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Evaluation of the Avian influenza surveillance system in Enugu State Nigeria, 2015-2017

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Abstract

Introduction: *the resurgence of highly pathogenic avian influenza (HPAI) H5N1 was reported in Nigeria in 2014. The isolation of a reassortants strain of influenza A subtype H5N8 in 2017 fueled speculation of a possible the emergence of a novel influenza strain with no prior human or animal immunity. About 3.4% of poultry in Enugu State were affected between 2015-2017. Hence, the need for a comprehensive reviews of the avian influenza (AI) surveillance system in Enugu State, Nigeria.* ***Methods:*** *a cross-sectional survey was conducted involving 27 poultry stakeholders (epidemiology officers, poultry farmers and surveillance point agents). Based on the US center for Disease Control and Prevention (CDC) updated guidelines for evaluating public health surveillance system. We analyzed surveillance data for HPAI between (January 2015- December 2017), from the National*

animal diseases information system, (NADIS) data bases of the Federal ministry of Agriculture and rural development, case reports for HPAI outbreaks from Federal ministry of Agriculture Enugu State and reports of the National influenza reference laboratory NVRI Jos. We accessed surveillance system attributes and interviewed poultry stake holder in Enugu State using a semi-structured questionnaire to obtain additional information. Data collected was coded and analyzed using Microsoft excel. Mean, frequencies of responses were determined and variables displayed in tables. ***Results:*** *in total, 27 AI stakeholders were interviewed, of these 10(37.1%) and 17(62.9%) of AI stakeholders had < 8 years and < 10 years of work experience in AI surveillance respectively. Between 2015-2017, 1028 suspected AI sample were screened for avian influenza in Nigeria, of these 817 (79.5%) were positive and Enugu State accounted for 3 (0.37%) of confirmed cases. Twenty (74%) of respondents reported that the system was simple and reporting platforms easy to populate, 23 (92.3%) reported that the system was flexible and can accommodate surveillance of other enzootic poultry diseases. Eighteen (66.7%) posited that AI surveillance was acceptable and wishes to continue to participate. Representatives of the surveillance system was Eight (47%), 12 (44%) reported that the surveillance system was unstable. The data quality was 101 (47%) and the predictive positive value was 79.5%. Timeliness of reports was 51% in 2015, 48% in 2016 and 47% in 2017.* ***Conclusion:*** *the avian influenza surveillance system in Enugu state is useful, simple, flexible and acceptable. Poor data quality, stability, timeliness of reports were identified during the period of study. We recommend prompt compensation of affected farmers, this may engender trust between poultry farmers and epidemiology unit hence, early disease reporting, and improved data quality. The State Government may consider engaging more surveillance point officer to improve coverage of disease reporting from local government areas.*

Introduction

Public health surveillance is a continuous collation, analysis interpretation and dissemination of data regarding health-related events [1-3]. It ensures that informed public health decisions are made based on how well a surveillance system meets its objectives by evaluating its attributes. Disease surveillance was introduced in Nigeria in 1988 following the outbreak of yellow fever [4-6], before this period there was no coordinated disease reporting system [7]. In 2006, the AI surveillance system was developed primarily in response to the outbreak of highly pathogenic AI; H5N1 which affected 32 States across 97 local government areas, one human fatality was reported in Lagos State Nigeria [4]. As a result, the Federal Ministry of Agriculture instituted the modified stamping out control measures, (depopulation, disinfection) and compensation of affected farmers, to reduce the burden of losses and prevent the sale of infected poultry
chicken [8]. The 2006 outbreak of HPAI resulted in the humane slaughter of over 1.2 million exposed poultry birds and compensation paid to the tune of 1.8 million dollars to affected farmers [9]. Subsequently, Nigeria was declared free of AI in January 2013 [10], however, in 2014 circulating level of Low pathogenic avian influenza (H5N2) was reported in a pool of ducks at “Shasha” live birds market in Ibadan Oyo state Nigeria [5]. This may have underscored the assertion that Nigeria was entirely free from avian influenza. Consequently, in 2015, the resurgence of HPAI H5N1 and the emergence of influenza A strain H5N8, co-circulating with H5N1 in the poultry subsector in Nigeria may have brought to the fore the need for a comprehensive evaluation of the avian influenza surveillance system in Nigeria with a view to providing information necessary public health action. This study was conducted to evaluate the avian influenza (AI) surveillance system in Enugu State, Nigeria covering the period of operation from January 2015 to December 2017. The assessment specifically evaluated the surveillance attributes: simplicity, flexibility, acceptability,

sensitivity, data quality, predictive value positive, representativeness, timeliness and stability of the AI system.

