of hands and sterilization of equipment after medical procedures (26.2%), disinfection of work environment (16.9%), and prevention of spread through overcrowding and coughing (15.8%).

Respondents were further asked about their practices for preventing avian influenza infection. The listed practices were use of personal protective equipment (93.4%), hand washing (3.9%) and referral of patients (2.7%) (Figure 9).

Respondents' practices for preventing avian influenza within one month preceding the study are shown in Table 4.24. They included wearing of gloves (92.2%), sterilization (82.9%), wearing of aprons (76.1%) and putting sharp objects in thick safety boxes made of cardboard (73.8%) (See Table for further details). The listed medical supplies available for preventing infections in health centres included gloves (88.7%), soap (58.8%) and regular supply of disinfectants (52.7%). For details see Table 4.25.

The precautionary measures listed by respondents for preventing avian influenza from spreading among health workers and others are presented in Table 4.26. The measures outlined by respondents included prevention with personal protective equipment (24.3%), isolation of patients (23.3%), use of personal protective equipment and sterilization (21.5%) and hand washing (10.8%) (See the Table for details).

The personal protective equipment for preventing avian influenza infections in hospitals are shown in Figure 10. These included face masks (35.2%), gowns (22.4%), respirators (12.5%) and goggles (2.8%). The frequency of the use of PPEs to avoid the spread of avian influenza in hospitals is shown in Figure 11. These included always (45.9%), never (25.3%), rarely (12.5%), often (11.9%) and sometimes (4.6%).

Regarding materials used for hygienic practices to avoid spreading avian influenza infection to patients and fellow health workers, 68.2% of the health care workers reported washing their hands with water; soap and disinfectants followed by 20.6% who reportedly washed their hands with water and soap (see Figure 12 for details). On the frequency of hand washing by respondents after attending to patients, majority (82.5%) stated that they washed their hands always (See Figure 13 for details).

Majority (70.9%) of the respondents always use water, soap and disinfectants for washing their hands always (Table 4.27).

Respondents' frequency of disinfecting medical equipment after use is shown in Figure 14. Many (75.5%) respondents always disinfected medical equipment after use. Few (13.0%) of them disinfect medical equipment often, while 6.0% do so sometimes.

Only 18.8% of the respondents said they had avian influenza educational materials in their health centres (see Table 4.28 for details). Table 4.28 also shows respondents capacity to prevent avian influenza infection. Majority (72.6%) claimed not to have been taught how to prevent avian influenza while in their professional training school.

Table 4.22: Knowledge of effective clinical measures for preventing infection in health centers by respondents.

Standard clinical measures for preventing infections in health care settings.	Yes (%)	No (%)	Don't know (%)	Total (%)
Hand Washing before and after performing medical procedures or examinations*	498(97.2)	12(2.3)	2(0.4)	512(100.0)
Sterilization of equipment*	484 (94.5)	27(5.3)	1(0.2)	512(100.0)
Wearing personal protective equipment*	426(97.3)	64(12.4)	6(1.2)	438(100.0)
Handling of beddings with gloves*	365(73.4)	112(22.5)	20(4.0)	497(100.0)
Putting sharp objects in separate plastic boxes or containers*	360(71.3)	134(26.5)	11(2.2)	505(100.0)
Isolation of patients with certain infections*	345(69.0)	127(25.4)	28(5.6)	500(100.0)
Not talking any how when patients are around*	195(40.1)	251(51.6)	40(8.2)	486(100.0)
Wearing medicated glasses.	134(27.1)	325(65.8)	35(7.1)	494(100.0)
Not wearing goggles.	119(24.6)	321(66.5)	43(8.9)	483(100.0)
Using water to clean needles, syringes and gloves before re-using them.	76(14.8)	420(82.0)	16(3.1)	512(100.0)
Not wearing shoes because the clinic environment should be sterile.	71(14.1)	412(81.7)	21(4.2)	504(100.0)

*Correct responses

Table 4.23: General guidelines for preventing diseases listed by respondents.

N=183

Prevention guidelines.*	**Frequency**	**%**
Washing of hands and sterilization of equipment after medical procedure	48	26.2
Disinfection of work environment	31	16.9
Prevention of spread through overcrowding and coughing	29	15.8
Health education for patients and health workers	23	12.6
Proper treatment	19	10.4
Not recapping needles	19	10.4
Immunization and periodic examination	8	4.4
Treatment, health education and proper waste disposal	6	3.3

*Non responses excluded

N=81

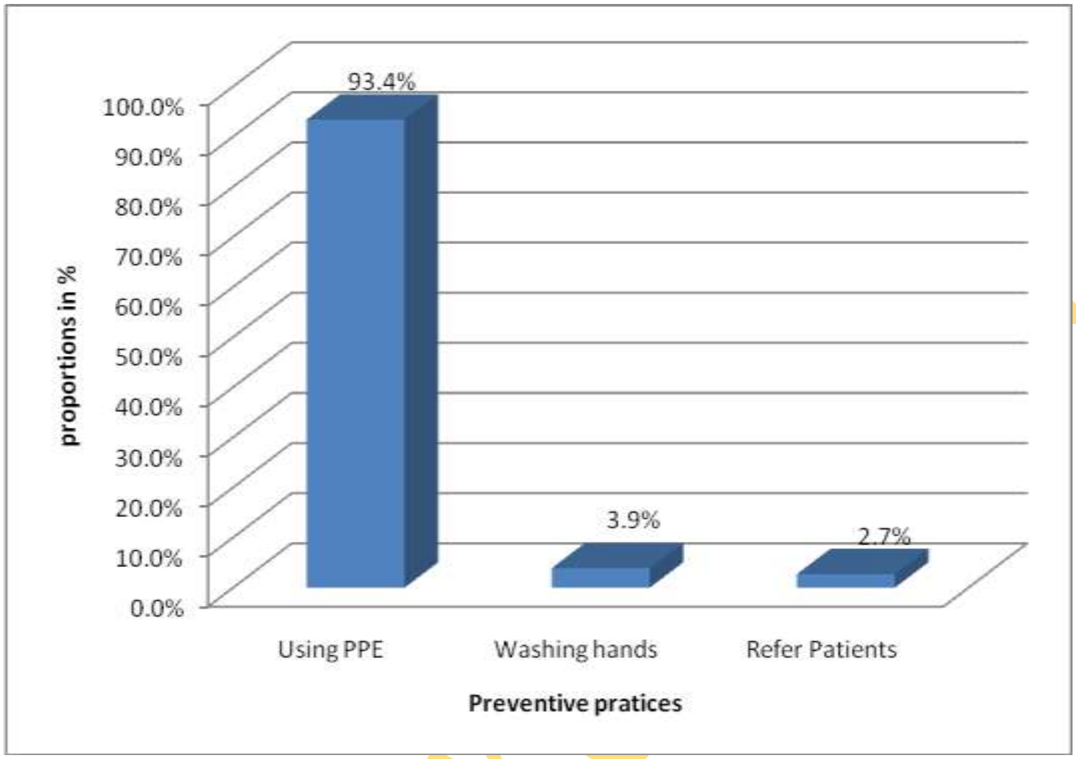


Figure 9: Respondents' practices for preventing avian influenza.

*PPE means Personal Protective Equipment

Table 4.24: Respondents' practices for preventing avian influenza within the one month preceding the study **N=515**

Preventive measures practiced *	Yes (%)	No (%)
Wearing gloves	475(92.2)	40(7.8)
Sterilization of medical equipment	427(82.9)	88(17.1)
Wearing aprons	392(76.1)	123(23.9)
Putting sharp objects in thick safety boxes made of cardboard	380(73.8)	134(26.2)
Avoiding splitting or splashing of body fluids	356(69.1)	159(30.9)
Putting sharp wastes in separate boxes	335(65.0)	180(34.9)
Putting sharp objects in plastic boxes	262(50.9)	253(49.1)
Isolation of patients	240(46.6)	275(53.4)
Wearing facemasks	220(42.7)	295(57.3)
Wearing goggles	144(28.0)	371(71.5)
Not washing hands before and after performing medical procedures	98(19.0)	417(80.9)
Wearing medicated glasses or eye glasses to protect the eyes	92(17.9)	423(82.2)
Putting sharp objects in nylon bags	81(15.7)	434(84.3)
Working on patients without gloves because gloves are not available	56(10.9)	459(89.2)
Re-use gloves because they are scarce	41(8.0)	474(92.0)
Re-use syringes because they are scarce	36(7.0)	479(93.0)

*Multiple responses included

Table 4.25: Availability of medical supplies for preventing infections in health centres.

Equipment	Available (%)	Not available (%)	Out of order/use (%)	Total
Gloves	431(88.7)	48(9.9)	7(1.4)	486(100.0)
Soap	288(58.8)	199(40.6)	3(0.6)	490(100.0)
Water	256(52.7)	223(47.9)	7(1.4)	486(100.0)
Disinfectants	245(50.0)	237(48.4)	8(1.6)	490(100.0)
Gown/overall	225(45.9)	262(53.5)	3(0.6)	490(100.0)
Surgical masks	144(29.7)	319(65.8)	22(4.5)	485(100.0)
Isolation room	91(18.8)	378(78.4)	13(2.7)	482(100.0)
Goggles	86(17.9)	376(78.2)	19(3.9)	481(100.0)
Respirator	64(13.1)	397(81.4)	27(5.5)	488(100.0)

Table 4.26: Precautionary measures listed by respondents for preventing suspected avian influenza infection from spreading among health workers and patients.

