A Collaborative Research Project Funded by:

DFID Department for International Development

Implemented by:

FAO

RVC Royal Veterinary College University of London

IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

HPAI HIGHLY PATHOGENIC AVIAN INFLUENZA PRO-POOR HPAI RISK REDUCTION

Impact of Highly Pathogenic Avian Influenza on Ghanaian Chicken Producers' Incomes

Ekin Birol and Dorene Asare-Marfo

DRAFT for comment

Africa/Indonesia Region Report No.16

Table of Contents

List of Tables

List of Figures

PREFACE

Since its re-emergence, HPAI H5N1 has attracted considerable public and media attention because the viruses involved have been shown to be capable of producing fatal disease in humans. While there is fear that the virus may mutate into a strain capable of sustained human-to-human transmission, the greatest impact to date has been on the highly diverse poultry industries in affected countries. In response to this, HPAI control measures have so far focused on implementing prevention and eradication measures in poultry populations, with more than 175 million birds culled in Southeast Asia alone.

Until now, significantly less emphasis has been placed on assessing the efficacy of risk reduction measures, including their effects on the livelihoods of smallholder farmers and their families. In order to improve local and global capacity for evidence-based decision making on the control of HPAI (and other diseases with epidemic potential), which inevitably has major social and economic impacts, the UK Department for International Development (DFID) has agreed to fund a collaborative, multidisciplinary HPAI research project for Southeast Asia and Africa.

The specific purpose of the project is to aid decision makers in developing evidence-based, pro-poor HPAI control measures at national and international levels. These control measures should not only be cost-effective and efficient in reducing disease risk, but also protect and enhance livelihoods, particularly those of smallholder producers in developing countries, who are and will remain the majority of livestock producers in these countries for some time to come.

This report looks at the livelihood impact of HPAI in Ghana.

http://www.hpai-research.net/index.html.

Author

Ekin Birol, Research Fellow and Dorene Asare-Marfo, Senior Research Assistant, Markets, Trade and Institutions Division, International Food Policy Research Institute

Disclaimer

Acknowledgements

The authors would like to acknowledge the valuable insights and suggestions received from Devesh Roy and Xinshen Diao.

Finally, the authors gratefully acknowledge United Kingdom Department for International Development (DFID) for funding the project.

More information

For more information about the project please refer to www.hpai-research.net.

1. INTRODUCTION

Poultry production is an important livelihoods activity in the rural areas of developing countries (see e.g., Sonaiya, 2007). Several studies from African and Asian countries have found that production of poultry within the village extensive and backyard extensive and intensive production systems not only contributes to income, but also to various other livelihoods indicators including food security, nutrition and gender equality (see e.g., Alabi et al., 2006; Gueye, 1998; 2000; 2007a; 2007b; Epprecht et al., 2007; Sonaiya, 2007; Iannotti et al., 2008; Birol and Asare-Marfo, forthcoming). Recent studies conducted in Asia have shown that among the rural poor, poultry income is most crucial for the livelihoods of the poorest segments (e.g., see Maltsouglou and Rapsomanikis, 2005 and Roland-Holst et al., 2007, for Viet Nam, and Birol and Asare-Marfo, forthcoming, for Indonesia). A detailed review of the literature on the role of poultry in rural livelihoods and the potential impacts of Highly Pathogenic Avian Influenza (HPAI) outbreaks and threats on various livelihoods indicators are presented in Oparinde and Birol (2008).

In this paper we focus on the rural poultry producing households in Ghana. Our aims are twofold. Our first aim is to present in detail the contribution of poultry to the incomes of rural Ghanaian households, disaggregated by agro-ecological zones, income segments and the size of flock. Our second aim is to calculate the impacts (i.e., income losses) that these households would suffer in the case of HPAI outbreaks and threats. The economywide impacts of HPAI are estimated with a Computable General Equilibrium (CGE) model by Diao (2008). The macro-level impacts of HPAI outbreaks and shocks were found to be modest. It is however expected that the rural poor households will bear the majority of the consequences of HPAI outbreaks and threats. To this end, following Diao (2008), household level impacts of three HPAI scenarios are simulated: The first scenario is based on an outbreak of HPAI which results in a uniform 10% loss of chicken stock due to infection and culling, across all agro-ecological zones of the country. The second scenario estimates the income losses that would be suffered as a result of a HPAI threat (such as an outbreak in a neighbouring country) which would generate a demand shock in the country, resulting in 40% reduction in poultry demand. The third scenario is a combination of the first two, resulting in a total of 46% losses in overall income from poultry.

The findings reveal that there are significant differences in the magnitudes of the contribution of poultry income to the overall household income, and consequently in the impact of HPAI outbreaks and threats on household income, across agro-ecological zones, income groups and poultry producers of different sizes. According to our calculations the segment of the population that would be affected the most is the poorest poultry producers in the first income group (first decile). These households would lose as much as 9% of their total household income. Across agro-ecological zones rural poultry producers in Northern Savannah would suffer the most from supply and demand shocks caused by HPAI outbreaks, whereas across producer types, small scale semi commercial producer would lose the highest share of their income. Therefore, heterogeneity across zones, income groups and

producers of different sizes should be taken into consideration when designing policies pertaining to poultry in general and HPAI control in particular.

The rest of the paper unfolds as follows. The next section summarises the poultry sub-sector in Ghana and the current situation of the HPAI. Section three describes the data used for this study. Section four reports the results of the contribution of poultry to rural incomes, and the impacts of various HPAI scenarios thereon. The final section concludes the paper.

2. BACKGROUND

According to Aning et al. (2008), 66 percent of all households in Ghana own poultry, which comprises traditional chickens, guinea fowls, ducks and turkeys. In total these birds make over 25 million in numbers. Rural poor manage poultry in village poultry systems, which are also known as village extensive and backyard extensive production systems. Village poultry is characterized as production of up to 200 birds, with an average of 30 (Awuni, 2002; Aboe et al., 2006b), in a low input intensive, free-roaming and scavenging production system, often without any housing and with no biosecurity measures. It has been estimated that backyard poultry production accounts for as much as 60 to 80% of the national poultry population (FASDEP, 2002; Gyening, 2006; Awuni, 2007; Aning et al., 2008). Similar to other developing countries, these poultry are kept for quick cash to meet households' several needs, such as food and nutrition security, payment of medical and school fees and other household expenditures (Awuni, 2002; MOFA/DFID, 2002; Karbo et al 2003; Aboe, et al., 2006a, b; Colecraft et al., 2006; Naazie et al., 2007; Aning et al., 2008). Backyard intensive production or semi-commercial, small scale production of poultry consists of poultry farms located in owners' backyards. The capacity of these farms can support up to 500 birds and the biosecurity levels in these farms are low (Aning et al., 2008).