Methods

Study area

Enugu State lies between latitude 6°30N and longitude 7°30E in the southeastern part of Nigeria. It has 17 local government areas and located in the tropical savannah zone of Nigeria. It is bordered by Abia and Imo State to the south, Ebonyi State to the East, Benue State to the North East, Kogi State to the northwest and Anambra State to the west, with an estimated population of 3.8 million. Enugu State has an estimated poultry population of 3.7 million [11]. Poultry farming in Enugu is mainly practiced under an intensive and free-range farming system [11] (Table 1).

Study design

A descriptive, cross-sectional survey wasconducted involving 27 poultry stakeholders (epidemiology officers, poultry farmers and surveillance point agents) to evaluate the AI poultry surveillance system of Enugu State (Nigeria) during the period of January 2015-December 2017. The selected poultry stakeholders includes all 17 surveillance point agents from the 17 Local government areas (LGA), of Enugu, 9 registered member of Poultry farmers association (PAN) Enugu State and the Federal epidemiology officer in charge of disease reporting in Enugu state between January 2015-December 2017.

Data collection

A trained interviewer administered questionnaires to poultry stakeholders and managers. The questionnaire followed the CDC updated guidelines on surveillance systems evaluation and assessed the following surveillance system attributes [11].

Data analysis

Data obtained was transferred to Microsoft excel for analysis Mean, frequencies of responses were determined and variables displayed in (Figure 1).

Ethical consideration

Permission for this study was obtained from the Nigerian center for disease control (NCDC). Informed consent was sort and obtained before administering questionnaires to consenting participants.

Results

Description of the AI surveillance system

The chain of communication of the AI surveillance begins with the detection and immediate notification of suspected outbreak by the avian influenza desk officer at the local government area. This information is collated and transmitted to the Zonal and Federal epidemiology officer at Ministry of Agriculture, then the disease notification and surveillance officer (DSNO) at the Federal and State Ministry of health (Figure 2, Figure 3). Retrospective and prospective disease investigation is conducted by the afore-mentioned teams to determine the epidemiology of the suspected outbreak. Laboratory samples, (whole carcass) are collected from affected poultry chicken and sample sent to the avian influenza reference laboratory at the National Veterinary Research Institute (NVRI) in Jos, Nigeria for confirmatory diagnosis. Similarly, human samples, (nasal swab) from individuals who had direct or indirect contact with affected poultry birds would be collected by the medical component (nurses) of the one health surveillance team to determine their health status. A quarantine notice is placed at the entrance of the affected farms to prohibit movement of poultry and related products in and out of the farm pending the outcome of laboratory investigation. Consequently, when laboratory results confirm a positive sample for avian influenza, a control zone of 3 kilometers is

established within the farm spanning from the foci of the outbreak to the buffer (zone immediately surrounding the farm premises). Similarly, a surveillance zone (zone outside and along the border of a control area) of 10 kilometers from the buffer zones to surrounding areas is established mainly for containment and contact tracing with a view to preventing the spread of infection (Figure 4), to contiguous farms and locality. Similarly, an individual who tested positive due to exposures to infected poultry chicken would be evacuated to the hospital for treatment.

Characteristic of AI in poultry in Enugu State

From 2015-2017 a total of 127,493 poultry chicken was affected by the outbreak of avian influenza in Enugu State across three farms of these 29,429(23%) poultry chicken died due to the outbreak, 98,064(76.9%), was humanely slaughtered (depopulated). There were no new cases in 2016, however, between 2015 to 2017; additional 125,000 poultry chicken was depopulated from an initial population 2,493 affected poultry in 2015. In general, 5 suspected cases were reported during these periods with 3 confirmed positive for avian influenza.