N=288

Precautions*	**No****	**%**
Protection with personal protective equipment	70	24.3
Isolation of patients	67	23.3
Personal protective equipment hand washing and sterilization	62	21.5
Washing of hands	31	10.8
Treatment of patients and use of personal protective equipment	24	8.3
Use of antibiotics	16	5.6
Health education and treatment	12	4.2
Sterilization of instruments	4	1.4
Use of antiviral drugs	2	0.7

*Non responses excluded

**Multiple responses included

N=304*

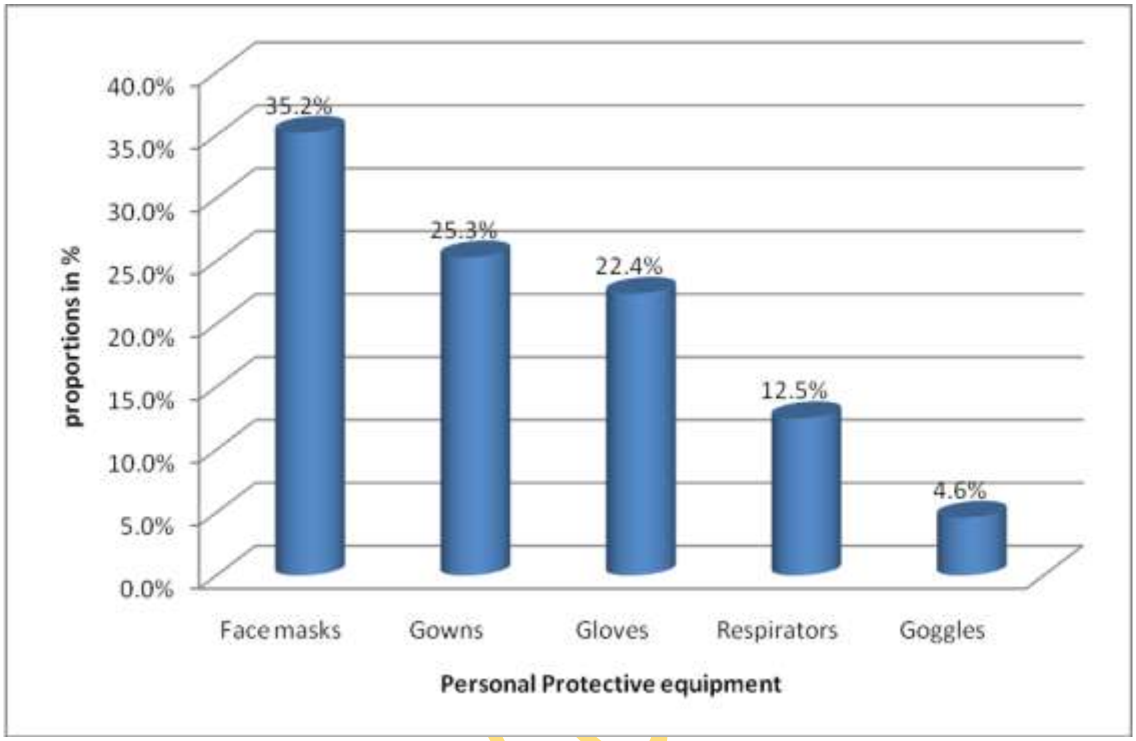


Figure 10: Specific personal protective equipment for preventing avian influenza infection.

***There were multiple responses**

N=479

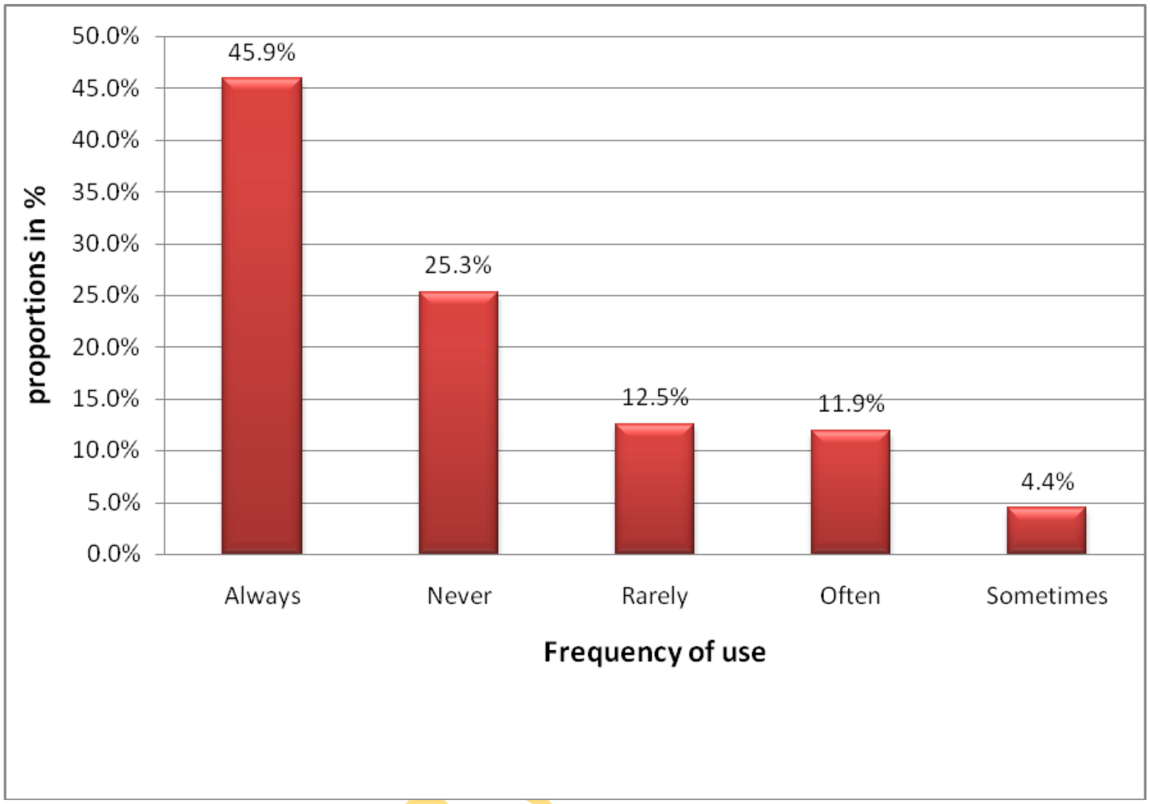


Figure 11: Frequency of use of personal protective equipment to avoid spread of avian influenza infection in health centres.

N=464

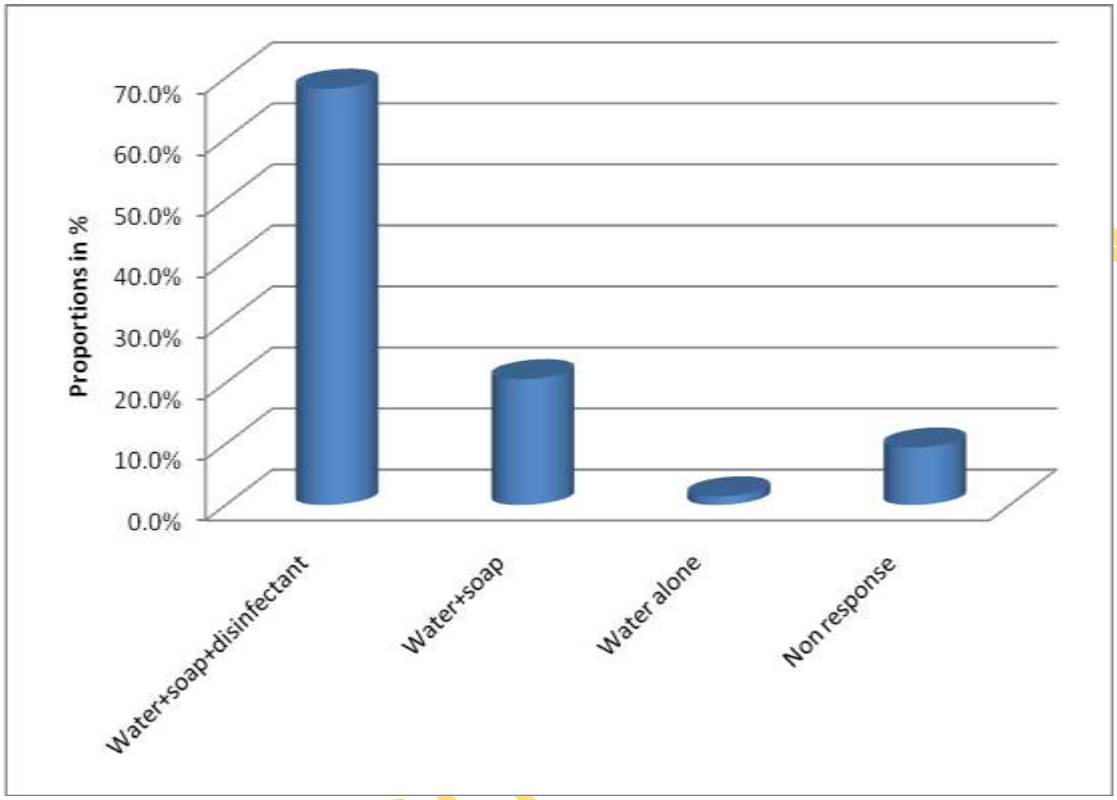


Figure 12: Materials with which respondents wash their hands.

* Appropriate Practice

N=491

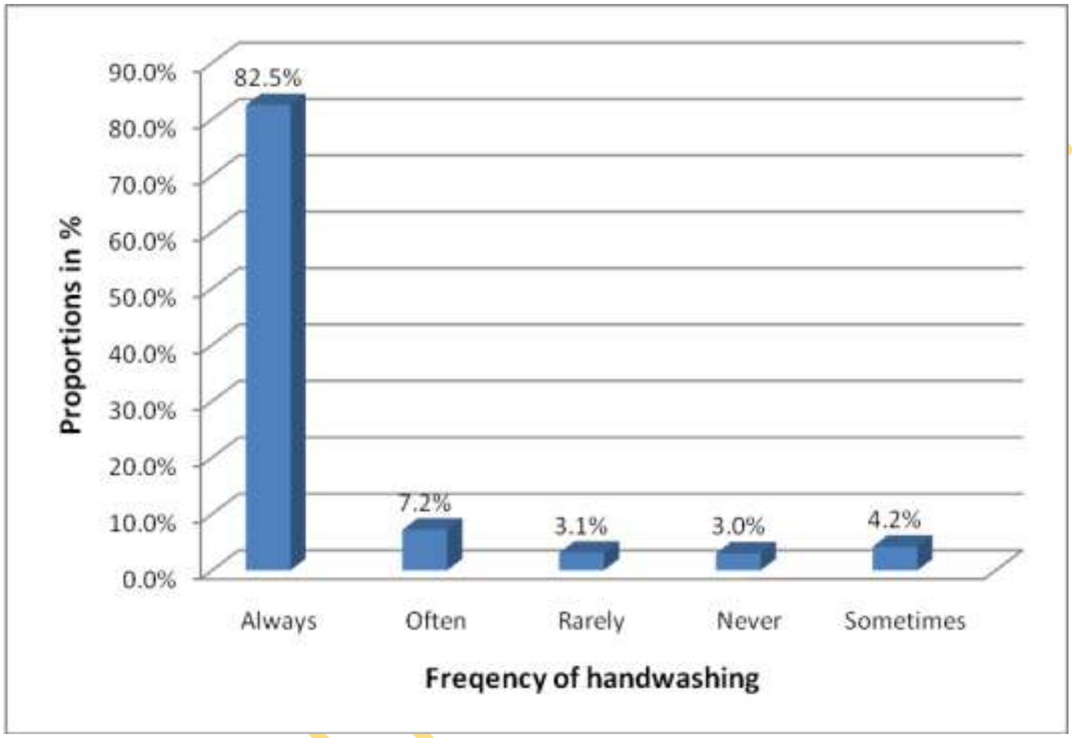


Figure 13: Frequency of hand washing after attending to patients.