Commercial production (with exotic breeds) is categorized as large scale (industrial), medium scale and small-scale poultry producers. The total numbers of all commercial farms in Ghana was estimated at 1372 in 2005 (Aning et al., 2008). Majority of these are located in Ashanti region, followed by Greater Accra and Brong-Ahafo regions (Aning, 2006). In Ghana there are currently five large scale, industrial farms, which are integrated with their own hatcheries, feed mills, processing units and marketing outlets. The medium and small-scale commercial producers depend on the large scale farms for day-old chicks (DOC), feed and sometimes broiler bird processing. Medium and small scale producers are also supplied by either commercial feed millers or importers of DOC with veterinary drugs and feed supplements (Aning et al., 2008).

There have been three HPAI outbreaks in Ghana to date (Aning et al., 2008). The first outbreak occurred in the Greater Accra region in April and May 2007, the second one took place in Brong Ahafo region in May 2007, and the final one was in Volta region in June 2007. Disease control policies included a combination of active surveillance, culling within a radius, and bans on sales and movement of poultry in and out of the infected area, closure of wet markets in the area, and the quarantine and disinfection of infected farms, machinery and equipment. Consequently, each one of these three outbreaks was effectively controlled by the Veterinary Services Directorate (VSD) of the Ministry of Food and Agriculture, with support from donor agencies, and co-ordination of the Avian Influenza Working Group (Aning et al., 2008). The numbers of birds that have died of the virus and those culled are reported in Aning et al. (2008). According to the VSD (2007), since the last outbreak in June 2007, there have not been any suspicious cases or reports of unusual deaths from anywhere in Ghana. Ghana is still in a state of high alert, however, mainly due to the circulation of the HPAI virus in West Africa, as evident from the July 2008 outbreaks in Nigeria (Aning et al., 2008; Obi et al., 2008).

3. DATA

The data used in this paper is from the fifth wave of the nationally representative Ghana Living Standards Survey (GLSS) series carried out by the Ghana Statistical Service (GSS). The first GLSS was carried out from 1987 to 1988, and the most recent one, i.e., the fifth wave of the GLSS (GLSS5) was conducted between 2005 and 2006. The primary objective of the GLSS series is to provide data to inform the government and other stakeholders about various aspects of living standards of Ghanaians, and changes in these standards over time (GSS, 2003). Apart from the demographic information collected in the surveys, the GLSS data cover various aspects of living conditions, such as consumption, education, health, housing, employment, and migration. Detailed data on agricultural (crop and livestock) production, consumption and income are also collected with the GLSS. For GLSS5, 8,686 randomly selected households were interviewed. Out of these, 5,069 households, i.e., 58.4% are located in rural areas, which are the focus areas of this paper.

As discussed in section 1, several previous studies from other developing countries found that poultry is an important source of livelihoods for the poorest segments of the populations. In order to investigate if this supposition is also valid in the Ghanaian context, the rural population is disaggregated into ten segments according to income levels. Specifically, households were categorized into each one of 10 distinct deciles based on a welfare measure/indicator variable from the GLSS poverty profile summary dataset (pov_gh.dta). The welfare measure, which is commonly used as a proxy for total income, is a consumption-based measure of total expenditure over a 12 month period, which has been weighted for inflation by a poverty price index based on January 1999 prices. In the rest of this paper this welfare measure is referred to as the total annual household income.
In addition to disaggregation by income groups, data are also disaggregated by zones. In Ghana livelihood patterns and strategies, and hence agricultural activities are typically linked to the agro-ecological zones (Aning et al., 2008). Consequently, following Diao (2008) the data were analyzed for four agro-ecological zones:
Coastal Zone: This zone covers the Eastern, Volta and Greater Accra regions. HPAI outbreaks took place in the latter two regions. Coastal zone supports cereals, vegetable and cassava production, as well as a moderate level of livestock production. Overall population density in this Zone ranges from 80 person/km^2 in Volta region to 109 person/km^2 in Eastern region. Percentage of people residing in rural areas ranges from 73% in Volta to 12% in Greater Accra region (MOFA, 2004; Aning et al., 2008).

Forest Zone: This zone consists of Ashanti, Western and Central regions. In this zone the main agricultural activity is root crop production, whereas the level of livestock production is low. Population density in this Zone ranges from 162 person/km^2 in Central region to 80.5 person/km^2 in Western region. In this zone percentage of people residing in rural areas ranges from 47% in Ashanti region to 84% in Central region (MOFA, 2004; Aning et al., 2008).
Southern Savannah Zone: This zone comprises Brong Ahafo region and part of Volta region, where HPAI outbreaks took place. Population density in this Zone ranges from 45 person/km^2 in Brong Ahafo region to 80 person/km^2 in Volta region. In this Zone percentage

of people residing in rural areas is high, ranges from 73% in Volta region to 63% in Brong Ahafo region (MOFA, 2004; Aning et al., 2008).

Northern Savannah Zone: This zone includes the Upper West, Upper East and Northern regions. This zone supports grain cultivation and is home to most of the livestock population of the country (MOFA 2004; Aning et al., 2008). Population density in this Zone ranges from 26 person/km^2 in Northern region to104 person/km^2 in Upper East Region. Percentage of people residing in rural areas of this zone is the highest across all Zones, ranges from 73% in Northern region to 84% in Upper East region (MOFA, 2004; Aning et al., 2008).

Finally, in order to understand the impact of HPAI outbreaks and threats on different size producers, small scale poultry producers were disaggregated into three types:

1. Village extensive poultry producers who manage 1 to 50 birds;
2. Backyard intensive poultry producers who manage 51 to 200 birds, and
3. Small scale semi-commercial producers who manage 201 to 500 birds.

It should be noted that these poultry producer definitions only loosely follow the ones reported in Aning et al (2008). This is because the focus of this paper is the small scale rural producers who rely on poultry as one of the many livelihoods strategies, rather than as the main livelihoods strategy as might be the case for small, medium and large scale commercial producers. Moreover, GLSS is a household level survey rather than a livestock producer survey, and hence statistically representative information on commercial poultry producers is not available in this data base.