The attribute of the avian influenza surveillance system

Usefulness: between 2015 to 2017, the laboratory component of the avian influenza surveillance system at National Veterinary Research Institute, (NVRI) Jos, received 1028 sample,1011(98%) were from farms, 16(1.6%) from Live bird market (LBMs) and 1(0.1%) from Zoological Garden, of these 1028 samples, 817 samples were positive for avian influenza (AI). Enugu state accounted for 3(0.37%) of the confirmed cases of avian influenza within the period.

Simplicity: the system integrates with the integrated disease surveillance and response (IDSR). Twenty (74%) of the respondent interviewed posited that the surveillance system was well understood, diseases reporting platforms were simple and easy to populate.

Flexibility: the avian influenza surveillance system has been adapted and is in use for reporting enzootic poultry diseases. Twenty-five (92.3%) of the respondents reported that the AI surveillance system has been used for reporting other poultry diseases such as Newcastle diseases.

Acceptability: participation of stakeholders in the avian influenza surveillance is germane for the effective functioning of the system. Assessment of stakeholders on their willingness to participate in the (AI) surveillance system shows that 18 (66.7%) of the respondents wants to continue to participate while 9(33.3%) expressed reservation towards participation.

Sensitivity: between 2015-2017 Nigeria reported 1028 suspected cases of avian influenza, 817 samples tested positive. Enugu State reported 5 suspected with 3 laboratory-confirmed and one which previously tested negative for AI from the initial confirmed cases consequently, sensitivity (66.7%).

Predictive Value Positive (PVP): the Avian influenza surveillance system in Nigeria reported 1028 suspected outbreak of AI between 2015 to 2017. Total serum sample positive for (AI) antibodies within this period was 817 consequently; the PVP for avian influenza surveillance were determined to be 79.5%.

Representativeness: a public health surveillance is representative if it accurately describes the occurrence of a health-related event over time and its distribution in the population of flock affected, 8(47%) of the respondent during the study could accurately describe the occurrence of the disease. Furthermore, this study found that farmers who had the previous history of the outbreak of avian influenza but were yet to be compensated as at the time of this study may not report a new case due to fears that their farms may be depopulated and compensation delayed or not paid at all.

Timeliness: in the year under review (2015-2017) the timeliness of reporting fell below 80%. We defined a timely report as any report that was reported at least before the second week of the new month. In 2015 the timeliness was 51%, 48% in 2016, and 47% in 2017, none of the reported data reviewed during the period of study met 100% target for reporting rate (Figure 5). Similarly, the time lag between sample collection and confirmatory diagnosis by the laboratory component of the avian influenza surveillance system takes about 24-72hr since control measures are largely dependent on laboratory results.

Stability: the avian influenza surveillance system is a donor-driven paucity of funds is a major militating factor especially in Nigeria where the release of funds for outbreak investigation and control is event-based, although the surveillance system has been unstable stable. fifteen (55.5%) of the respondents posited that poor funding and constant changes in the policy direction of the government especially in the agricultural subsector are a militating factor to the effective functioning of the surveillance system.

Data quality

This reflects the completeness and validity of the data recorded in the surveillance system. On a cumulative scale, our finding showed that 54% of surveillance reports from field offices are complete per month, while 46% of the LGA had incomplete report per month. Annually, only 96 (47%) of total surveillance reports are complete (Table 1).

Limitations

This study could not access the cost of the surveillance system because we had no permission to make such information public.