Table 4.27: Frequency of hand washing with water, soap and disinfectants.

N=491

Frequency of hand washing	**No**	**%**
Always	365	70.9
Often	77	15.0
Sometimes	42	8.2
Rarely	4	0.8
Never	3	0.6

*Non responses excluded

N=491

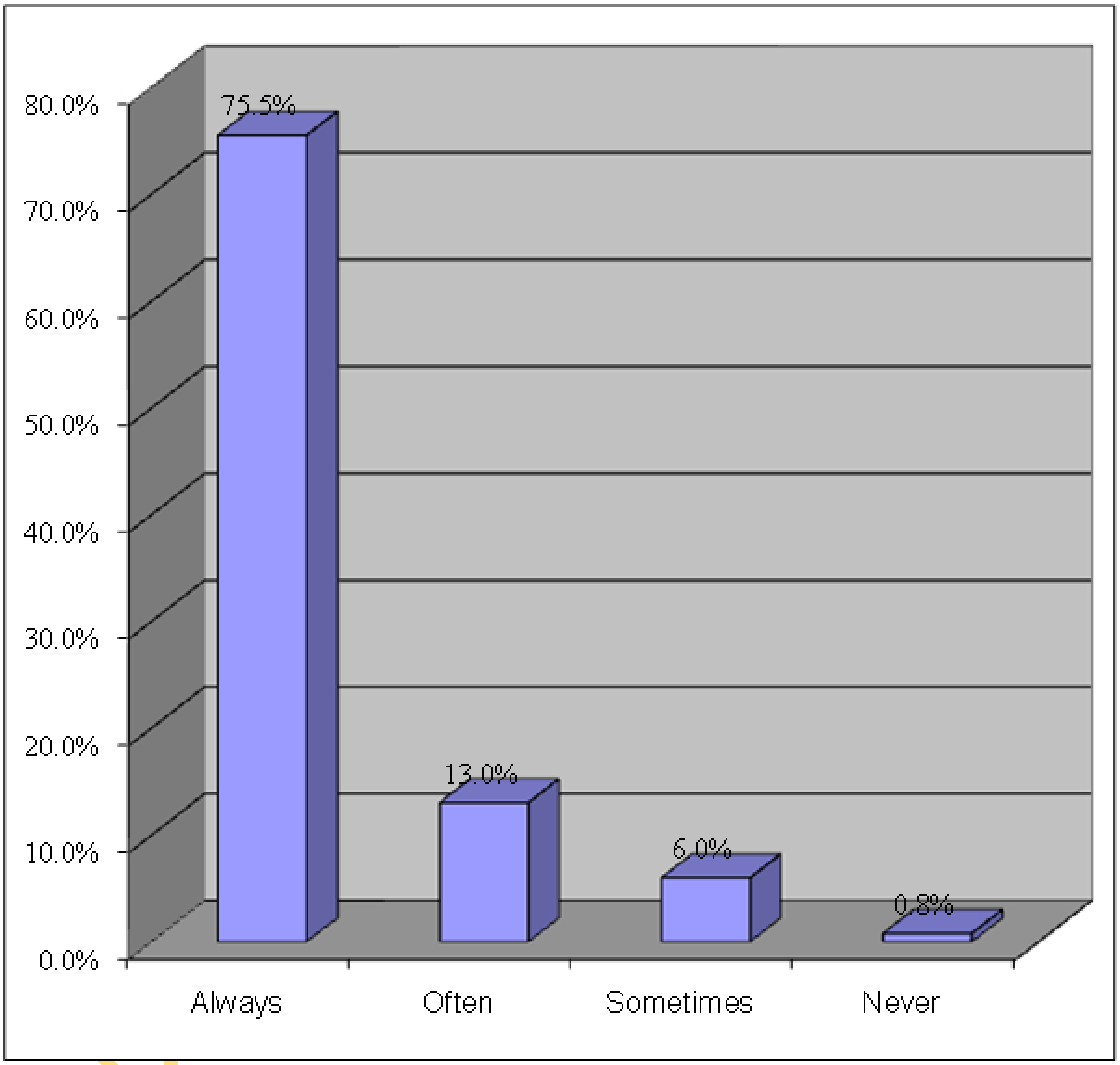


Figure 14: Respondents' frequency of disinfecting medical equipment.

Table 4.28: Respondents' capacity for preventing avian influenza infection.

Capacity	Yes (%)	No (%)	Don't know (%)	Total
Taught about avian influenza infection in a training school.	126(24.5)	347(72.6)	15(2.9)	515(100.0)
Received continuous professional education on avian influenza infection management.	96(19.9)	370(76.6)	17(3.5)	483(100.0)
Have avian influenza infection prevention committee in clinic or health facility.	96(20.1)	318(66.7)	63(13.2)	477(100.0)
Have avian influenza education materials in your hospitals/health care facility.	91(18.8)	390(80.7)	2(0.4)	483(100.0)
Ever received any PPE for the prevention of avian influenza infection.	35(7.2)	444(91.7)	5(1.0)	484(100.0)
Availability of Avian influenza isolation room.	45(9.3)	421(87.1)	17(3.5)	483(100.0)

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This chapter focuses on the discussion of the findings of this study. It starts with the discussion of the socio-demographic characteristics of the respondents, followed by awareness and knowledge of avian influenza; perceptions of avian influenza, infections prevention and control in health facilities with special reference to avian influenza; basic and post-basic training experiences relating to infection control; and infections control and prevention practices. The implications of the findings for health education are also discussed in this chapter. The chapter ends with conclusion and evidence based recommendations.

Socio-demographic characteristics

The 515 respondents who were involved in this study were drawn from five of the six peri-urban LGAs in Ibadan whose health authorities gave approval for the study to be carried out in their areas of jurisdiction. The socio-demographic characteristics reflect the categories of workers involved in PHC services in the LGAs.

In Oyo State, the Medical Officers of Health (MOH) are the PHC coordinators in the LGAs. Informal discussions revealed that their roles include the following management functions: development of annual work-plans; budgeting for PHC activities; disbursement of approved funds for all PHC activities including avian influenza infection prevention and control at the LGA level; prevention and control of infections generally; implementation of timely continuing education for frontline PHC workers; and provision of appropriate personal protective equipment for PHC workers. The doctors are not attached to any specific health care facilities. They develop a supervisory visit schedule and pay regular visits to all the PHC facilities in their areas of jurisdiction to handle medical cases that are beyond the competence of facility-based PHC workers including nurses/midwives, CHOs, and CHEWs. They also monitor the performance of their staff. In short, the PHC coordinators are the chief accounting and implementation officers as far as PHC activities are concerned. The articulated role of the MOH implies that they have a pivotal role to play in the management of avian influenza control and prevention.

The nurses and or midwives in the services of the LGA health facilities were qualified primary health care staff who are trained for a minimum of five years (three years of basic nursing (Nursing and Midwifery Council of Nigeria, 2005) and two years midwivery programme) (Nursing and Midwifery Council of Nigeria, 2005). The midwivery component is not compulsory for all practicing nurses. This implies that not all nurses are midwives. Nurses and midwives however indulge in some clinical practices which may have implications for the spread of iatrogenic diseases including avian influenza infection. Nurses and midwives are usually exposed to the basic principles of infection control during their basic training. The acquired knowledge and practice of universal precautions against infections need to be reinforced through using appropriate health education strategies with special reference to additional precautionary measures for preventing and controlling avian influenza infection in clinical settings.

The Community Health Officers (CHOs) are the most senior members of the community health practitioners in Nigeria (Oyedeji, 2010). The community health practitioners are made up of CHOs, Senior and Junior CHEWs. The CHEWs constituted a majority of the respondents in this study. They are traditionally trained to spend 30% of their time in the community and 70% in the clinic (NPHCDA, 2008). However, it has been noted in a previous study that because of the shortage of health personnel in the LGAs, virtually all the CHOs and CHEWs spend 90% of their time in the health facilities with about 10% or less of their time spent in the communities especially during outreach sessions and health campaigns (Oyedeji, 2010). Like nurses and doctors therefore, they have critical roles to play in avian influenza prevention and control.

There are two modes of entry into the CHO programme; direct and indirect. For the direct entry programme, entry qualifications are Senior Secondary School Certificates (West African School Certificate (WASC), National Examination Council Certificate (NECO) or General Certificate Examination (GCE) ordinary level certificate) with five credits including Mathematics and English language. The indirect entry is for qualified CHEWs. The duration of the training is two years and the higher diploma in Community Health is the certificate awarded. The CHO has administrative, medical, training and supervisory responsibilities related to PHC activities (Community Health Practitioners' Registration Board of Nigeria, 2006).

The SCHEWs and JCHEWs are trained by States' Schools of Health Technology. The entry qualification for CHEWs is WASC, NECO or GCE ordinary level certificate with five credits including Mathematics and English Language. They may train as CHOs after two years working experience. The entry qualification for JCHEWs is WASC, NECO or GCE ordinary level certificate. Their training is for two years and they may train as SCHEWs after two years working experience (NPHCDA, 2008).

The CHEWs are trained to spend 30% of their time in the health facility and 70% of their time paying regular outreach visits to their communities (field visits or supervisory visits) (Best and Chinyere, 2010). On such occasions, they may participate in community activities, attend meetings of Ward Development Committees (WDC) and Village Development Committees (VDC), supervise the activities of JCHEWs or follow up on clients referred by community-based health care providers. The community based health related activities of the CHEWs could be used as opportunities for providing avian influenza prevention and control education under the supervision of the Medical Officers of Health or PHC coordinators in the study area. Since the organizational structure and pattern of staffing of LGA PHC department are the same in all the 33 LGAs in Oyo State, Nurses and Midwives, CHOs, CHEWs and HAs could be used to facilitate a State wide avian influenza prevention and control programme in the State.

A large majority of the respondents were females. This is not surprising as females constitute a large proportion of the health workers in Nigeria (Monica, Varun and Stuti, 2003). Specifically, the practice of nursing in Nigeria is dominated by females (Adetunji, Margaret, Bayo, and Eyitayo, 2008). Female nurses therefore have unique roles to play in the mobilization of fellow women for avian influenza prevention and control at the community level.

A preponderance of respondents were in the 35-39 years age group and their overall mean age was 38.4 ± 8.7 years. This implies that a majority of them were mature adult health workers. A similar result was obtained in a study of frontline LGA health care workers previously conducted in Igboora, Oyo State, Nigeria by Omokhodion, Umar and Ogunnowo, (2000).

