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# Financial Cost implication of Highly Pathogenic Avian Influenza (HPAI) Resurgence in Oyo State

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## ABSTRACT

**Highly pathogenic avian influenza $H_1N_1$ (HPAI) is a devastating disease of poultry; it is associated with a high death rate and disrupts poultry production and trade. Oyo state experienced previous outbreaks of HPAI before the biocontainment in 2006/2007 where 200,000 chickens died and over 100,000 were depopulated. Resurgence of Avian Influenza was confirmed by the Oyo State Avian Influenza Desk Officer as at February 2015. This study analysed previous methods of assessing losses due to avian influenza, and used a revised economic model to calculate costs associated with the avian influenza resurgence in Oyo State. The evaluation used epidemiological data, production figures and other input parameters to determine the final costs.The infection caused a loss of 200,272,800 Naira ($910,330.91) in Oyo State.**
**This study urges government to develop an Avian Influenza emergency preparedness system coupled with a rapid response initiative, which must be tested regularly to forestall a future resurgence bearing in mind the huge economic losses associated with the disease.**
**The productive longevity and the unrealised worth of the laying birds must be considered in embarking on a broad- based cost appraisal of Highly Pathogenic Avian Influenza. Finally, an inter-disciplinary approach is deemed necessary to provide a good framework for efficient disease control decision making when tackling Avian Influenza.**

**Key words: Avian Influenza, Oyo State, Poultry, Resurgence, Financial Impact.**

## INTRODUCTION

Highly pathogenic avian influenza (HPAI) is a devastating disease of poultry; it is associated with a high death rate and disrupts poultry production and trade (Wakawa *et al.,* 2008).
The poultry sector represents a major source of income in Nigeria. It contributed approximately 4.45 % of the total animal contribution to the agricultural gross domestic product (GDP) in 2004 (Central Bank of Nigeria, 2004).
Losses associated with livestock diseases may be easy to identify, but it is extremely difficult to attach a cost implication, and these cost implications are often in-complete (Holtz-Eakin, 2005).
Nigeria experienced Highly Pathogenic Avian Influenza outbreaks in 2006 in which above 200,000 chickens died and the rest were depopulated from the farms affected (Gardner *et al*, 2007).

A Government official (Avian Influenza desk officer) confirmed the resurgence of Avian Influenza in Oyo state as at February, 2015.

Previous rapid appraisals have shown that the official confirmation of HPAI in Nigeria causes initial panic resulting in a total boycott of poultry and poultry products (UNDP, 2006). Within 2 weeks, egg and chicken sales declined by 80.5% and up to 4 months after, prices had not recovered up to 50% pre-HPAI levels. In the same study, it was reported that about 80% of the workers in affected farms and 45% of those in unaffected farms had lost their jobs at the immediate periods (UNDP,2006). A projection indicates that about 21% fall in chicken production and US $250 million of revenue loss could be experienced nationally if a worse case of Avian Influenza (bird flu) outbreak occurs in Nigeria (You and Diao, 2007).

A review of socio-economic evaluation models of previous workers indicated that the cost of any illness is the sum total of direct, indirect, intangible and control costs (Holtz-Eakin, 2005)

Therefore, there is a need to determine the economic consequences and assess the financial cost implication of Highly pathogenic Avian Influenza towards designing contingency plans to prevent a resurgence in Oyo State.

**Materials and Method**

**Study Approach**

An appraisal of the economic impacts of the re-emergence of Highly pathogenic Avian Influenza (HPAI) outbreaks and Government intervention (including compensation) in Oyo State (Nigeria) was done.

**Study Area**

Oyo State, 8degrees North and 4 degrees East (8.000°N 4.000°E) covers approximately an area of 28,454 square kilometers and is ranked 14th by size. Agriculture is the main occupation of the people of Oyo state. Ibadan is located in South-western Nigeria. It is the capital of Oyo state . its population is estimated to be about 3,800,000 according to 2006 estimates. A Government official (Avian Influenza desk officer) confirmed the resurgence of Avian Influenza in Oyo state.

The choice of Ibadan in Oyo state was because samples brought from that region tested positive to Highly Pathogenic Avian Influenza.