4. RESULTS

4.1 Contribution of poultry to rural household incomes

The focus of this paper is the rural poultry producers in Ghana. The numbers of rural households across income deciles in each zone and distribution of households in each income group across zones are reported in Table 1. Across agro-ecological zones a greater proportion of the rural population is located in the Forest zone, followed by North Savannah. Across income groups the greater proportions of the rural population are below the poverty line (30%, i.e., in the first three income group). A great majority of these poorest rural households are located in the Northern Savannah Zone, followed by the Forest Zone. A greater proportion of the wealthier households, comprising of those in the eighth, ninth and tenth income deciles are located in the Forest Zone, followed by the Coastal Zone.

Table 1. Distribution of rural households across zones and income groups (deciles), by agro-ecological zone

	Income groups (Deciles)										
	1	2	3	4	5	6	7	8	9	10	Total
Coastal	25	58	78	95	94	116	94	105	95	102	862
	2.9	6.73	9.05	11.02	10.9	13.46	10.9	12.18	11.02	11.83	100
	3.35	10.3	14.8	17.56	19.11	23.06	22.43	24.59	24.11	29.23	17.37
Forest	62	185	234	266	244	263	224	223	229	184	2,114
	2.93	8.75	11.07	12.58	11.54	12.44	10.6	10.55	10.83	8.7	100
	8.3	32.86	44.4	49.17	49.59	52.29	53.46	52.22	58.12	52.72	42.6
S. Savannah	20	52	67	62	64	60	47	46	23	22	463
	4.32	11.23	14.47	13.39	13.82	12.96	10.15	10	4.97	5	100
	2.68	9.24	12.71	11.46	13.01	11.93	11.22	10.77	5.84	6.3	9.33
N. Savannah	640	268	148	118	90	64	54	53	47	41	1,523
	42.02	17.6	9.72	7.75	5.91	4.2	3.55	3.48	3.09	2.69	100
	85.68	47.6	28.08	21.81	18.29	12.72	12.89	12.41	11.93	11.75	30.69
Total	747	563	527	541	492	503	419	427	394	349	4,962
	15.05	11.35	10.62	10.9	9.92	10.14	8.44	8.61	7.94	7.03	100
	100	100	100	100	100	100	100	100	100	100	100

Source: GLSS5.

The average per capita incomes of households in each decile are depicted in Table 2, by Zone. In terms of average per capita incomes, below the poverty line there are significant differences across zones. The lowest average per capita income in the first decile is in

Northern Savannah Zone, followed by the Forest Zone. In the following two deciles, however, the lowest average per capita incomes belong to those households located in the Southern Savannah Zone. In the upper three deciles, those rural households located in the Coastal Zone enjoy the highest average per capita incomes, whereas those in Northern Savannah have the lowest average incomes in the eighth, ninth and tenth deciles.

Table 2. Average per capita income (in thousand Cedis) in each income group, by agro-ecological zone

	Income group (Deciles)									
	1	2	3	4	5	6	7	8	9	10
Coastal	131.93	148.95	216.29	294.47	419.33	617.03	795.85	1172.38	1905.88	3934.40
Forest	76.32	124.42	206.02	290.31	379.98	535.38	694.24	1010.32	1697.91	3621.14
S. Savannah	85.35	111.06	154.07	240.09	388.32	633.81	852.44	1083.11	1608.15	3437.33
N. Savannah	67.11	137.73	210.77	264.59	381.86	498.65	476.65	810.38	1229.13	2794.04

Source: GLSS5.

Table 3 presents the numbers of households that keep poultry as a livelihoods activity, across income deciles and agro-ecological zones. In this paper our focus is the chicken producing households as chicken is the most commonly reared poultry species across Ghana. About half of all households in the sample (i.e., 49.9%) rear chickens. Almost half of all rural households in Northern Savannah (i.e., 47%) raise chickens, followed by a third (i.e., 33.4%) of all those located in the Forest Zone. In terms of income groups, a greater majority of those households in the first three income groups raise chickens (23% in segment 1, 14% in segment 2 and 12% in segment 3) compared to households in the wealthier segments. In fact an inverse relationship is observed between income level and proportion of households that raise chickens in that income level. Across zones, a great majority of the chicken rearing households with incomes below the poverty line, i.e., those in the first three deciles, are located in Northern Savannah Zone, followed by the Forest Zone. A greater majority of the wealthier poultry producing households, i.e., those in the last three deciles, are located in the Forest Zone, followed by Northern Savannah (in the eighth decile) and Coastal zone (in the tenth decile).

Table 3. Numbers of chicken raising rural households across income groups, by agro-ecological zone

	Income groups (Deciles)										
	1	2	3	4	5	6	7	8	9	10	Total
Coastal	6	22	21	40	29	38	30	27	25	29	267
	2.25	8.24	7.87	14.98	10.86	14.23	11.24	10.11	9.36	10.86	100
	1.07	6.43	7.39	14.65	12.72	16.52	17.65	17.2	19.08	29	10.78
Forest	29	76	113	112	110	111	83	78	68	46	826
	3.51	9.2	13.68	13.56	13.32	13.44	10.05	9.44	8.23	5.57	100
	5.17	22.22	39.79	41.03	48.25	48.26	48.82	49.68	51.91	46	33.36
S. Savannah	10	27	41	34	28	33	18	18	10	5	224
	4.46	12.05	18.3	15.18	12.5	14.73	8.04	8.04	4.46	2.23	100
	1.78	7.89	14.44	12.45	12.28	14.35	10.59	11.46	7.63	5	9.05
N. Savannah	516	217	109	87	61	48	39	34	28	20	1,159
	44.52	18.72	9.4	7.51	5.26	4.14	3.36	2.93	2.42	1.73	100
	91.98	63.45	38.38	31.87	26.75	20.87	22.94	21.66	21.37	20	46.81
Total	561	342	284	273	228	230	170	157	131	100	2,476
	22.66	13.81	11.47	11.03	9.21	9.29	6.87	6.34	5.29	4.04	100
	100	100	100	100	100	100	100	100	100	100	100

Source: GLSS5.

The average contribution of income from chicken sales to total household income is reported in Table 4. The contribution of chicken to overall household income is on average 11%. Across zones, income from chicken sales contributes most to the incomes of those households located in North Savannah (12.6%) and South Savannah (11.2%). Across segments income from chicken sales contributes the most to the incomes of the poorest (first income group) households, comprising almost a fifth (18%) of the total income.