Awareness and Knowledge of avian influenza

The results of this study showed that the respondents are generally aware of avian influenza infection as a dangerous infection and most of them gained knowledge of avian influenza from the mass media. The radio, television, newspapers and posters were the four main sources of information about avian influenza among the respondents. This finding is a reflection of their media habit and preferences. In Thailand, Tavorn, et al, (2008) similarly observed that the mass media played important roles in the delivery of avian influenza related information. The pivotal role of the mass media in information dissemination has been acknowledged by several authorities including Boyd, Barbara and William, (2009) and Tavorn, et al, (2008). A major advantage inherent in using the media is that they can be used to reach millions of people at the same time with health education messages (FAO, 2009b)

The outbreak of avian influenza in Nigeria generated a lot of media attention. The mass media helped to increase people's level of awareness about the impact of the epidemic on the poultry industry as well as the potential vulnerability of human beings.

The high level of awareness of avian influenza among the HCWs is indicative of the effectiveness of public enlightenment through the mass media. More effective health education services through the use of the mass media should be encouraged. The high level of awareness of avian influenza among the respondents may also be due to the fact that the study population is made up of health workers. Health workers are usually among the first category of people to be aware of cases of epidemics and health problems of public health importance.

Respondents' mean knowledge score on AI using a 61- point scale was 37.2 ± 9.4 with 66.6% of the respondents having a fair knowledge about avian influenza. Clearly, this affirms that there were gaps in the knowledge of the HCWs about AI infection.

Knowledge was greater in persons with higher education compared to those with lower education. Professionals (Doctors, Nurses, CHOs, and JCHEWs, SCHEW, Pharmacy technicians and Health assistants) had higher mean knowledge scores than non-professionals (Primary school and Secondary School Certificate holders). This may be due to the specialized training acquired by the professional HCWs.

Arzu et al, (2008) had a similar experience in their study conducted among HCWs in Turkey. They observed that, professional HCWs had a better knowledge of avian influenza than non-professionals. This they attributed to the fact that the professionals may have received more formal training in avian influenza management than the non-professionals. Furthermore, their job descriptions may influence their knowledge as the professional HCWs have the greatest opportunity for direct patient care.

Respondents with more years of work experience as a health worker had a higher knowledge of AI than those with fewer years of work experience as a health worker. This may be so because of their longer years of working experience as a health worker. It has been noted that more years of working experience is associated with greater experience in acquiring more knowledge and skills in clinical work (Arzu et al, 2008).

Only a small proportion of the HCWs listed avian influenza among the diseases that could easily spread in health centres. This may be because although most of them were aware of the infection, many of them had no detailed knowledge of the disease including mode of transmission. It is to be noted that avian influenza is a highly virulent emerging infection which many health workers have not known in great detail compared with other endemic diseases such as malaria.

Poor or low level of knowledge of avian influenza among health workers is not limited to the study area. For instance, a study conducted in the USA by Brenda, Michael, James and Daniel (2006) showed that none of the respondents was aware that avian influenza is a disease of major concern to Americans. Low level of knowledge about avian influenza among frontline health workers has negative implications for the prevention and control of the infection. It can, for instance, lead to delay in the initiation of appropriate preventive measures against the infection by the HCWs. The situation can lead to the spread of avian influenza infection in health care settings.

It was observed in this study that the knowledge of avian influenza transmission in terms of the vehicle for transmitting the infection was high, as many of the respondents were able to state correctly that infected birds are common reservoirs of the avian influenza pathogen. However, only a few of them were aware that avian influenza is a contagious infection caused by a virus. None of them could precisely state the virus implicated in the causation of avian influenza. A similar observation was noted in a study carried out by Maia, Wayne, George, Maia, and Louise-Anne (2007) among health care workers in Georgia, USA. The HCWs were of the opinion that it is infected birds that cause avian influenza infection and only 15.5% of them could correctly identify H5N1 as the virus that causes the avian influenza infection.

The result calls for an urgent institution of an educational intervention aimed at upgrading the knowledge of the HCWs about the actual causative virus of AI. As health workers, their knowledge of the actual causative agent of AI will enable them effectively relay correct AI related health education messages and deliver appropriate control and preventive services to people in their communities. Gerald, Nugroho, Cheong, Wong, Rina, Meena, Kelvin, Chia and David (2009) have stated that for HCWs to protect themselves and members of their communities from AI adequate knowledge of the causative agents of such infection is important.

Majority of the respondents had some basic knowledge of the major signs and symptoms of AI such as, cough, shortness of breath, elevated body temperature greater than 38ºC, headache, running nose, sore throat, vomiting and diarrhea. However, some gaps in knowledge relating to other severe symptoms of AI were noted. For instance, few of them we aware of the typical symptoms of AI infection like pneumonia, muscle ache (*myaglia*), conjunctivitis, excessive decrease in white blood cells, and low blood platelets. This result corroborates the result of a previous study carried out by Tavorn et al, 2008, among AI high risk population in Thailand which revealed that most of their respondents' knowledge about major signs and symptoms of AI was limited. According to Tavorn et al, (2008), 69.1% of their respondents did not know AI symptoms characterized by high fever, headache, *myaglia*, sore throat cough, and pneumonia. This lack of detailed knowledge of the etiology of AI infection including some signs and symptoms of AI by the health workers has potential for leading to defective diagnosis and inappropriate treatment of the infection.

Half of the respondents were able to recognise the possibility of human to human transmission of AI infection through caring for AI patients. In an attempt to raise peoples' level of awareness about AI infection governmental and non-governmental organizations in Nigeria had disseminated AI related messages across the country including the study areas through the media and other sources. This may have helped in increasing their knowledge about the transmission of AI infection among birds but not the possibility of human to human transmission of the infection.

The findings also show that there is a gap in respondents' knowledge relating to medicine for the management of AI infection. A large proportion of the respondents are not aware that *Tamiflu* and *Relenza* are the recommended medication for the management of AI infection. This finding is quiet similar to that of Arzu et al, (2008) in a study conducted among medical doctors in Istanbul, Turkey. They noted that medication for AI management was less well known by doctors.

A large number of the frontline HCWs stated that *Avianfluciline* and Antibiotics are the recommended drugs for the management of avian influenza. This is a serious health concern as it is an indication of their lack of preparation for the management of AI in the LGAs. There is therefore an urgent need to bridge the knowledge gap of the HCWs regarding the use of *Tamiflu* and *Relenza* so as to ensure prompt management of AI in the study LGAs.

Perceptions of avian influenza

Given the role of risk perceptions in inducing certain health behaviors, it is necessary to understand peoples' risk perceptions regarding infectious diseases (Brug, Aro, Richardus, 2009). Risk perceptions is defined as the perceived seriousness of a health threat and perceived personal vulnerability to a given health related condition as revealed by the health belief model (Susanna, Joan and Isaac, 2003). Consciousness of ones vulnerability is important for initiating precautionary actions (Weinstein, 1988). Awareness of health workers' risk perceptions of phenomena is needed with a view to coming up with appropriate preventive strategies for them. This is more so because as HCWs they are more vulnerable. This informed the need to document the HCWs perception of avian influenza.

A mixture of both positive and negative perceptions of avian influenza was noted among the respondents. Agreement with the seriousness of avian influenza indicates a positive perception while disagreement connotes a negative perception. Typical examples of positive risk perceptions related to avian influenza included vulnerability of everyone to avian influenza infection; and perceptions that it could be prevented. The wrong perception included the notion that avian influenza is not a serious infection and that an avian influenza patient is unlikely to die of the infection. All these perceptions have implications for health education.

Findings of this study show that respondents perceived avian influenza infection to be serious but did not perceive themselves to be vulnerable. A similar observation was made by Tapanan and Virasakdi, (2009) among frontline health personnel in Thailand. According to them, the perception of each individual is a fundamental factor that contributes to the spread, prevention and control of infectious diseases. This low risk perception in this and other studies may be attributable to low level of knowledge (Abdullahi, Oguntunde and Habib, 2010). The implication of this is that the HCWs are not likely to take preventive measures against avian influenza infection. They are also not likely to be involved in the initiation of measures to protect other people including their patients from avian influenza infection.

A large majority of the health workers were of the view that a person who takes care of an avian influenza patient is likely to contract the disease. This finding is in line with what was documented by Arzu et al, (2008) and Carolyn, Jacqueline, Wing, Paul, Dominic, William, Mak, Wilina, John, Matthew, Seymour, Anthony, Joseph, Laura, Thomas, Jean, Robert, Xiuhua, Nancy and Keiji, (2000). These investigators noted that based on epidemiologic evidence, human-to-human transmission of avian influenza could occur while caring for avian influenza patients. According to Brug et al, (2009), for people to voluntarily engage in precautionary actions, they need to be aware of the risk first. Risk perceptions are thus important for initiating precautionary actions.

Although the absolute risk from human to human transmission of avian influenza virus may be low at this time, the high case fatality seen among human avian influenza patients indicates that the consequences of infection are very serious and so intensive measures to protect HCWs against avian influenza infection is warranted. The risk of human to human transmission of avian influenza could increase in the future. Consequently, every avian influenza case should be managed by HCWs with the assumption that human to human transmission of the disease can occur and that the risk for such transmission is unpredictable.

It was observed that slightly above half of the respondents perceived all age groups to be susceptible to avian influenza infection. Avian influenza cases reported in Indonesia and Vietnam suggested that everybody is equally susceptible to avian influenza infection (WHO, 2007). The ability of the HCWs to recognise every human as vulnerable to avian influenza infection provides good foundation for health education relating to the promotion of appropriate treatment for avian influenza infection.

The respondents' level of perceived vulnerability to avian influenza in their place of work (i.e. health facilities) was low. A similar finding was observed in a study conducted by Curtis and Pollard, (2007) on the perceptions towards avian influenza among physicians. Their study revealed that more than half of the physicians did not consider the possibility of their risk of contracting avian influenza. This is a faulty perception. As far as avian influenza is concerned HCWs could contract the infection in their place of work because of the substantial amount of airborne and droplet-transmitted respiratory infections which HCWs are exposed to in the health facilities (WHO, 2008).

The HCWs perception of low vulnerability by the HCWs may inhibit their motivation to engage in protective behaviours. Perception of low vulnerability to avian influenza infection must be addressed through continuous training and health education (Ran, Saad, Daniel and George, 2006).

Infections prevention and control in the health facilities with special reference to avian influenza

The measures outlined by respondents for preventing avian influenza infection among HCWs include, isolation of patients, prevention with personal protective equipment, sterilization and hand washing. Only a very few of the respondents were of the opinion that the *Tamiflu* and *Relenza* were the recommended medicines for the management of avian influenza infection. This implies that there is inadequate knowledge among the HCWs relating to the importance of the use of antiviral medicines for the management of avian influenza infection. This might lead to non prescriptions of such medicines in the management of avian influenza patients in the health centres. A previous study by Katowa, Mukwato, and Maimbolwa (2007) similarly showed that although respondents in their study were of the opinion that hand hygiene and proper disposal of medical wastes are means of preventing avian influenza infection, they did not recognize the use of antiviral medicines as a means of managing avian influenza infections.