Discussion

The avian influenza surveillance system in Enugu was useful, the system detected an outbreak of Avian influenza in three commercial poultry farms in Enugu State between 2015-2017, this finding was in tandem with [1, 4]. The system is flexible and has been adapted for reporting of other enzootic poultry diseases even though the surveillance system was initially designed only for states with confirmed cases of HPAI this was in agreement with studies in North America [1] and Nigeria [2]. The system is acceptable by a vast majority of poultry stakeholders in Enugu State, however, farmers whose farms were depopulated but were yet to be compensated as at the time of the study expressed reservation toward continuous participation in the avian influenza surveillance system, a similar finding was reported by [7]. However, apathy toward participation was addressed following advocacy to stakeholders. The surveillance system is donor-driven, subject to changes in government policies in the agricultural subsector this may affect its function as a surveillance system this finding was in tandem with [1]. The time lag between sample collection and confirmatory diagnosis by the laboratory component of the avian influenza surveillance system takes about 24-72hr finding supported
by [1], delay in laboratory results may stall control measures during a suspected outbreak since control policies (depopulation, disinfection and compensation) are subject to laboratory confirmation of avian influenza. Hence, may lead to persistence and spread of poultry disease. The probability of the system to identify a truly positive case during the period of study was 79.5% which contrast with 15.4% and 66.7% reported in a similar study in Nigeria [1].

Conclusion

The avian influenza surveillance system complemented by the laboratory component has been useful, simple, flexible, and acceptable; however, data quality, stability and representativeness of surveillance reports are a major concern which may affect the performance of the AI surveillance system. Delayed compensation of affected farmers, the paucity of funds to conduct active case searches especially

during influenza off seasons may be the bane effective poultry disease notification and control in Enugu State, Nigeria. We recommend that the government should establish a dedicated funding commission with proper budgetary support to fund the activities of the avian influenza surveillance system. Similarly, training and re-training of surveillance officers on the rudiment of disease reporting may improve data quality and representativeness of surveillance reports. Prompt compensation of farmers whose farms were depopulated during an outbreak may engender trust between surveillance point agents and farmers thus enhance co-operation and improved disease notification.

What is known about this topic

- *It´s donor-driven, event-based surveillance system;*
- *The system was initially developed to function in State with only reported cases of HPAI;*
- *It control strategies consist of depopulation of affected farm, disinfection of farm and compensation of farmer.*

What this study adds

- *The Avian influenza surveillance system is useful, simple, flexible, and acceptable;*
- *Poor data quality, instability of the system, delayed reporting, non-representativeness of AI surveillance data and delayed compensation of affected farmers are militating factors to AI control strategies.*

Competing interests

The authors declare no competing interests.

Authors' contributions

All the authors contributed to the conduct of this work. Mr Ameh read the manuscript and made contribution. Dr Adebowale read the manuscript and designed the flow chats.

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Table and figures

Table 1: completeness of surveillance reports form returns to the Federal Epidemiology unit of the ministry of Agriculture Abuja between January-December 2015

Figure 1: map of Nigeria showing Enugu State Nigeria

Figure 2: flow chat of Avian influenza notification channel in Enugu State, Nigeria

Figure 3: flow chat of showing response partway for Avian influenza outbreak in Enugu State, Nigeria

Figure 4: avian influenza surveillance and control zones

Figure 5: annual timeliness of submitted reports 2015-2017

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Table 1: completeness of surveillance reports form returns to the Federal Epidemiology unit of the ministry of Agriculture Abuja between January-December 2015

Month/ LGA	Jan.	Feb.	March	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Perf. /LGA	% C
Aninri	0	0	0	*	*	*	*	0	*	*	0	0	6	50.0
Awgu	0	0	0	0	*	*	*	*	0	*	0	0	5	41.7
Enu-E	*	*	*	0	*	*	*	*	0	0	0	0	7	58.3
Enu-N	0	0	*	*	*	0	*	0	0	0	0	0	4	33.0
Enu-A	*	0	0	0	*	*	*	*	*	0	0	0	6	50.0
Ezeagu	0	*	*	0	*	0	0	*	*	0	0	0	5	41.7
Igbo Etiti	*	0	0	*	*	0	*	*	*	*	0	0	7	58.3
Igbo Eze	0	*	0	*	0	*	*	0	*	*	0	0	6	50.0
Igbo-A	0	0	*	*	*	0	*	0	*	*	0	0	6	50.0
Isi-Uzo	*	*	*	0	*	0	*	0	*	0	0	0	6	50.0
Nkanu-E	0	0	*	*	*	0	*	0	*	0	*	0	6	50.0
Nkanu-W	*	*	0	0	*	0	*	*	0	0	*	0	6	50.0
Nsukka	*	*	*	0	*	0	*	*	0	*	0	0	7	58.3
Oji river	*	0	*	0	*	*	0	*	0	*	0	0	6	50.0
Udenu	0	0	*	0	*	*	*	0	*	*	0	0	6	50.0
Udi	*	*	*	0	*	0	0	0	*	*	0	0	6	50.0
Uzo-U	0	0	*	*	*	0	*	*	*	*	0	0	7	58.3
Total	8	7	11	7	16	7	14	9	11	10	2	0	96	47.0
% C.	47.0	41.0	65.0	41.0	94.0	41.0	82.0	53.0	68.0	59.0	12.0	0.0	47.0	