Table 4. Average share of income from chicken sales, by agro-ecological zone

	Income group (Decile)										
	1	2	3	4	5	6	7	8	9	10	Total
Coastal	7.67	9.40	7.76	12.61	4.29	9.19	2.80	8.33	2.95	27.07	9.88
Forest	27.60	10.86	8.26	8.30	5.41	6.65	7.84	7.08	22.27	5.79	9.23
S. Savannah	-	10.75	8.84	22.37	8.05	8.99	19.46	12.10	9.94	-	11.16
N. Savannah	17.57	9.06	9.44	9.64	21.21	5.84	3.92	8.93	2.92	2.12	12.59
Total	18.01	9.65	8.74	10.93	9.69	7.28	6.48	8.33	12.14	11.06	10.98

Source: GLSS5.

When chicken production is disaggregated by producer type we see that across Ghana over half of the rural chicken producers are backyard intensive, i.e., manage 50 to 200 chickens, whereas small scale semi-commercial producers who manage over 200 but less than 500 chickens constitute the smallest proportion of rural chicken producers. Almost half of small scale semi commercial producers sell their chickens, revealing that the other half are keeping their chickens for egg production, whereas over a fifth of all village extensive producers sell chickens.

Table 5. Smallholder chicken producer types in rural Ghana

Producer type	Size of flock	% of all producers	% that sell chicken	% of total income from chicken
Village extensive	<50	36	23.8	11.4
Backyard intensive	50-200	53	36.2	12.6
Small scale semi-commercial	200-500	11	48.9	13

Source: GLSS5.

Distribution of these three types of producers across zones and income groups are reported in Tables 6 through 8. Table 6 depicts that almost half (48%) of all village chicken keepers are located in Northern Savannah, followed by Forest Zone (30.6%). In addition, the great majority of the poorest village chicken producers (first and second deciles) are located in the Northern Savannah zone, whereas majority of village chicken producers in the third decile are located in Forest Zone (42%). In fact with the exception of the two poorest segments (i.e. first and second deciles), the numbers of village chicken keepers appears to be proportionately highest in the Forest zone within each of the income groups. Among the richer households (eights, ninth and tenth deciles) majority of the village chicken keepers are located in Forest and Coastal zones respectively.

Across all zones over a quarter (i.e., 27%) of all households in the poorest income segment keep village chickens. In fact an inverse relationship is observed between income level and proportion of households that manage village chicken. There are significant differences in the distribution of village chicken keepers among income groups within each zone. In the Coastal zone, a smaller proportion of households in the first two segments keep village chickens, compared to their counterparts in the other segments, which exhibit similar proportions. In the Forest zone households in segments three to six are more likely to raise village chickens, whereas in Southern Savannah Zone, a greater proportion of households in the third, fourth and sixth income segments keep village chickens. In Northern Savannah on the other hand, a great majority of village chicken keepers are in the first two income segments.

Table 6. Numbers of village chicken producers (less than 50 chickens) across income groups, by agro-ecological zone

	Income groups (Decile)										
	1	2	3	4	5	6	7	8	9	10	Total
Coastal	4	3	12	12	11	12	12	13	15	14	108
	3.7	2.78	11.11	11.11	10.19	11.11	11.11	12.04	13.89	12.96	100
	1.67	2.59	12.5	13.04	14.1	16.67	19.67	24.53	33.33	37.84	12.13
Forest	13	23	40	36	40	33	30	23	21	13	272
	4.78	8.46	14.71	13.24	14.71	12.13	11.03	8.46	7.72	4.78	100
	5.42	19.83	41.67	39.13	51.28	45.83	49.18	43.4	46.67	35.14	30.56
S. Savannah	4	9	11	13	6	14	10	6	4	3	80
	5	11.25	13.75	16.25	7.5	17.5	12.5	7.5	5	3.75	100
	1.67	7.76	11.46	14.13	7.69	19.44	16.39	11.32	8.89	8.11	8.99
N. Savannah	219	81	33	31	21	13	9	11	5	7	430
	50.93	18.84	7.67	7.21	4.88	3.02	2.09	2.56	1.16	1.63	100
	91.25	69.83	34.38	33.7	26.92	18.06	14.75	20.75	11.11	18.92	48.31
Total	240	116	96	92	78	72	61	53	45	37	890
	26.97	13.03	10.79	10.34	8.76	8.09	6.85	5.96	5.06	4.16	100
	100	100	100	100	100	100	100	100	100	100	100

Source: GLSS5

For backyard chicken production (Table 7), similarly to village chicken keeping, a great majority of the producers are located in Northern Savannah (47.5%) followed by Forest Zone (33%). Across all zones, households in the first four segments are more likely to manage

backyard chickens, ranging from 21% in the first group to 12% in the fourth group. Similarly to village chicken keepers, proportion of households that manage backyard chickens decrease with increasing income. Below the 30% poverty line, majority of the backyard intensive chicken producers are located in the Northern Savannah Zone, followed by Forest zone. In the upper three deciles, on the other hand greater proportion of these producers can be found in the Forest Zone, followed by the Northern Savannah Zone.

Within each zone, it appears that in Coastal and Forest Zones, backyard intensive chicken production is mainly undertaken by those households in the middle-income groups, i.e., fourth to sixth deciles. In the Southern Savannah Zone, households in third, fourth and fifth deciles mostly raise backyard chickens. The poorest segments dominate backyard chicken production in the Northern Savannah Zone.

Table 7. Numbers of backyard chicken producers (51-200 chickens) across income groups, by agroecological zone

	Income groups (Deciles)										
	1	2	3	4	5	6	7	8	9	10	Total
Coastal	2	16	7	23	15	24	14	13	9	12	135
	1.48	11.85	5.19	17.04	11.11	17.78	10.37	9.63	6.67	8.89	100
	0.72	8.56	4.52	14.65	13.16	18.75	16.47	15.12	12.86	24	10.32
Forest	11	41	61	67	50	58	39	47	38	24	436
	2.52	9.4	13.99	15.37	11.47	13.3	8.94	10.78	8.72	5.5	100
	3.99	21.93	39.35	42.68	43.86	45.31	45.88	54.65	54.29	48	33.33
S. Savannah	6	13	23	20	19	14	6	8	5	2	116
	5.17	11.21	19.83	17.24	16.38	12.07	5.17	6.9	4.31	1.72	100
	2.17	6.95	14.84	12.74	16.67	10.94	7.06	9.3	7.14	4	8.87
N. Savannah	257	117	64	47	30	32	26	18	18	12	621
	41.38	18.84	10.31	7.57	4.83	5.15	4.19	2.9	2.9	1.93	100
	93.12	62.57	41.29	29.94	26.32	25	30.59	20.93	25.71	24	47.48
Total	276	187	155	157	114	128	85	86	70	50	1,308
	21.1	14.3	11.85	12	8.72	9.79	6.5	6.57	5.35	3.82	100
	100	100	100	100	100	100	100	100	100	100	100

Source: GLSS5.