Regarding individual measures for preventing avian influenza in the health centres, many of the respondents attached relatively low importance to PPE especially face masks, gowns, respirators and goggles whereas according to Teppei, Ken, Miwako, Hiroyuki, Tsutomu, Reiko, Takashi, Nobuya, Kazuo, Hiroshi, Kentaro, Gerald, Sin, and David (2008), the WHO guidelines consider the use of PPE as important for preventing HCWs from contracting avian influenza infection. The relatively low importance attached to the use of PPE by the respondents in this study may be due to the lack of PPE in most of the health centres.

Only a few of the health workers had ever received PPE for the prevention of avian influenza infection. This may have contributed to the relatively low importance attached to PPE by the HCWs. Vazl, McGrowder, Alexander-Lindo, Gordon, Brown and Irving (2010) noted that almost three-quarters of the health workers in their study reported that provision of PPE was inadequate in their health centres. In a study carried out by Sadoh, Fawole, Sadoh, Oladimeji, and Sotiloye (2006) among health workers in Ogun State, Nigeria, it was reported that just over one-half of them indicated that they were provided with protective equipment most times. The implication of this is that the HCWs will attempt to carry out medical procedures without the use of PPE, a practice which can compound avian influenza control efforts.

On the frequency of the use of PPE to avoid the spread of avian influenza infections in hospitals, the regularity of use was fair as only a few of the health workers use PPE always. This may also be attributed to the lack of PPE in the health centres. This finding is similar to the result obtained in a study carried out among health care workers at first level health care facilities in two rural districts in Pakistan. The Pakistan-based study showed that 48.1% of the health care workers had never worn gloves, 20.9% wore gloves always and 75.9% had never used aprons (Janjua, Razaq, and Chandir 2007). This negates the WHO recommended guideline which considers the use of PPE as important for preventing health workers from contracting avian influenza (WHO, 2008). Protective barriers reduce the risk of exposure of health workers' skin or mucous membranes to potentially infectious materials such as avian influenza viruses. They also reduce the risk of exposure to blood and other body fluids to which universal precautions apply (Goldman, 1991).

Basic and post basic training relating to infection control

Regarding the capacity of respondents to prevent avian influenza infection, only a few of the participants in this study stated that they had ever received training on avian influenza infection in their training school. This result is in contrast with the FAO report of

2009 which stated that many medical officers in Uganda indicated that they had been trained on the protocols for avian influenza management. This lack of training on avian influenza in the study area could prevent the HCWs from effectively performing their jobs of protecting themselves, their co-workers and the community people from contracting avian influenza.

The WHO (2007b) has recommended that healthcare workers should receive training on avian influenza including its control and precautionary measures for preventing it. Adequate training of HCWs will enable them not only to perform their jobs, but also to protect their lives and health, as well as the health of their co-workers and people in their communities. Occupational safety and health training at all levels should be emphasized as a means of improving working conditions and the work environment, and thus inculcating a healthy and safe work culture among the HCWs

Training and general education have been found to be of paramount importance to developing awareness among health care workers, as well as improve adherence to good clinical practice (Godin, Naccache, Morel, and Ebacher, 2000; Twitchell, 2003). As observed by Patricia, McGovern, Donald and Laura (2000), health care workers who receive some training in the use of PPE were 5.7 times more likely to be compliant in the use of PPE than their peers without such training. Training on the use of PPE is therefore important (Patricia, et al, (2000).

The main challenges in conducting these training activities in the LGAs may however be the multidisciplinary approach that is required which should include clear clinical guidelines in identifying, reporting and treating human cases of avian influenza. Health care worker preparedness training should address the modes of avian influenza transmission and specify how to implement appropriate infection control strategies against the infection.

Infections control and prevention practices

This study showed that the HCWs were aware of standard clinical measures for preventing infections in health centres although they lack adequate knowledge of some aspects of such standard clinical measures. This is shown by the positive recognition of such standard clinical measures such as hand washing before and after performing medical procedures or examinations, sterilization of medical equipment, wearing of PPE, putting sharp objects in separate plastic boxes or containers, handling of beddings with gloves and isolation of patients with certain infections. A similar observation was made in a study by Okaro, Eze and Ohagwu (2009) among radiographers in Enugu State, Nigeria. Okaro et al, (2009) noted that radiographers were aware of standard precautions although they lack adequate knowledge of some aspects of such standard precautions.

In the absence of proper precautions, health care facilities can become sources of infection transmission. In order to address the problem of infection transmission within health care settings, WHO/CDC developed precautionary guidelines collectively known as standard precautions for implementation within health care settings which HCWs are expected to comply with as part of their professional duty (Chin, 1990). It has been noted that universal precautions are effective in preventing occupational exposure incidents of HCWs to infectious substances in the health care centres (Hutin, Hauri, Chiarello, Catlin, and Stilwell, 2003).

Nigeria has its own national policy on standard precautions (Isah, Sabitu, and Ibrahim, 2009) which advocates for a nationwide adoption of universal precautions by HCWs. Its implementation are meant to reduce accidental exposure to blood and body fluids and the attendant infection that could result thereof. The commonly recommended preventive strategies for reducing occupational injuries and to increase conformity with standard precautions include education, awareness campaigns, provision of PPE and the creation of a compliance-enabling environment (Ayalu, Shiferaw, Bezatu and Jean-Michel, 2010).

One of the interesting findings from this study was that over half of the HCWs reportedly washed their hands with water, soap and disinfectants with a view to avoiding the spread of avian influenza to patients, fellow health workers and their immediate family members. This is similar to the reports of Kolude, Owoaje and Omokhodion (2002) and Sadoh et al, (2006) which revealed that a large majority of the health care workers who participated in their study in public hospitals in Abeokuta, Ogun State, Nigeria, always washed their hands or other skin surfaces when they come in contact with blood or other body fluids.

The hand washing practice of HCWs should be encouraged. It is an important measure that can be used to reduce environmental microbial contamination from avian influenza virus in particular. Hand washing is the simplest, most effective method for stopping the spread of hospital-based infections (Wenzel, 2004). Control measures showing the protective effect of hand hygiene in the prevention of the spread of infection are widely reported in the literature and broadly accepted (Ryan, Christian and Wohlrabe, 2001 and Wenzel, 2004).

Contact with infected patients was identified by most of the respondents in this study as a major factor that can facilitate the spread of hospital acquired infections. This observation is in line with what was noted by Liem, Lim and WHO Avian Influenza Investigation Team, (2004) in Vietnam, which concluded that among HCWs, professional practices which have implications for avian influenza transmission includes the following: exposure to the case patient; providing direct care to case patient; face-to-face talking with AI patient; working in wards where an AI patient is admitted, exposure to an AI patient coughing/sneezing; handling clinical specimens from AI patients without using gloves, administering breathing treatments to patients without protection; changing bed linens or bathing an AI patient and performing other tasks that involve close and more prolonged exposure to AI patients.

Other practices that can lead to the transmission of avian influenza among HCWs include non-sterilization of medical equipment, improper handling of contaminated article of clothing, improper use of PPE and not following the proper steps for wearing and removal of PPE (Brankston, Gitterman, Hirji, Lemieux, and Gardam, 2007 ; WHO, 2009). Anderson and Anderson (1995) have noted earlier that hospital acquired infections occurs during hospitalization through pathogens which are transmitted from one person to another by direct or indirect contact.

Implications of findings for health education

Health education is any planned combination of learning experiences designed to predispose, enable and reinforce voluntary behaviour conducive to health in individuals, groups or communities (Green and Kreuter, 1991). FAO/WHO, (2006) have stated that a coordinated multi-sectoral approach is needed to address issues of avian influenza infection including its prevention.

This study revealed that only a few of the HCWs had received training on avian influenza management in their training schools. This is clearly a deficiency among the HCWs that training on avian influenza can help fill. The training of health care providers is often identified as a first step to revitalizing health services, particularly in areas with a weakened public health sector (Jonathan and Joshua, 2000).

Health care workers training programme on avian influenza should address identified gaps in their knowledge and skills for avian influenza control. It should be designed to cover topics such as the followings: potential ways of contracting avian influenza virus; proper diagnosis of avian influenza cases; recognition of the right medication for the management of avian influenza infection; importance of taking practical measures to prevent or control avian influenza infection; proper hand hygiene; adherence to the use of PPE and use of universal preventive practices. This will strengthen the capacity of the HCWs to detect and respond rapidly to cases of avian influenza infection in their communities.

In-service training is an educational intervention that improves the competence of the HCWs who may not have had training on avian influenza during their basic training. The ultimate goal of an in-service training should be the development of a sustainable system for existing health workers to acquire knowledge and skills needed for implementing and sustaining safe and effective avian influenza control programmes. In-service training programmes could be in form of seminars, conferences and similar continuing education opportunities. The results of this study are useful in the design of an in-service training curriculum for the HCWs. For effectiveness, in-service training programmes should address the specific training needs of each category of health workers based on their statutory job description. For instance following the emergence of avian influenza in Turkey, basic and in-service training and educational materials were provided by the country's ministry of health to upgrade their knowledge and skills relating to the infection. This helped to improve their knowledge greatly (Mills, robins, Bergstrom and Lisiri, 2006). Training has been proven to be effective as an in-service health education strategy (Oshiname and Breiger, 1992).

Advocacy is a health education strategy that can be used to motivate and involve the following target groups in avian influenza infection prevention and control efforts: policy-makers, traditional and religious leaders, LGA legislative assemblies, NGOs, the media, and members of the community. Advocacy involves making a case for a particular issue, using skillful persuasion and strategic action. Simply put, advocacy means actively supporting a cause and trying to get others to support it as well (UNFPA, 1997). Advocacy has been an important strategy for improving public health throughout the world. It has been used to call attention to and promote improvements in services in health facilities, schools, and refugee camps (USAID, 2007). The strategy is also useful for mobilizing people to support the provision and wearing of protective gear for workers in high-risk occupations (USAID, 2007).

Advocacy could be used to ensure that the health care facilities in the LGAs are equipped with the needed medicines and supplies for the effective prevention and control of avian influenza. The strategy is needed for influencing health policy makers to invest in the training of HCWs on the prevention and control of AI.