C: Complete; 1: Complete report; 0: No report; *: LGA with at least 2 surveillance reports is ranked; Perf: Performance

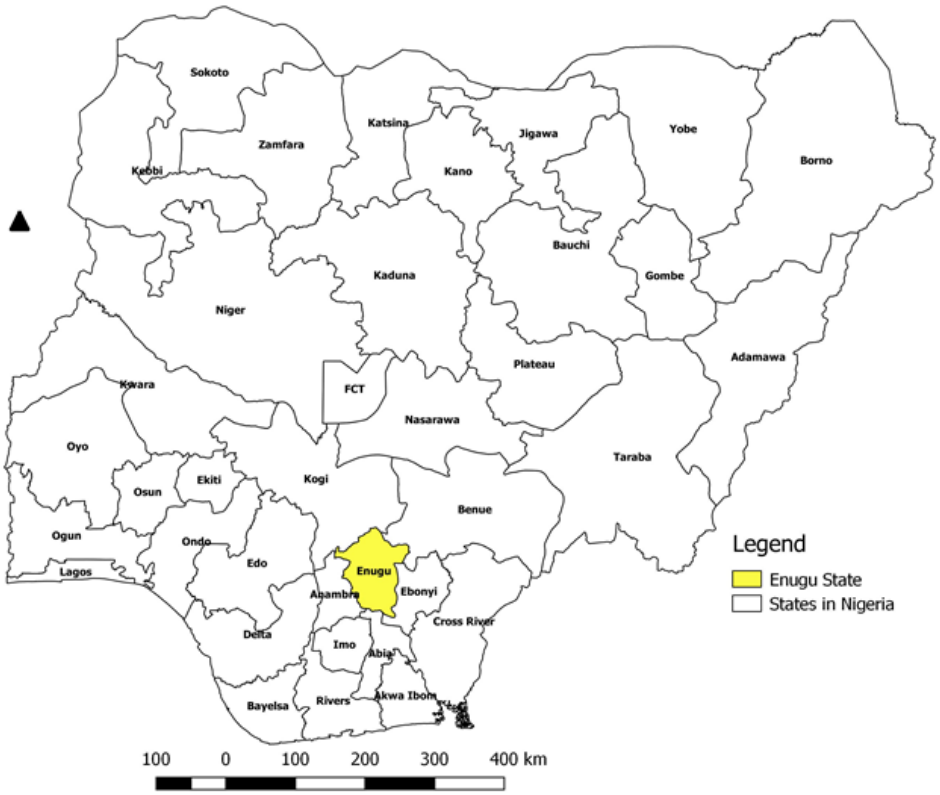

Figure 1: map of Nigeria showing Enugu State Nigeria

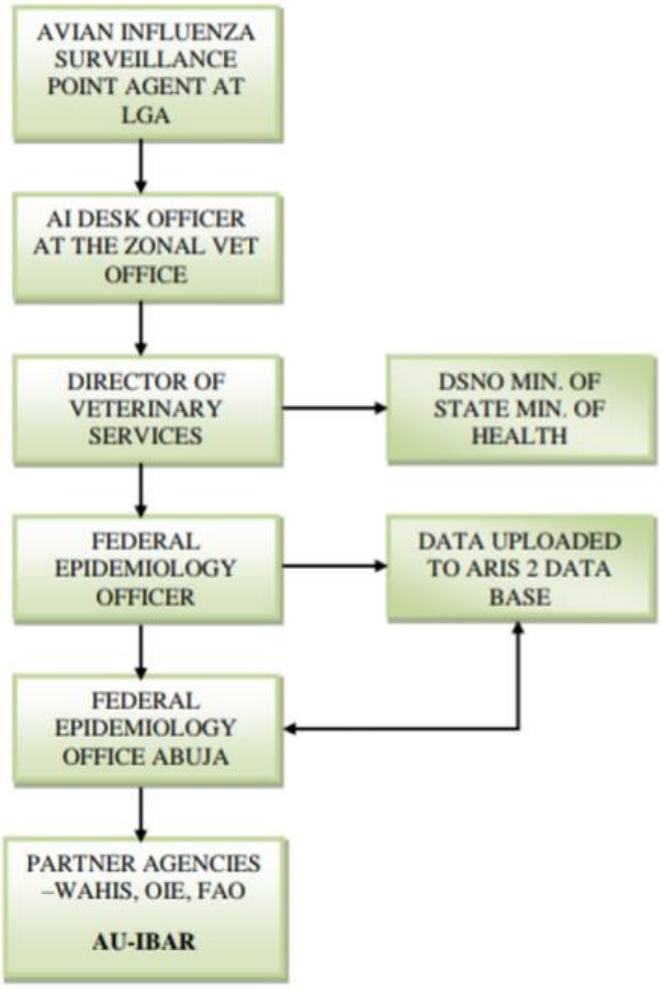

Figure 2: flow chat of avian influenza notification channel in Enugu State, Nigeria