**Data Management and Analysis**

Our estimates deal only with the four farms (with 3,500; 12,000; 700; and 2,000 commercial layer chickens) that were confirmed having Avian Influenza from February to July, 2015 in Oyo State. A number of assumptions were made because all the farms affected were commercial laying farms:

1. Each laying bird laying at 80% production = 284eggs per laying year
2. Cost of medication, farm attendant, security, Veterinary Doctor, and miscellaneous expenses was = 1,284 naira
3. Cost of laying birds as at the time of depopulation = 1,200 naira
4. Cost of each egg =30 naira

Economics of the outbreak was appraised using mathematical models:

(Ci = PS {υ+ β+ δ+ γ}) Or Ci = PSυ+ PSβ+ PSδ+ PSγ).

Where Ci = cost implications

P = Population of poultry

S = Susceptibility rate of population

υ= Direct losses: losses from mortalities (cost due to mortality of poultry and values of chicks lost from breeders)

β= Indirect losses: egg and meat loss (value of direct loss of eggs due to yield reduction, cost of rejection of poultry meat and eggs, and cost associated with glut)

δ= Intangible losses: opportunity cost (cost of rearing replacement stock to production or sale point, cost of feeding to point of production, cost of retaining facilities and staff during downtime and rearing stage, and cost of destroying remaining population of animals)

γ= Miscellaneous costs (cost of intense campaign to win back consumer confidence, cost of control and administrative/governmental policies, and external inputs) (Fashina *et al*., 2008).

**Calculating for υ(direct costs)**

PSυ1 = Actual determined direct value based on the outbreak situation (January to August)

PSυ2 = Estimated direct value based on mild scenario of HPNAI outbreak (10 % losses in commercial poultry population).

PSυ3 = Estimated direct value based on severe scenario of HPNAI outbreak (70 % losses in commercial poultry population).

PSυ = Market value of birds + value of chicks lost (Fashina *et al*., 2008).

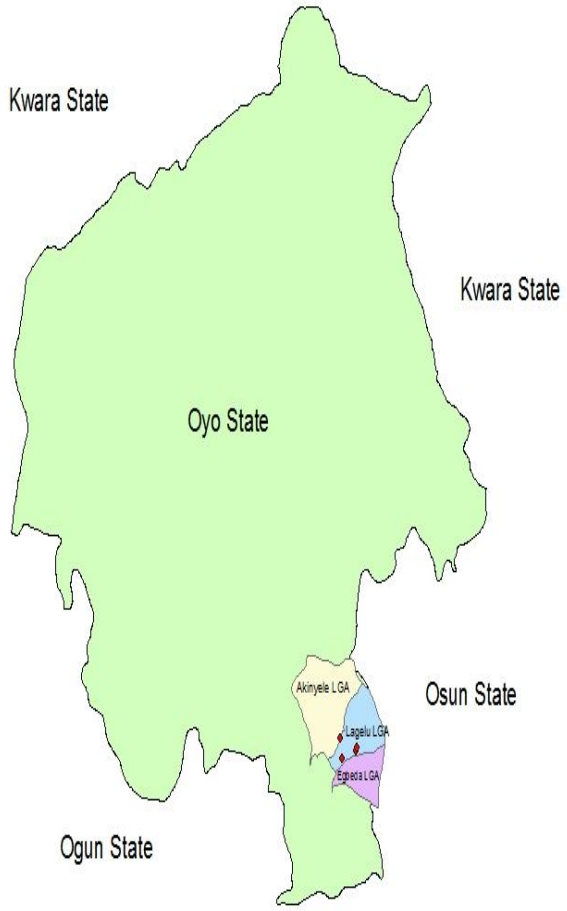


**Fig 1**: Map showing places affected with Highly Pathogenic Avian influenza in Oyo State

**Calculating for β(indirect costs)**

PSβ= Cost (glut) Costs associated with glut: reduction in price observed x (total annual national production [trays per annum] – trays lost to mortality in HPNAI) (Fashina *et al*., 2008).