Public enlightenment is another useful health education strategy. The strategy has been widely used to disseminate information successfully through the use of several media (both print and electronic media) aimed at raising people's awareness and knowledge relating to avian influenza. Its principles could also be harnessed to upgrade the knowledge of HCWs and to mobilize the community to be involved in avian influenza infection control. Public enlightenment is needed to empower the general population with the factual information needed to prevent the spread of the infection. In Uganda, for instance, public enlightenment has been used to raise awareness and to improve the knowledge of the people about avian influenza infection by providing evidence-based information on the disease (FAO, 2009b). Chamblee (2007) has emphasized the importance of public education in tackling misinformation about avian influenza infection. The main objective is to create awareness, address knowledge gaps and influence positive behaviour change through increased information, knowledge and understanding leading to commitment to adoption of healthier behaviour (Chitnis and Mansor, 2007). Public enlightenment involving the use of the mass media could be used to empower HCWs with factual information on AI in the study LGAs. This is more so because the mass media are their important sources of health information.

Right information equips people with knowledge of the facts which in turn dispels fear and misconceptions about avian influenza infection (FAO, 2009b). Public enlightenment messages in the study areas should among other things contain information on the following issues: modes of transmission; medication against avian influenza; avian influenza symptoms in birds and humans; protective practices and how to use them; risk perceptions; realistic assessment of personal risk; perceived severity or magnitude of risk; perceived susceptibility and negative consequences of non-compliance with protective activities. Avian influenza related public enlightenment programmes should be targeted at the needs of different audiences such as poultry handlers in the LGAs, teachers, traditional leaders and religious authorities who are key stakeholders.

Supportive supervision is a type of supervision which involves on-the-job exchange of useful ideas and assistance between a supervisor and the supervisees (Nino, Linda and Joan, 2008). It could be used to assist HCWs in the study area to carry out their duties and assigned tasks well. It is useful for guiding and encouraging staff to optimize their work performance. Supportive supervision is an effective approach for helping to facilitate the acquisition of functional knowledge and skills beyond the traditional training setting (Program for Appropriate Technology in Health (PATH), 2003). Supportive supervision could provide follow-up training and strengthen internal relationships among the HCWs (MLM, 2004). The HCWs in the study area will, in addition to training, require supportive supervision. During supportive supervision, the supervisors assess the HCWs training needs, provide feedback, and identifies opportunities for the effective prevention and control of avian influenza infection.

Partnership is the process of involving large group of people representing diverse interests to build support for the control or prevention of avian influenza infection. These alliances can be short term and strategic or long term and ongoing, requiring varying levels of support (Rahma, 2010). Partnership is the common action between health and other related social and economic sectors for the achievement of a common goal, while the contribution of the different sectors is closely coordinated (WHO, 1997). Building partnerships and nurturing a diverse collection of interests for avian influenza infection prevention and control can take time and effort, but it allows different groups to capitalize on each other's strengths in order to achieve the same goal (USAID, 2007). Diverse partnerships communicate to policy makers, opinion leaders, and the public at large that there is an issue so important that a wide range of interests, who may otherwise have little in common, have come together to promote change (USAID, 2007). It allows smaller organizations to pool their resources and take on projects and initiatives that are too large for small individual groups to address (UNFPA, 1997). Avian influenza infection prevention and control involves many players in the areas of health, agriculture, natural disaster response, finance and planning, and a multi-sectoral approach is therefore essential to combat the infection (Rachel, 2008). Various key stakeholders in the study area could be influenced, through advocacy and other appropriate health education strategies to form partnerships for the prevention and control of AI with special reference to prevention and control in health care settings.

Conclusion

This study revealed that the level of awareness of avian influenza infection among the respondents was high. However, the HCWs lacked detailed knowledge about the infection. That this happened, despite the fact that all received information about avian influenza infection from different sources, is a source of concern. Advocacy, training, public enlightenment and the building of sustainable partnerships are necessary to address the situation.

The knowledge of the respondents about avian influenza varied with their profession. Generally, core health workers in the LGAs were more knowledgeable about the infection compared with their non-health workers counterparts. This is expected as the professionals are exposed to more educational opportunities than the non-professionals regarding AI. There are gaps in knowledge relating to symptoms, etiology and medications for treating avian influenza infection among the HCWs. This needs to be addressed urgently in view of the pivotal roles played by these categories of frontline HCWs in infection prevention in health facilities.

Positive and negative perceptions about avian influenza existed among the respondents. A major negative perception is respondents' perceived non-susceptibility to AI infection. Perceptions such as this can lead to complacency among the health workers which can expose them and their clients to iatrogenic AI infections. Other negative perceptions that can compromise the prevention and control of AI include the notion that avian influenza is not a serious infection and that an avian influenza patient is unlikely to die of the infection.

There was a positive perception towards the seriousness of avian influenza infection which should be re-inforced among the HCWs. The positive perceptions related to avian influenza included perceived vulnerability of everyone to avian influenza infection and perceptions that the infection could be prevented. Positive perceptions have potential for the initiation of preventive measures.

This study showed that there is high level of awareness among the healthcare workers relating to universal precautions. Further probing however, revealed that their level of knowledge was shallow and compliance with the preventive measures was not encouraging among the frontline health care workers in the five peri-urban LGAs.

Recommendations

The recommendations based on the findings of the study are as follow:

1. Sustained public enlightenment interventions relating to avian influenza infection prevention using the mass media are needed in the LGAs. These interventions should be targeted at the HCWs and it should be aimed at improving their knowledge as well as their AI prevention and control skills.
2. Elements of basic avian influenza prevention and control education should be infused into the basic training curricula of HCWs. In-service training programmes relating to the diagnosis, treatment, prevention and control of avian influenza is needed for the practicing HCWs.
3. Many of the respondents in this study had negative perception of their non-susceptibility to avian influenza infection in their health centres. There is need to design an appropriate educational intervention to upgrade their knowledge about their susceptibility to AI infection.
4. There is a need for regular medical continuing education to increase HCWs knowledge and their level of compliance with infection prevention measures. This will go a long way to improve their skills in infection control in their LGAs.
5. Since availability of PPE and compliance with their use are related, there is need for the LGA health authorities to be influenced through advocacy to make PPE available in all the study LGAs.

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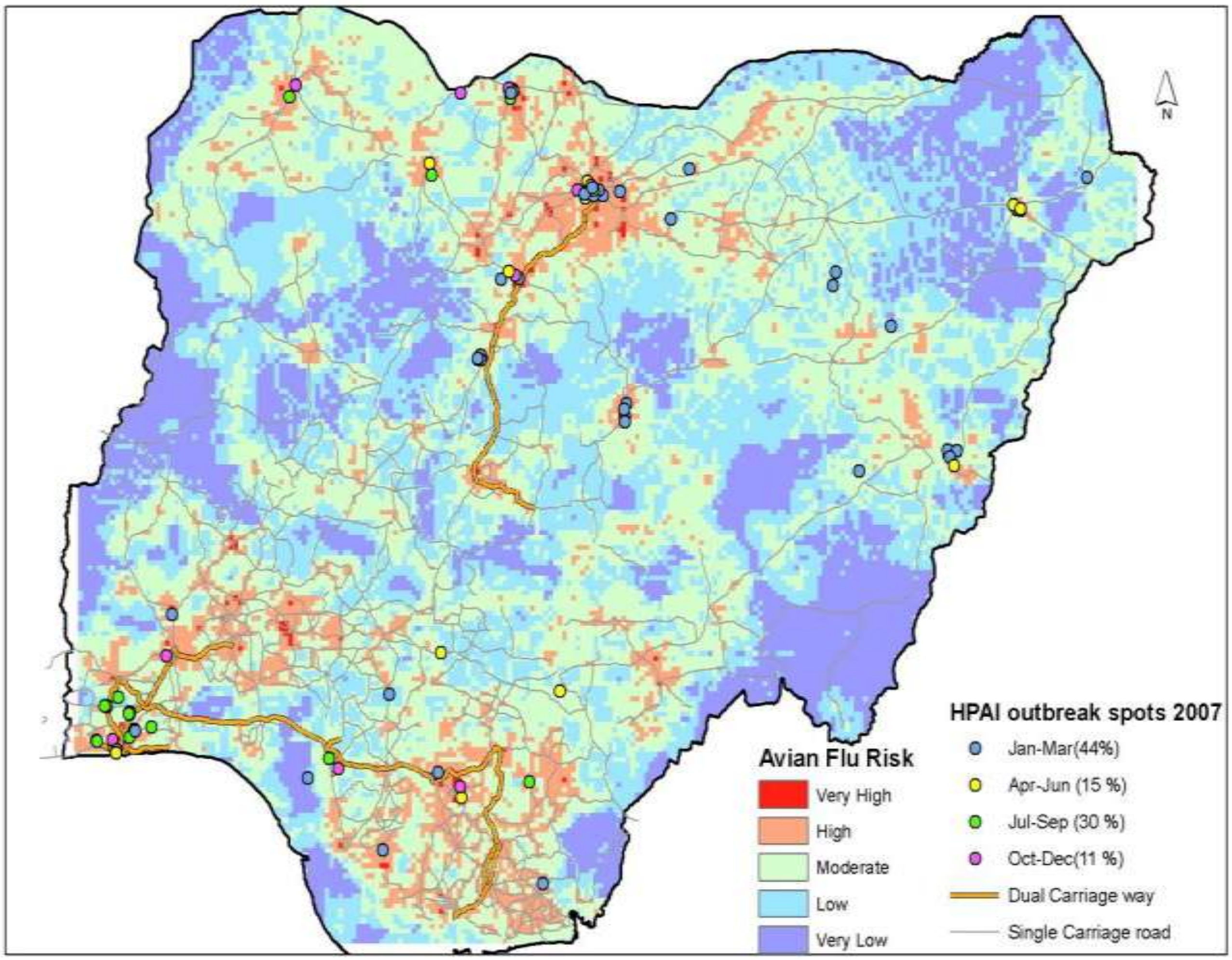
PPENDIX I

Figure1: HPAI Outbreak Distribution in Nigeria



Source: Department of Livestock Federal Ministry of Agriculture and Water Resource

APPENDIX II

Letter written by the Head of Department to facilitate the research process

Ref. HPE/SF.263

17th June, 2009

The PHC Coordinator,
Lagelu LGA,
Ibadan,
Oyo State.

<u>LETTER OF INTRODUCTION</u>

<u>Re: AFUYE, Busayo - Matric. No. 55641</u>

This is to certify that the above named student is an MPH (Health Promotion and Education) student in the Department of Health Promotion and Education, Faculty of Public Health, University of Ibadan, Ibadan.

Kindly accord him all necessary assistance he may require in connection with his research project titled **"Assessing the Knowledge, Perceptions and Practices of PHC Health Workers in Egbeda and Lagelu LGAs on the Prevention and Control of Avian Influenza Disease (Bird flu)."**

Thank you.