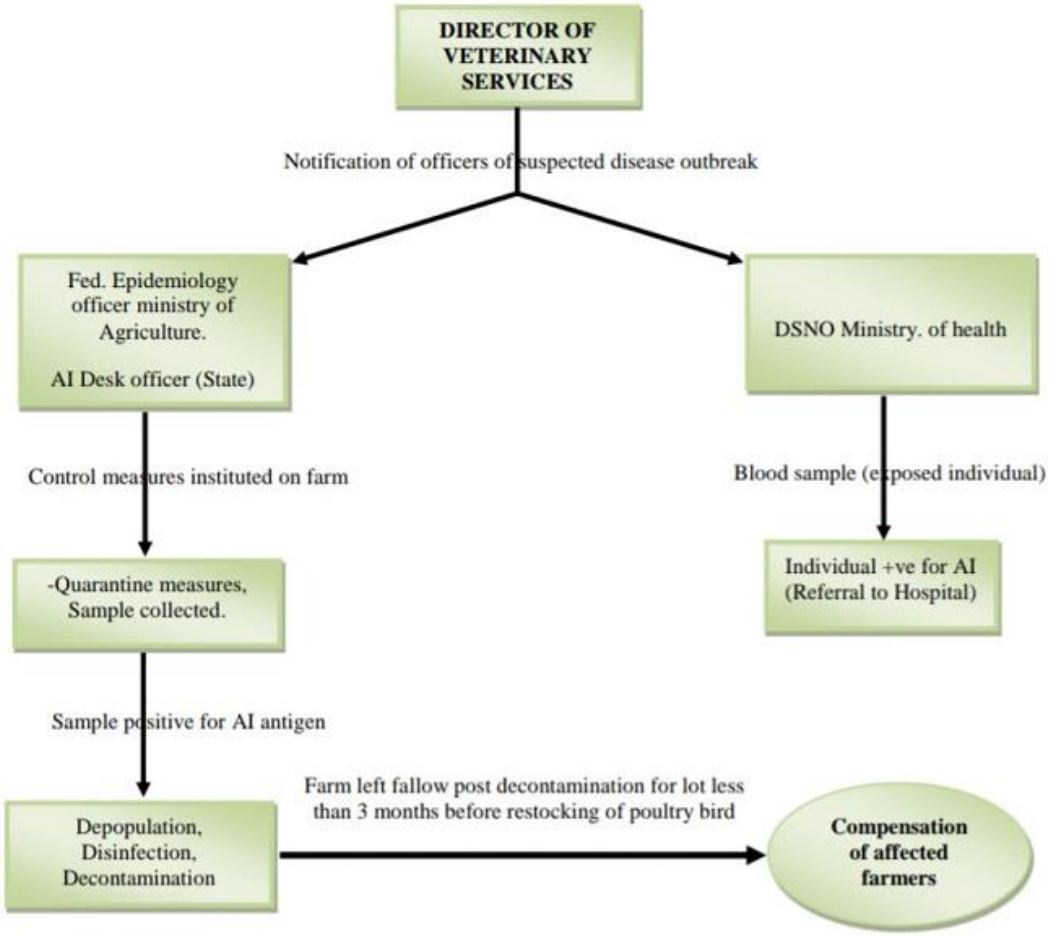

Figure 3: flow chat of showing response partway for avian influenza outbreak in