**Calculating for δ(intangible costs)**

Since intangible costs are costs of rearing replacement stock, facilities retention, staff retention, downtime cost and destruction/disposal of remaining of affected flocks, therefore

PSδ = Replacement cost + downtime cost + destruction/disposal cost Replacement cost= (99.985 % cost for raising pullets to POL* + 0.015 % cost for layer breeders pullets to POL) x total number lost

* POL: Point of lay bird

Downtime cost for facilities= Facility cost per bird per annum x downtime period per annum x number of birds (N100 per bird per annum† x 3/12 months x number of birds† $778.21 per 1 000 birds per annum for retaining poultry pen (field investigations and data from poultry producers, 2006) (Fashina *et al*., 2008).

**RESULT**

**Use of Mathematical Models in Assessing impact of Avian Influenza on the farms**

(Fashina et al) made Mathematical models

Ci = PS {υ+ β+ δ+ γ} Or

Ci = PSυ+ PSβ+ PSδ+ PSγ

As shown in the materials and method.

**Assumptions**

Given that each laying bird laying at 80% production = 284 eggs per laying year
Working with the assumption that cost of medication, farm attendant, security, Cost of medical intervention and miscellaneous expenses was = 1,284 naira
Cost of laying birds as at the time of depopulation = 1,200 naira Cost of each egg =30 naira Therefore applying the formula:
Ci = PSʊ+ PSβ+ PSδ+ PSγ

**Impact Assessment for Farm C**

Population of birds = 3,500 laying birds
To calculate Direct loss (PSʊ)
PSʊ = Population of birds X Cost of each bird
= 3,500 X 1,200 naira = 4,200,000 naira.

**Calculating for Indirect Costs (PSβ)**

PSβ = Cost of eggs that was supposed to have been sold for the laying year would be
calculated as = Population of birds X Total number of eggs expected per X Cost of each egg = 3500 X 284 X 30 = 29,820,000

**Calculating for Intangible costs (PSδ)**

PSδ = Cost of medication, farm attendant, security, medical intervention cost, and miscellaneous expenses was = 1,284 naira X Population of laying birds
= 1,284 X 3,500 = 4,494,000

**Using the mathematical model**:

Ci = PSʊ+ PSβ+ PSδ+ PSγ
Ci = 4,200,000 + 29,820,000 + 4,494,000
= 38,514,000 naira
= 175,063.64 Dollars

**Impact Assessment for Farm D**

Population of birds = 12,000 laying birds
To calculate Direct loss (PSʊ)
PSʊ = Population of birds X Cost of each bird
= 12,000 X 1,200 naira
= 14,400,000 naira

**Calculating for Indirect Costs (PSβ)**

PSβ = Cost of eggs that was supposed to have been sold for the laying year would be calculated as = Population of birds X Total number of eggs expected per X Cost of each egg = 12,000 X 284 X 30 = 102,240,000

**Calculating for Intangible costs (PSδ)**

PSδ = Cost of medication, farm attendant, security,medical intervention cost, and miscellaneous expenses was = 1,284 naira X Population of laying birds
= 1,284 X 12,000 = 15,408,000

**Using the mathematical model**:

Ci = PSʊ+ PSβ+ PSδ+ PSγ
Ci = 14,400,000 + 102,240,000 + 15,408,000
= 132,048,000 naira
= 600,218.18 Dollars

**Impact Assessment for Farm E**

Population of birds = 700 laying birds
To calculate Direct loss (PSʊ)
PSʊ = Population of birds X Cost of each bird
= 700 X 1,200 naira = 840,000 naira

**Calculating for Indirect Costs (PSβ)**

PSβ = Cost of eggs that was supposed to have been sold for the laying year would be calculated as = Population of birds X Total number of eggs expected per X Cost of each egg= 700 X 284 X 30= 5,964,000 naira

**Calculating for Intangible costs (PSδ)**

PSδ = Cost of medication, farm attendant, security, medical intervention cost, and miscellaneous expenses was = 1,284 naira X Population of laying birds
= 1,284 X 700 = 898,800 naira

**Using the mathematical model**:

Ci = PSʊ+ PSβ+ PSδ+ PSγ
Ci = 840,000 + 5,964,000 + 898,800
= 7,702,800 naira
= 35,012.727 Dollars

**Impact Assessment for Farm F**

Population of birds = 2,000 laying birds
To calculate Direct loss (PSʊ)

PSʊ = Population of birds X Cost of each bird
= 2,000 X 1,200 naira
= 2,400,000 naira