Finally, Table 8 reveals that a greater majority of the small scale semi commercial producers are in the Forest zone followed by Northern Savannah. Across income groups, overall poorer households (i.e., those in the first three income groups) as well as middle income household (those in the fifth and sixth segments) are more likely to be engaged in small scale semi commercial chicken production. Similarly to other producer types, majority of the poorest small scale producers are located in Northern Savannah, followed by Forest zone, whereas a great majority of the richest producers are in the Forest Zone, followed by the Coastal Zone.

Table 8. Numbers of small scale semi commercial chicken producers (201-500 chickens) across income groups, by ago-ecological zone

	Income groups (Deciles)										
	1	2	3	4	5	6	7	8	9	10	Total
Coastal	0	3	2	5	3	2	4	1	1	3	24
	0	12.5	8.33	20.83	12.5	8.33	16.67	4.17	4.17	12.5	100
	0	7.69	6.06	20.83	8.33	6.67	16.67	5.56	6.25	23.08	8.63
Forest	5	12	12	9	20	20	14	8	9	9	118
	4.24	10.17	10.17	7.63	16.95	16.95	11.86	6.78	7.63	7.63	100
	11.11	30.77	36.36	37.5	55.56	66.67	58.33	44.44	56.25	69.23	42.45
S. Savannah	0	5	7	1	3	5	2	4	1	0	28
	0	17.86	25	3.57	10.71	17.86	7.14	14.29	3.57	0	100
	0	12.82	21.21	4.17	8.33	16.67	8.33	22.22	6.25	0	10.07
N. Savannah	40	19	12	9	10	3	4	5	5	1	108
	37.04	17.59	11.11	8.33	9.26	2.78	3.7	4.63	4.63	0.93	100
	88.89	48.72	36.36	37.5	27.78	10	16.67	27.78	31.25	7.69	38.85
Total	45	39	33	24	36	30	24	18	16	13	278
	16.19	14.03	11.87	8.63	12.95	10.79	8.63	6.47	5.76	4.68	100
	100	100	100	100	100	100	100	100	100	100	100

Source: GLSS5.

Finally, Tables 9 through 11 report in detail the average share of income from chicken sales in total household income by producer type, across income segments and agro-ecological zones. Table 9 reports the contribution of village extensive chicken production to overall household income. On average households in the poorest segment derive almost a fifth of their income from chicken sales (18.2%), whereas across regions, households in Northern Savannah rely on chicken sales the most (13%) and those in Coastal depend on chicken sales the least to provide for their income.

Table 9. Average share of income from chicken sales for village extensive producers, by zone

	Income group (decile)										
	1	2	3	4	5	6	7	8	9	10	Total
Coastal	5.04		6.44	5.33	1.00	4.40	3.01	2.89	2.80	6.71	4.42
Forest	10.63	9.52	6.70	5.96	5.54	7.21	7.99	8.63	41.51	3.60	9.61
S. Savannah		9.79	10.49	7.02	5.87	3.25	22.30	27.18	5.44		10.92
N. Savannah	18.69	11.20	8.82	5.91	3.18	7.79	0.46	4.49	0.31	1.01	13.10
Total	18.15	10.92	8.18	5.97	4.25	6.37	7.86	8.00	15.74	4.18	11.40

Source: GLSS5.

Among backyard producers (Table 10), similarly to village extensive producers, on average households in the poorest segment derive over a fifth of their income from chicken sales (21%). Across regions, households in Northern Savannah rely on chicken sales the most (15%), followed by those in the Coastal zone (11%).

Table 10. Average share of income from chicken sales for backyard intensive producers, by zone

	Income group (Decile)										
	1	2	3	4	5	6	7	8	9	10	Total
Coastal	9.77	16.93	8.43	11.91	3.49	9.63	3.29	11.00	3.48	53.82	10.93
Forest	39.64	10.94	5.53	8.58	5.58	6.98	6.17	5.31	9.87	7.53	8.12
S. Savannah		8.96	5.83	22.69	4.09	4.75	12.78	10.63	7.80		8.07
N. Savannah	20.29	9.75	10.29	9.79	43.77	6.84	5.10	11.19	3.54	3.18	15.37
Total	20.66	10.12	8.02	10.95	16.63	7.05	5.45	9.05	6.70	11.07	12.57

Source: GLSS5.

Finally, Table 11 reports the share of chicken sale income in the overall income of the small scale, semi commercial chicken producing households. Among this producer type, those households in the poorest segment as well as those in the fourth segment derive the most income from chicken sales (around 20%), followed by those in the third segment (16%). Across regions, households in Southern and Northern Savannahs derive the largest shares of their income from chicken sales (around 16%).

Table 11. Average share of income from chicken sales for small scale semi commercial producers, by zone

	Income group (Decile)										
	1	2	3	4	5	6	7	8	9	10	Total
Coastal		0.00		13.29	16.83	5.25	1.33		2.18	20.19	10.10
Forest	12.06	16.88	15.51	11.67	6.13	5.92	10.37	3.14	15.24	3.74	9.62
S. Savannah		15.99	12.53	24.16	28.04	14.48		6.02	26.43		16.05
N. Savannah	21.00	11.10	20.48	35.97	12.84	2.93	2.32	7.13	3.87		15.57
Total	20.22	12.26	15.80	19.88	12.47	6.83	7.05	5.36	12.16	7.85	12.96

Source: GLSS5.