Dr. I.O. Olaseha
Ag. Head of Department

HEAD
DEPARTMENT OF HEALTH
[illegible]
[illegible]

APPENDIX III

QUESTIONNAIRE

HEALTH WORKERS' KNOWLEDGE, PERCEPTIONS AND PRACTICES RELATING TO AVIAN INFLUENZA INFECTION IN PERI-URBAN LOCAL GOVERNMENT AREAS OF IBADAN, NIGERIA

Dear Respondents,
I am a student of the Department of Health Promotion and Education, Faculty of Public Health, College of Medicine, University of Ibadan. The purpose of this study is to **assess the knowledge, perceptions and practices of PHC Health workers in Akinyele, Egbeda, Lagelu, Ido, , and Oluyole Local Government Areas of Oyo State relating to Avian Influenza (Bird Flu) infection**. The findings of this study will help in the formulation of programmes and policies aimed at combating the spread of avian influenza infection in Nigeria. I wish to inform you that there is no right or wrong answers to the questions asked and that participation is voluntary. Your identity, responses and opinions will be kept confidential and no name is required in filling the questionnaire. Please try and give honest responses to the questions asked as much as possible as your maximum cooperation will assist in making this study a success.

Would you want to participate in the study? (1)Yes ☐ (2) No ☐

Thank you very much.

Office use only

Interviewer's name: ______________ Date: ______________________

LGA: __________________________ Serial number: ______________

Important Instruction(s). Please your names are not required on the questionnaire; so do not supply or write them.

Section A: Socio-demographic information

Instruction: In questions 1-8 you are requested to tick **(√)** one response that applies to you from the alternatives provided. Boxes are provided for each choice for you to tick. Where necessary you will be asked to write your answers in the blank spaces provided.

1. Sex: (1) Male ☐ (2) Female ☐
2. Marital status: (1) Married ☐ (2) Widowed ☐ (3) Separated ☐ (4) Co-habiting ☐ (5) Single ☐

3. What is your highest level of Education?

☐ ☐ ☐

(1) Primary school (2) Secondary school (3) School of Nursing

(4) University ☐ (5) JCHEW ☐ (6) SCHEW ☐ (7) CHO ☐

(8) Health assistant ☐ (9) Pham Tech. ☐ (10) Doctor ☐

(11) Others (specify)…………

4. What is your religion? (1) Christianity ☐ (2) Islam ☐ (3) Traditional religion ☐

(4) Others (Specify)…………………

5. What is your age (as at last birthday in years)……………

6. What is your present job designation or rank? (specify) ………………

7. For how long have you been a health Worker? ……………

8. What is your ethnic group?

(1) Yoruba ☐ (2) Ibo ☐ (3) Hausa ☐ (4) Others (specify)……………

Section B: Workplace information

9(a) List any infection that you know can spread in your clinic or hospital if there are no precautionary or safety measures.____

____

9(b) How do these infections actually spread in health care settings?

____

10. The table below contains some CLINICAL measures. Some are correct while some are not. For each, tick **(√)** whether it is a measure for preventing infections in health centers (clinics, hospitals e.t.c.) or not. If unsure tick **(√)** Don't know/Not sure.

		Tick (√)		
S/N	**Effective measures for preventing infections in health centers, hospitals and clinics e.t.c.**	**Yes**	**No**	**Don't know/ Not sure**
10.1	Sterilization of equipment.			
10.2	Hand Washing before and after performing medical procedures or examinations.			
10.3	Wearing personal protective equipment.			
10.4	Not wearing shoes because the clinic environment should be sterile.			
10.5	Isolation of patients with certain infections.			
10.6	Putting sharp objects in separate plastic boxes or			

	containers.			
10.7	Wearing medicated glasses.			
10.8	Not talking any how when patients are around.			
10.9	Not wearing goggles.			
10.10	Handling of beddings with gloves.			
10.11	Using water to clean needles, syringes and gloves before re-using them.			

11. List other prevention guidelines you know. ____

____

12. Which of the measures in the table below did you practice in the past month? Please be honest; remember that whatever you say will not be counted against you, but will be used to help all health workers in this LGA.

		Tick (√)	
S/N	**Measures practiced within the last one month.**	**Yes**	**No**
12.1	Sterilization of medical equipment.		
12.2	Wearing goggles.		
12.3	Wearing aprons.		
12.4	Wearing gloves.		
12.5	Wearing face masks.		
12.6	Avoiding splitting or splashing of body fluids.		
12.7	Not washing hands before and after Performing medical procedures.		
12.8	Isolation of patients with certain categories of ailments.		
12.9	Putting sharp objects in Nylon bags.		
12.10	Putting sharp objects in plastic boxes.		
12.11	Putting sharp objects in thick safety boxes made of cardboard.		
12.12	Putting sharp wastes in separate boxes.		
12.13	Re-use gloves because they are scarce.		
12.14	Re-use syringes because they are scarce.		
12.15	Wearing medicated glasses or eye glasses to protect the eyes.		
12.16	Working on patients (touching, handling body fluids and blood e.t.c) without		

	washing of hands because gloves are not available.		

13. How common do you get new information about new health or disease issues from these sources?

		Tick (√)		
S/N	**Source of health information**	**Yes**	**No**	**Not at all**
13.1	Television			
13.2	Radio			
13.3	Newspapers			
13.4	Fellow Health workers			
13.5	Training programmes participated in			
13.6	Journals			
13.7	Posters			
13.8	Pamphlets			
13.9	Friends			
13.10	Workshop/seminars			
13.11	Magazines			
13.12	Billboards			
13.13	Others (specify)			

Section C: Knowledge of Avian Influenza (Bird flu) infection

14. Have you ever heard about avian influenza or bird flu?

(1) Yes ☐ (2) No ☐ If No please **discontinue** the interview.

15. If yes to question 14 above, please tick **(√)** your sources of information about avian influenza. How often do you hear about avian influenza from each of the sources in the table below?

		Tick (√)		
S/N	**Sources of information about avian influenza**	**Frequently**	**Sometimes**	**Not at all**
15.1	Television			
15.2	Radio			
15.3	Newspapers			

15.4	Fellow Health workers			
15.5	Training			
15.6	Journals			
15.7	Posters			
15.8	Pamphlets			
15.9	Friends			
15.10	Workshop/seminars			
15.11	Magazines			
15.12	Memo/Circular			
15.13	Billboards			
15.14	Others (specify)			

16. What do you think causes avian influenza (bird flu)?

(1) Birds (chickens/fowls) ☐ (2) Virus ☐ (3) Bacteria ☐ (4) Drug resistant germs ☐

(5) Others (specify)………………

17. For each of the statements below tick (√) whether it can lead to the spread of avian influenza infection among birds (chickens/fowls). Tick **(√)** Yes, No, or Don't Know/ Not sure in the table below.

		Tick (√)		
S/N	**Can each of the followings lead to the spread of avian influenza (bird flu)?**	**Yes**	**No**	**Don't know/ Not Sure**
17.1	Uncontrolled poultry (fowls, chickens e.t.c.) movement in live poultry "chicken" markets.			
17.2	Indiscriminate sale of poultry and poultry products.			
17.3	Mixing of infected and healthy birds/chickens/fowls.			
17.4	Mixing of free roaming birds with caged birds/chickens/fowls.			
17.5	Rearing together different species of birds. E.g. turkeys and chickens together.			
17.6	Contact between wild and domestic birds. E.g. Wild geese and chickens.			

17.7	Contact with infected eggs.			
17.8	Poor sanitary conditions in poultry (fowls, chickens e.t.c.) farms.			
17.9	Inadequate guidelines on poultry/chicken rearing.			
17.10	Inadequate quarantine services or care.			
17.11	Entry of infected staff into a non infected poultry (fowls, chickens e.t.c.) farm.			
17.12	Exchange of farm staff between infected and non infected poultry farms.			

18. In what ways can human beings get avian influenza (bird flu) infection?

Please answer the questions by ticking (√) True or False, Don't Know/ Not sure in the table below.

		Tick (√)		
S/N	**How can humans get avian influenza?**	**True**	**False**	**Don't know/ Not sure**
18.1	By touching or handling dead birds/chickens/fowls.			
18.2	By touching or handling sick birds/chickens/fowls.			
18.3	By eating improperly cooked birds/chickens/fowls.			
18.4	By eating improperly cooked eggs.			
18.5	While providing care for people with avian influenza (bird flu).			
18.6	By eating wild birds/chickens/fowls.			
18.7	Through mosquito bites.			
18.8	Touching infected poultry feeds.			
18.9	Living in the same house with poultry and playing with poultry.			
18.10	By Using knife or cutlery used for cutting infected fowls/chicken/birds in cutting food items (e.g. bread) without sterilization.			
18.11	Mixing healthy and infected persons.			

18.12	Allowing fowls or poultry to live in residential houses.			

19. If a person is sick with avian influenza (bird flu) how likely is he/she to die of the infection?

(1) Unlikely because patients usually recover fully without treatment ☐ (2) Likely ☐

(3)Very likely ☐ (4) Don't know ☐

20. Which age group is at most high risk of getting avian influenza (bird flu) infection? **Choose only one** please.

(1) Children less than 5 years old ☐ (2) Children 5 – 17 years old ☐

(3) Adults age 18 - 60 years old ☐ (4) Adults over age 60 ☐ (5) All age groups ☐

(6) Don't know ☐

21. The table below contains some signs/symptoms of diseases generally. For each tick (√) which is wrong or correct as a possible sign/symptom of avian influenza (bird flu). If you are in doubt about which is right or wrong tick **(**√) Don't know/Not sure.

		Tick (√)		
S/N	**Signs and Symptoms**	**Wrong**	**Correct**	**Don't know/Not sure**
21.1	Sore throat			
21.2	Cough			
21.3	Shortness of breath			
21.4	Running Nose			
21.5	Conjunctivitis			
21.6	Body Rash			
21.7	Muscle ache (Myaglia)			
21.8	Diarrhoea			
21.9	Vomiting			
21.10	Headache			
21.11	Pneumonia			
21.12	Excessive decrease in white blood cells			
21.13	Low blood platelet level			
21.14	Elevated body temperature greater than 38ºC			

22. At what temperature can the organism that causes avian influenza be killed? Choose only one by ticking (√). (1) 37◦C ☐ (2) 78◦C ☐ (3) 56◦C ☐ (4) 46◦C ☐

23. When a patient comes to you with an ailment which of the conditions or situations or behaviour of the patient in the table below will make you to start suspecting avian influenza. For each situation tick (√) Yes or No or Don't know/ Not sure.