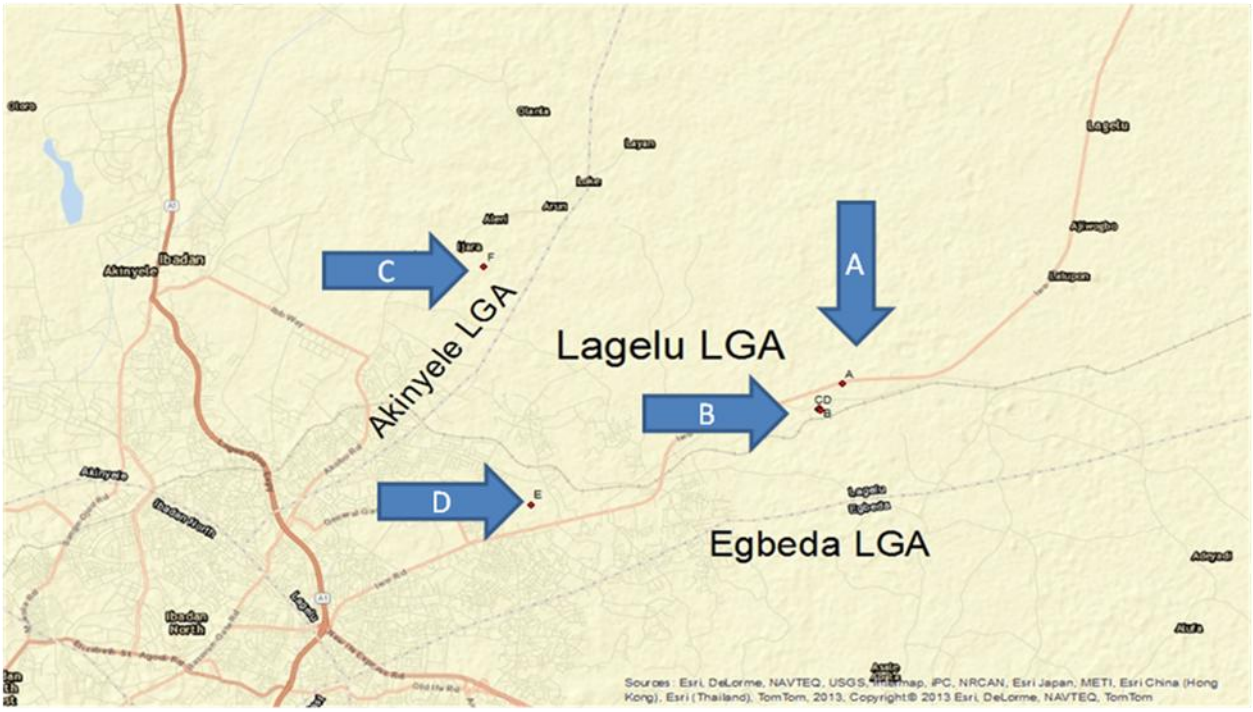


**Figure 2**: Point Data map showing Spatial Distribution of Farms Confirmed with Avian Influenza

**Calculating for Indirect Costs (PSβ)**

PSβ = Cost of eggs that was supposed to have been sold for the laying year would be calculated as = Population of birds X Total number of eggs expected per X Cost of each eg = 2,000 X 284 X 30
= 17,040,000.

**Calculating for Intangible costs (PSδ)**

PSδ = Cost of medication, farm attendant, security, medical intervention cost, and miscellaneous expenses was = 1,284 naira X Population of laying birds
= 1,284 X 2,000
= 2,568,000 naira

**Using the mathematical model**:

Ci = PSʊ+ PSβ+ PSδ+ PSγ
Ci = 2,400,000 + 17,040,000 + 2,568,000
= 22,008,000 naira
= 100,036.36 Dollars

**Therefore,**

Total impact of the four farms:

Ci = Impact on farms C, D, E and F
= 38,514,000 naira + 132,048,000 naira + 7,702,800 naira + 22,008,000 naira
= 200,272,800 Naira
= 910,330.91 Dollars
The Point data map in figure 2 shows the spatial distribution of the farms that were visited and those that experienced the Avian Influenza resurgence.