4.2 Impacts of HPAI shocks and threats on poultry income

As explained in the introduction to this paper, three HPAI scenarios are simulated to calculate the livelihoods, i.e., income impacts of this disease on the total household income. In the first scenario, following Vanzetti (2007) it is assumed that an outbreak of HPAI will infect birds across the country in a uniform manner across all agro-ecological zones and producer types. In this scenario supply shock caused by HPAI will result in a 10 percent decrease in the overall chicken stock. The second scenario considers the income losses that would be suffered as a result of an HPAI scare (such as a false alarm or an outbreak in a neighbouring country) which results in a demand shock in the country. Ghana National Association of Poultry Farmers (GNAPF) reports a 40 percent decrease in the chicken purchases due to consumers' attitudes towards and perceptions of HPAI risks (GNAPF, 2006). Following this estimation, a 40% reduction in chicken demand is assumed to reduce sales of poultry by 40%. The third scenario (i.e., the worst case scenario) is a combination of the first two scenarios, resulting in a total of 46% losses in the overall income from chicken sales.

Each one of these three scenarios is simulated for the pool of all chicken producers across agro-ecological zones, and also for chicken producers disaggregated according to the size of flock. Following the reductions in chicken sales income due to 10% supply shock, 40% demand shock, and an overall 46% shock, changes in total income were calculated. Overall, similarly to Diao (2008) it was observed that the demand shock of 40% dominates the income effects, therefore for brevity only the impacts of the worst case scenario (scenario 3) are reported here.

The results reveal that in the worst case scenario on average rural poultry producers would lose 5.7 % of their total income. When disaggregated into agro-ecological zones and producer types, we see that across zones, rural poultry producers in Northern Savannah bear the highest income losses, whereas across producer types small scale semi-commercial producers are generally hit the hardest by the demand and supply shocks caused by HPAI outbreaks (Figure 1).

Figure 1. Impacts of HPAI shocks on rural smallholder chicken producers' income, by agro-ecological zone & producer type

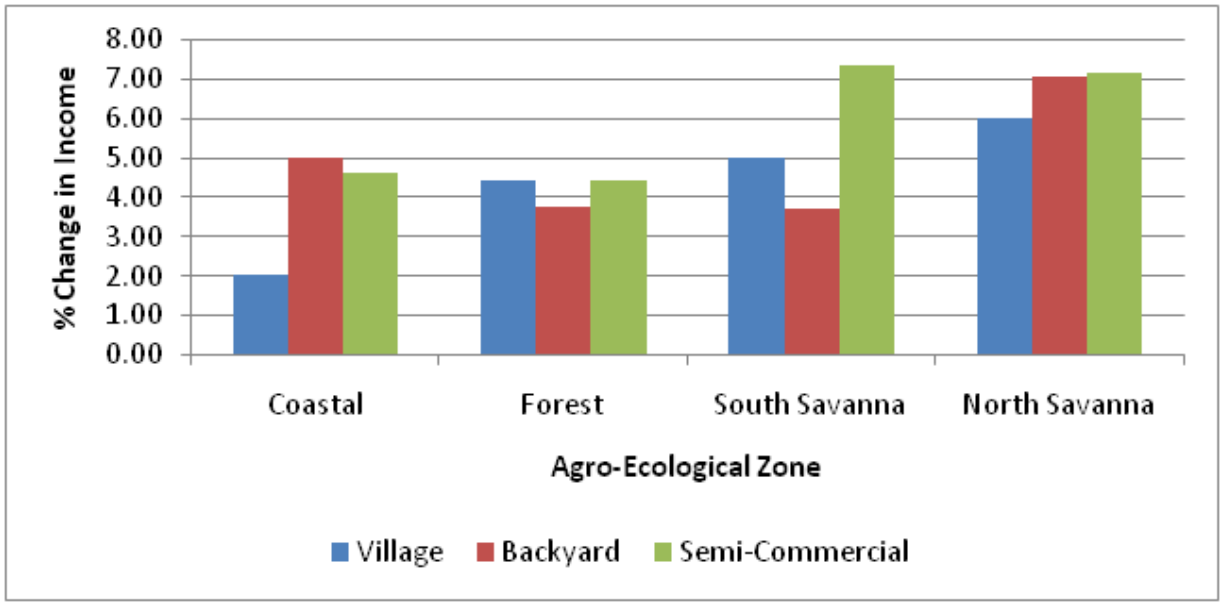
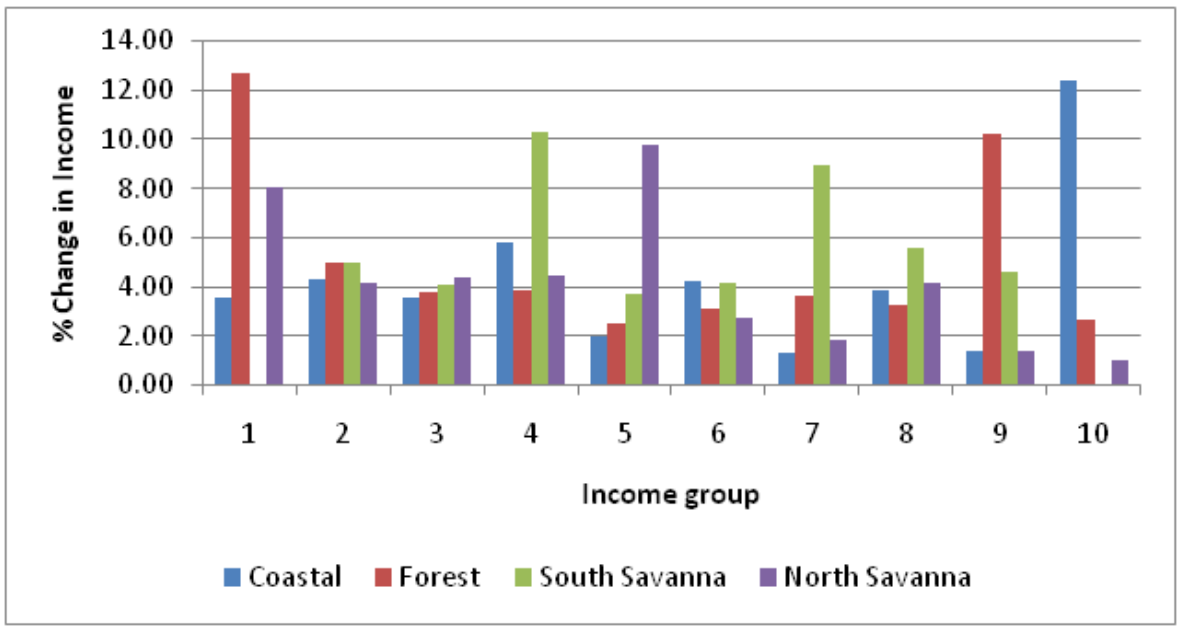