		Tick (√)		
S/N	**Situations/Conditions**	**No**	**Yes**	**Don't know/Not sure**
23.1	If the patient says he/she has eaten cooked eggs and developed fever, shortness of breath.			
23.2	If the patient says he/she has taken care of another patient suspected of having avian influenza.			
23.3	If the patient has eaten sick or dead birds/chicken/fowls and then developed fever, and shortness of breath.			
23.4	If the patient has handled dead/sick birds/chickens/fowls and developed cough, fever, and shortness of breath.			
23.5	If the patient has butchered sick birds/chickens/fowls and then developed fever, cough, and shortness of breath.			

24. How long does it take for avian influenza infection to manifest in a patient after infection?

(1) 2-8 days ☐ (2) 24 hours ☐ (3) Don't know ☐

25. What medication is used for the treatment of avian influenza (bird flu) infection?

(1) Paracetamol ☐ (2) Avianfluciline ☐ (3) Tami flu ☐ (4) Antibiotic ☐

(5) Relenza ☐

26. Which avian influenza drug do you have in your health centre? (Put none if no avian influenza drug is available)

____

27. When is therapy for avian influenza most effective? (1) Within 24 hours ☐

(2) 2 days after infection ☐ (3) Within 2 weeks after infection ☐ (4) Don't know ☐

Section D: Health Workers Practices related to avian influenza (Bird flu) infection

28. If you suspect avian influenza (bird flu) infection in a patient will you report this illness?

(1) Yes ☐ (2) No ☐ (3) Don't know ☐ If No or Don't know go to question 30)

29. If yes to question 28 to whom will you report the illness? (a) PHC coordinator ☐

(b) Disease Surveillance and Notification Officer ☐ (c) Don't know ☐

30. Which of the followings do you have in your health centre or health care facility? For each please tick **(√)** Present, Absent or Out of order/use

		Tick (√)		
S/N	**Equipment/facility**	**Present**	**Absent**	**Out of order/use**
30.1	Gloves.			
30.2	Surgical masks.			
30.3	Respirator.			
30.4	Gown/overall.			
30.5	Goggles.			
30.6	Regular supply of water.			
30.7	Regular supply of soap.			
30.8	Regular supply of disinfectants.			
30.9	Isolation room.			

31(a) If you have a patient with or suspected to be having avian influenza (bird flu) infection what precautions would you take to protect yourself and others from getting infected?

____

____

31(b) List the personal protective equipment that you will employ in preventing avian influenza infection in your health centre or health care facility

____

____

32(a) In the past 3 months have you modified your working habit for fear of getting avian influenza (bird flu) infection? (1) Yes ☐ (2) No ☐

32(b) If Yes, please How?

____

____

33. With what do you wash your hands after seeing patients? (1) With water alone ☐
(2) With water and soap ☐ (3) With water + soap + disinfectants ☐

34. Have you ever taken care of a patient with avian influenza infection in your clinic?
(1)Yes ☐ (2) No ☐ (3) Don't know ☐

35. For each of the questions below tick (√) as appropriate.

Practices		**Tick (√)**				
S/N		**Always**	**Often**	**Sometimes**	**Rarely**	**Never**
35.1	How often do you use protective measures to avoid spread of avian influenza infection in your hospital?					
35.2	How often do you wash your hands after attending to patients?					
35.3	How often do you wash your hands with water and soap?					
35.4	How often do you wash your hands with water, soap and disinfectants?					
35.5	How often do you disinfect medical equipments in your clinic?					

Section E: Perceptions of Avian Influenza (Bird flu) infection

36. How serious is avian influenza infection? (1)Very serious ☐ (2) Somehow serious ☐
(3) Not serious ☐ (4) Don't know ☐

37. Can avian influenza (bird flu) infection be prevented? (1) Yes ☐
(2) Not sure/Uncertain ☐ (3) No ☐

38. How likely do you think you can get avian influenza (bird flu) in your health clinic?

☐ ☐ ☐

(1) Very likely (2) Somehow likely (3) Not likely at all

39. What do people in your community believe or say about avian influenza infection?

____

____

40. How common is avian flu in the community where you work? (1) Very Common ☐

(2) Somehow common ☐ (3) Not common ☐) Don't know ☐

(5) Never been reported ☐

41(a) Is there a possibility of an outbreak of avian influenza in the community where you work? (1) Yes ☐ (2) No ☐

41(b) If Yes to question 40(a) above, what are your reasons?

____

Section F: Prevention Practices against avian influenza (Bird flu) infection

42. For each of the questions below state Yes, No, or Don't know by ticking **(√).**

		Tick (√)		
S/N	**Prevention practices**	**Yes**	**No**	**Don't know**
42.1	Is there an avian influenza (bird flu) infection prevention and control committee in your clinic/health care facility?			
42.2	Is there an avian influenza isolation room in your clinic/health care facility?			
42.3	Did you learn about avian influenza (bird flu) infection in the training school?			
42.4	Have you ever received training on avian influenza (bird flu) infection management?			
42.5	Have you ever received training on behavioural change for preventing avian influenza infection?			
42.6	Do you have avian influenza Information, education and communication materials in your hospital/health care facility?			
42.7	Have you ever received any personal protective equipment for prevention of avian influenza (bird flu) infection?			

Thank you for participating in this study.

APPENDIX IV

A: Consent Form for Survey Respondents
Name of the Investigator: Afuye Busayo
Name of Organization: University of Ibadan
Name of Sponsor: Self
Title of Project:

Health workers' knowledge, perceptions and practices relating to Avian Influenza infection in peri-urban Local Government areas of Ibadan, Nigeria.

Greetings: My name is **AFUYE BUSAYO** and I am a Student of the Department of Health Promotion and Education, College of Medicine, University of Ibadan. I am involved in a study to document the knowledge, perceptions and practices of Primary Health Care (PHC) workers relating to avian influenza infection (bird flu).Your honest answers to the questions contained in the questionnaire will be useful in planning for appropriate ways in controlling and /or preventing avian influenza in your Local government area.

Purpose of the research:

We are planning to carry out a study to document PHC workers knowledge, perceptions and practices relating to the control of avian influenza infection (bird flu) in five of the six peri-urban Local Government Areas in Ibadan, Oyo State of which your LGA is one. We would therefore like to find out about your views, opinions, perceptions, and practices related to avian influenza infection. Your honest answers to the questions we will ask you will be useful for policy formulation concerning the control of avian influenza infection in your LGA and in Oyo State at large.

Procedures:

To find answers to some of these questions, we invite you to take part in this research project and participate in an interview. If you accept, you will be asked to answer some questions about some aspects of your life as a health worker. A lot of the questions will relate to your experience, knowledge, perceptions and practices related to the prevention of avian influenza infection.

You will be asked some questions one by one and your answers will be recorded on a questionnaire. This will be done so that I will remember everything that you told me.

Although it is important that you answer all the questions, if you do not wish to answer any of the questions included in the survey, you may ask to move on to the next question. We assure you that we will not tell any other person whatever you disclose to us. Remember also that your name is not required in the interview. Participation in the study is voluntary and you are free to discontinue if you so desire. You are also free to ask questions about the study at any time.

Risks and Discomforts:

There is a slight risk as you may feel uncomfortable talking about some of the issues. However, we do not wish this to happen, and you may refuse to answer any of the questions or not take part in a portion of the survey if you feel the question(s) make you uncomfortable. Participation in the survey will take about 30 minutes of your time.

Benefits

There will be no direct benefit to you as a person but the information obtained from this study will be used for designing appropriate intervention programmes for the control and prevention of avian influenza in health care settings in Oyo State.

Incentives

You will not be provided any monetary incentives or special tangible rewards for participating in the study. However we will register our gratitude to you for participating.

Confidentiality:

We have taken the following steps to ensure that you are safe and that the information you provide us is confidential:

The interview will take place in a private place, where no one else will hear what you discuss with the interviewer.

The information that we collect from this research project will be kept confidential.

Information collected from you will be stored in a file that will not bear your name. Any other identifier or mark which is capable of revealing your identity will also not be put on your questionnaire so no one can trace your responses to you.

You may talk to the leader of the research team in case you have any concern or question before, during or after participating in the survey.

All the questionnaires including your own used in this study will be destroyed after the research is completed

Opportunity to Refuse and/ or Withdraw:

You do not have to take part in this research if you do not want to, and refusing to participate will not affect you or your hospital, clinic or health centre. You may stop participating in the interview at any time that you wish, and there will be no negative consequences for you in any way. Your participation is purely voluntary.

Who to contact:

If you have any question you may ask now or later. If you wish to ask questions later, you may contact any of the following:

(I) Afuye Busayo

Department of Health Promotion and Education,

College of Medicine, University of Ibadan.

Telephone: 08026966464

Email: olubusyo2000@yahoo.com

(ii) Dr F. O. Oshiname (Supervisor)

Department of Health Promotion and Education,

College of Medicine, University of Ibadan.

Telephone: 08035001060.

E Mail: foshiname@yahoo.com

Certification of Consent for Qualitative Study

I have been invited to take part in the research on knowledge, perceptions and practices of Primary Health Care Workers relating to avian influenza infection (bird flu). I have read the foregoing information and I have had the opportunity to ask questions about the research and all my questions have been answered to my satisfaction. I therefore consent voluntarily to be a participant in this study and understand that I have the right to withdraw from the interview at any time I so wish.

Print Name of Subject ----------------------------	Date and Signature of Subject -----------------------------------
Print Name of Interviewer ------------------------------	Date and Signature of Interviewer ------------------------------------

APPENDIX V

ETHICAL APPROVAL

TELEGRAMS................ TELEPHONE................

MINISTRY OF HEALTH

DEPARTMENT OF PLANNING, RESEARCH & STATISTICS DIVISION

PRIVATE MAIL BAG NO. 5027, OYO STATE OF NIGERIA

Your Ref. No. ....
All communications should be addressed to
the Honourable Commissioner quoting
Our Ref. No: AD 13/479/70

Date: 14th September, 2010

The Principal Investigator,
Department of Health Promotion and Education,
College of Medicine,
University of Ibadan,
Ibadan.

Attention: Afuye Busayo

Ethical Approval for the Implementation of Your Research Proposal in Oyo State.

This acknowledges the receipt of the corrected version of your Research Proposal titled "*Knowledge, Perceptions and Practices of Primary Health Care Workers on the Prevention and Control of Avian Influenza Infection in Six Local Government Areas, Oyo State*".

The Committee has noted your compliance with all the ethical concerns raised in the initial review of the proposal. In the light of this, I am pleased to convey, to you, the approval of the committee for the implementation of the Research Proposal in Oyo State, Nigeria.

Please, note that the committee will monitor, closely, and follow up the implementation of the research study. However, the Ministry of Health would like to have a copy of the results and conclusions of the findings as this will help in policy making in the health sector.

Wishing you all the best

Adepoju
Mrs V.A. Adepoju
Director, Planning, Research & Statistics
Secretary, Oyo State, Research Ethical Review Committee.