**Impact Assessment / Compensation Package**.

Only two of the farms were compensated about 4 weeks after their farms were being depopulated after their farms were being confirmed to have had Avian Influenza. A 40 (fourty) year old male owner of Farm C said, “we lost approximately two million naira as a results of birds that died during the outbreak while approximately one and a half million naira was lost due to total depopulation of the remaining birds and as at now we have not been compensated” (That was as at March 2015). A fifty-two year old owner of Farm B said, “Government promised to compensate us, by paying #1,450 (One thousand four hundred and fifty naira only) per bird”. I have been compensated with 920 (nine hundred and twenty) naira per bird, although the compensation reached me exactly four weeks after my farm was depopulated”. Another

farmer who owns Farm D located along Moniya-Iseyin road in Akinyele Local Government Area said, “The Avian Influenza outbreak caused a great loss to me. My birds started to die suddenly. I lost about 1,300 birds to the disease and a further 724 birds to depopulation. As at the time of this interview, I have not been compensated”. However, after periodical visits to these farmers we confirmed that they were compensated 6 months after the outbreak occurred.

## DISCUSSION

Commercial layer flocks are very important for the Nigerian economy. The Nigerian poultry sub-sector is the second in importance to petroleum (Ducatez *et al*., 2006). Markedly visible economic impacts are felt when outbreaks of infectious diseases occur in developed countries. Economic impacts can also be seen in the economic profile of developing countries when infectious diseases occur suddenly.

The dominant source of outbreak sequalae is the breakdown of national public health infrastructure (Bogich *et al*., 2012)

Governments with inactive disease surveillance and emergency preparedness system are ill-prepared in the eventuality of a disease outbreak and hence focus on funding control campaigns, instead of funding the prevention of the outbreak.

A region cannot assess the real effects of Avian Influenza resurgence without examining the financial cost implication of the disease. The economic impacts are further amplified due to the time lost during the decision making process in response to the disease outbreak. (Fasina *et al.*, 2008).Losing 910,330.91 Dollars in only four (4) farms, due to the effects of Avian Influenza on only egg laying chickens in this study is a huge economic loss by all standards.It is difficult to know the true economic impacts in monetary terms from previous studies (Fashina *et al*., 2008)

The financial effects of Avian influenza resurgence involves most farmers losing their livelihood as a result of culling of birds by Government officials. Some farmers never recover from the loss and hence are discouraged from re-embarking on poultry production

A delay in the compensation (coming 6 months after the depopulation) would affect the farmers such that they may never be able to recover from the aftermath of the Avian influenza outbreak. Compensation with about half of the value that Government promised would definitely discourage other farmers further from reporting suspected Avian Influenza cases to appropriate Government quarters.

## CONCLUSION

The productive longevity and the unrealised worth of the laying birds must be considered in embarking on a broad-based cost appraisal Highly Pathogenic Avian Influenza.

The loss of livelihood, frustration and total discouragement affects most of the farmers whose farms are affected with Avian Influenza outbreak.

Late compensation and under valuing after depopulating farms in an Avian Influenza outbreak situation, would discourage other farmers from reporting if, or when they notice Avian Influenza signs in their flock.

Even though it is difficult to calculate the cost of loss of an Avian Influenza outbreak, the true economic impacts can still me felt (Howe 1985; Otte *et al.,* 2004; Holtz-Eakin, 2005; Fashina *et al*., 2008).

.Avian Influenza is a disease that disrupts cross-border trade with neighbouring countries as it threatens food security of nations and carries with it a zoonotic scare (FAO 2002; European Commission 2004; Otte *et al*., 2004; Holtz-Eakin, 2005; Rushton *et al*., 2005; Ducatez, *et al*., 2006; OIE 2006).

Avian Influenza economic impact assessment is still incomplete if the effect on feed millers, traders in live bird markets, day-old-chick suppliers and those in the hospitality industry among other categories of service providers have not been evaluated and added up.

## RECOMMENDATION

Governments should develop an Avian Influenza emergency preparedness system coupled with a rapid response initiative, which must be tested regularly to forestall a future outbreak of Avian Influenza.

Government should also increase disease surveillance activities in high risk areas. They must also ensure that public enlightenment campaigns are put in place to allow the public know about the economic impact of Avian Influenza.

A space- time model can be developed to predict the likely occurrence of a future Avian Influenza outbreak in order to put in place measures to prevent the predicted outbreak.

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