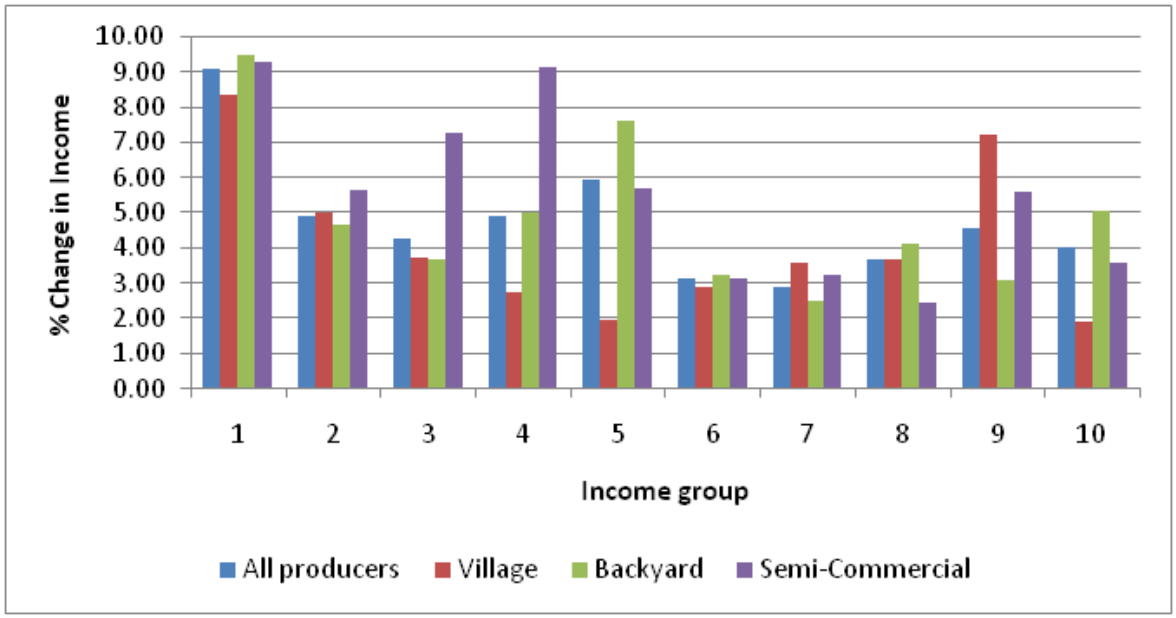
Figure 2 illustrates the impact of the worst case scenario across agro-ecological zones and income groups. Overall chicken producing households located in Northern Savannah suffer the highest losses with an average of 6.8 % reduction in their total household incomes, while those in the Forest Zone suffer the least losses, with an estimated 4 % average reduction in income. Among the poorest three income groups, however, producers in the Forest zone lose the greatest share of their income, followed by those in Northern Savannah, while among the wealthiest three income groups, producers in the Coastal and Forest Zones bear the highest income losses.

Figure 2. Impacts of HPAI shocks on rural smallholder chicken producers' income, by agro-ecological zone & income group



In terms of impacts across each producer type, semi-commercial producers are affected the most, with an average 5.9 % reduction in their total household income. Figure 3 reveals that across all producer types, producers in the bottom four decile groups suffer significantly higher income losses than their counterparts in higher income groups. In fact the poorest chicken producers (first income group) lose as much as 9% of their total income.

Figure 3. Impacts of HPAI shocks on rural smallholder chicken producers' income, by producer type & income group



5. CONCLUSIONS

Similarly to other developing countries, rural poultry production is an important livelihoods activity in Ghana. A simple analysis of the data from the fifth wave of the Ghana Living Standards Survey (GLSS5) reveals that about half of all rural households rear chickens. Of those households that rear chickens, majority (89%) do so in village extensive and backyard intensive production systems, which are characterised by low input (e.g., feed, housing, vaccinations etc.) requirements, as well as low biosecurity levels. The remaining 11% raise chickens in small scale semi commercial production system, which requires more inputs compared to backyard and village production, however is also characterised by low biosecurity levels (Aning et al., 2008). On average income from chicken sales comprises over a tenth (11%) of household income though there are significant differences across income groups, agro-ecological zones and producer types. Similarly to evidence from other developing countries, across Ghana it is the poorest households that depend on income from poultry the most. Households in the bottom income group derive as much as 18% of their income from chicken sales.

Overall majority of the rural poultry producers are located in Northern Savannah and Forest Zones. Across income groups, greater proportions of chicken rearing households with incomes below the poverty line are located in these two zones, revealing that in these zones chicken rearing is an important livelihoods activity especially for the very poor. The three Highly Pathogenic Avian Influenza (HPAI) outbreaks which occurred in Ghana in 2007 however took place in the other two zones, namely Coastal and Southern Savannah. Therefore should HPAI outbreaks occur in Northern Savannah and Forest zones, the impact of the disease on the livelihoods of rural poor is expected to be highly significant.
Three scenarios were simulated to investigate the potential impacts of HPAI outbreaks and threats on incomes of chicken rearing rural households. The first scenario considered an HPAI outbreak which results in a uniform 10% loss of all chickens across all agro-ecological zones of the country. The second scenario estimated the income losses that would be suffered as a result of a HPAI threat (such as an outbreak in a neighbouring country) which would generate a demand shock in the country, resulting in 40% reduction in chicken demand. The third scenario is the worst which is a combination of the first two scenarios, resulting in a 10% supply shock and 40% demand shock.

The findings reveal that there are significant differences in the impact of HPAI outbreaks and threats across the agro-ecological zones, income groups and poultry producers of different sizes. According to our calculations in the worst case scenario (Scenario 3) an average Ghanaian rural poultry producer would lose 5.7% of their total household income. This figure however varies significantly depending on the income group, agro-ecological zone and poultry producer type. Across income groups, households in the poorest segment would lose almost a tenth of their income (9%); across agro-ecological zones, those producers located in Northern Savannah would bear the highest losses (6.8%), whereas across producer types, small scale semi-commercial producers would lose the highest proportion of their incomes (5.9%). It should be noted that in this study only income from chicken sales is considered. Income from other poultry and egg sales should also be included in the analysis

to capture the entirety of contribution of poultry to household income. Therefore it is likely that the income impacts reported here are only lower bounds.

Finally, the overall results have revealed that there is significant heterogeneity in the contribution of poultry to household income, as well as in the impacts of HPAI on household income, across and within agro-ecological zones, as well as among different income groups and producers of different sizes. This heterogeneity should be investigated into further detail (perhaps at a regional level, rather than according to agro-ecological zone) and also should be taken into consideration when implementing policies regarding HPAI prevention and control, as well as when designing potential compensation schemes.

References

Aboe, P.A.T., K. Boa-Amponsem, S.,A.Okantah, P.T. Dorward, and M. J. Bryant (2006a). Free range village chickens on the Accra Plains, Ghana: their contribution to households. Trop. Anim. Health Prod. 38: 223-234.

Alabi, R.A, A.O Esobhawan, M.B. Aruna, 2006. Econometric Determination of Contribution of Family Poultry to Women's Income in Niger-Delta, Nigeria. Journal of Central European Agriculture, Vol. 7, No. 2, pp.753 – 760.

Aning, K.G. (2006). The Structure and Importance of the Commercial and village based poultry in Ghana. FAO Review Paper, 44p.

Aning, K.G., P.K. Turkson and D. Asuming-Brempong. 2008. Pro-poor HPAI Risk Reduction Strategies in Ghana- Background Paper. DFID Pro-poor HPAI Risk Reduction Strategies Project, Africa/Indonesia Region Report No. 2

Birol, E. and Asare-Marfo, D. 2008. Role of poultry in rural livelihoods in Indonesia: Estimating the livelihoods impact of Highly Pathogenic Avian Influenza. IFPRI. Mimeo.

Awuni, J, A, (2002). Strategies for the improvement of rural chicken production in Ghana.

Colecraft, E., G. S Marquis, R. Aryeetey, O. Sakyi-Dawson, A. Lartey, B. Ahunu, E. Canacoo, L. M. Butler, M. B. Reddy, H. H. Jensen and E. Huff-Lonergan (2006). Constraints on the Use of Animal Source Foods for Young Children in Ghana: A Participatory Rapid Appraisal Approach. Ecology of Food and Nutrition. 45:351 – 377.

Diao, X. 2008. Assessing the Economywide Impact of Avian Flu in Ghana : A Dynamic CGE Model Analysis. IFPRI. Mimeo

Epprecht, M., L.V. Vinh, J. Otte and D. Roland-Holst. 2007. Poultry and poverty In Vietnam. HPAI Research Brief, No:1- Year, 2007

FASDEP (2002) Food and Agriculture Sector Development Policy, MOFA, Accra 67pp.

Ghana National Association of Poultry Farmers (GNAPF). 2006.

Guèye, E.F, 1998. Poultry plays an important role in African village life. *World Poultry* 14 (10): 14 – 17.

Guèye, E.F. 2007a. "Evaluation of the impact of HPAI on family poultry production in Africa" World's Poultry Science Journal, Vol. 63, September 2007

Guèye, E.F., 2000. The role of family poultry in poverty alleviation, food security and the promotion of gender equality in rural Africa. *Outlook on Agriculture*, 29: 129-136.

Guèye, E.F., 2005. Gender aspects in family poultry management systems in developing countries. *World Poultry Science Journal,* Vol. 61.

Guèye, E.F., 2007b. The role of family poultry in poverty alleviation, food security and the promotion of gender equality in rural Africa. *Outlook on Agriculture,* 29: 129-136.

Gyening , K.O. (2006) The future of the poultry industry in Ghana. Paper prepared for the Ghana Veterinary Medical Association 7pp.

http://www-naweb.iaae.org/nafa/aph/public/4-strategies-awuni.pdf

GSS (2003). Ghana Living Standards Survey Round Four (GLSS 4) 1998/99: Data User's Guide. Ref Type: Data File

Iannotti, L., M. Barron, and D. Roy. 2008. Animal Source Food Consumption and Nutrition Among Young Children in Indonesia: Preliminary Analysis for Assessing the Impact of HPAI on Nutrition. IFPRI.

Karbo, N. and F. K Avornyo (2006) State of the guinea fowl industry in the Northern Region (Ghana). ACTION-AID commissioned Report. RUMNET Publishers, Tamale. 26pp.

Kushi, D.H., Adegbola, T.A. and Umeh, A.P., 1998. 'The role of women in animal production'. In Sonaiya, E.B., Family Poultry, food security and the impact of HPAI. *World's Poultry Science Journal,* Vol. 63, March 2007.

Maltsoglou, I, and G. Rapsomanikis, 2005. The contribution of livestock to household income in Vietnam: A household typology based analysis. *Working Paper,* No. 21. A Living from Livestock: Pro-Poor Livestock Policy Initiative (PPLPI).

MOFA/DFID (2002). The role of livestock in rural livelihood. Report of DFID Study, Accra.

Naazie, A., E. A. Canacoo and C. Mwinbong (2007). Socio-Cultural Aspects of Poultry Production in the Upper East Region of Ghana. Ghanaian Journal of Animal Science. Vol. 2 & 3. No. 1 pp 27 – 34

Obi, T.U., O.A. Olubukola and G. A. Maina. 2008. Pro-Poor HPAI Risk Reduction Strategies in Nigeria: Background Paper. DFID Pro-poor HPAI Risk Reduction Strategies Project, Africa/Indonesia Region Report No. 5

Oprainde, A.O. and E. Birol. 2008. Impacts of Highly Pathogenic Avian Influenza on Rural Livelihoods: Conceptual and Analytical Frameworks and Data Requirements. IFPRI. Mimeo.

Roland-Holst, D., M. Epprecht and J. Otte, 2007. External Shocks, Producer Risk, and Adjustment in Smallholder Livestock Production: The Case of HPAI in Viet Nam. *Research Report.* Pro-Poor Livestock Policy Initiative A Living from Livestock.

Sonaiya, E.B., 2007. Family Poultry, food security and the impact of HPAI. *World's Poultry Science Journal,* Vol. 63.

Vanzetti, D. .2007. "Chicken Supreme: How the Indonesian Poultry Sector can Survive Avian Influenza", Contributed Paper at the 51st AARES Annual Conference, Queenstown, New Zealand, 13-16 February, 2007.

Veterinary Services Directorate 2007. An update of the Highly Pathogenic Avian Influenza situation in Ghana. Powerpoint presentations by Director of VSD at Bio-security workshops for farmers and stakeholders 2007.