Enugu State, Nigeria

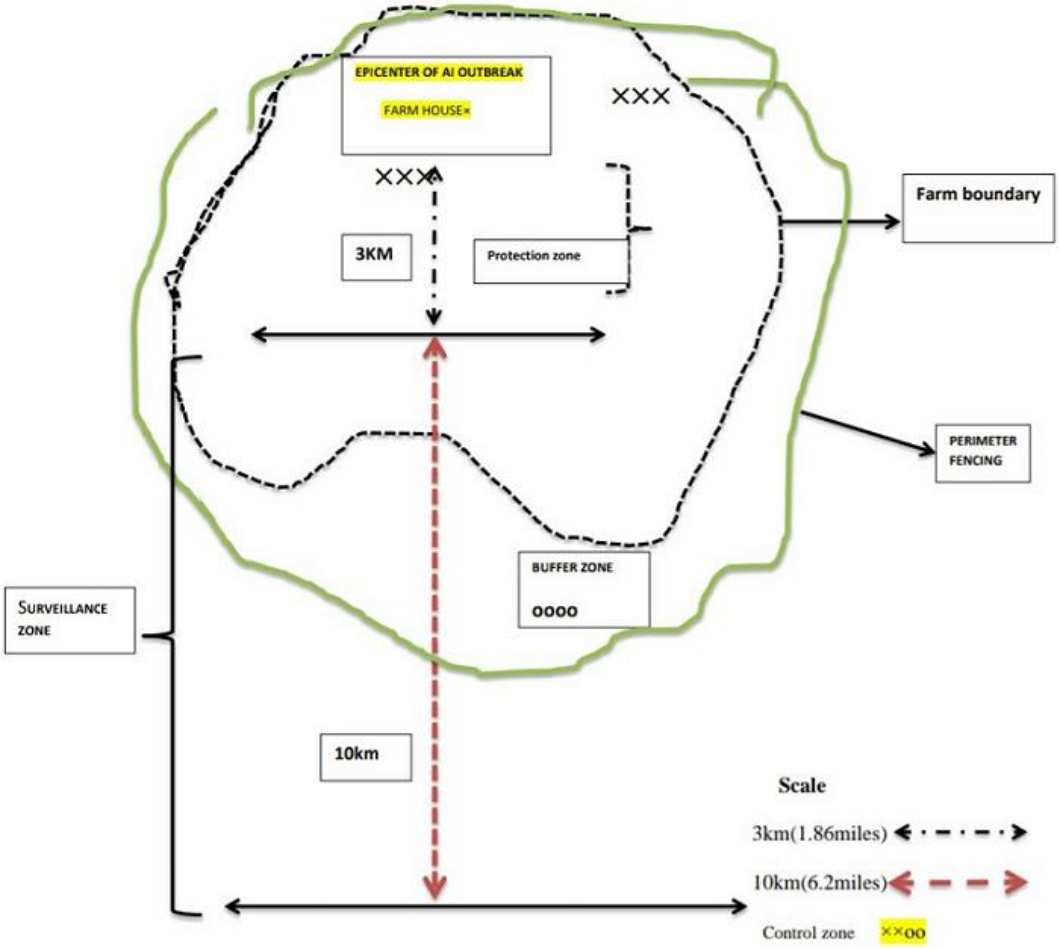

Figure 4: avian influenza surveillance and control zones

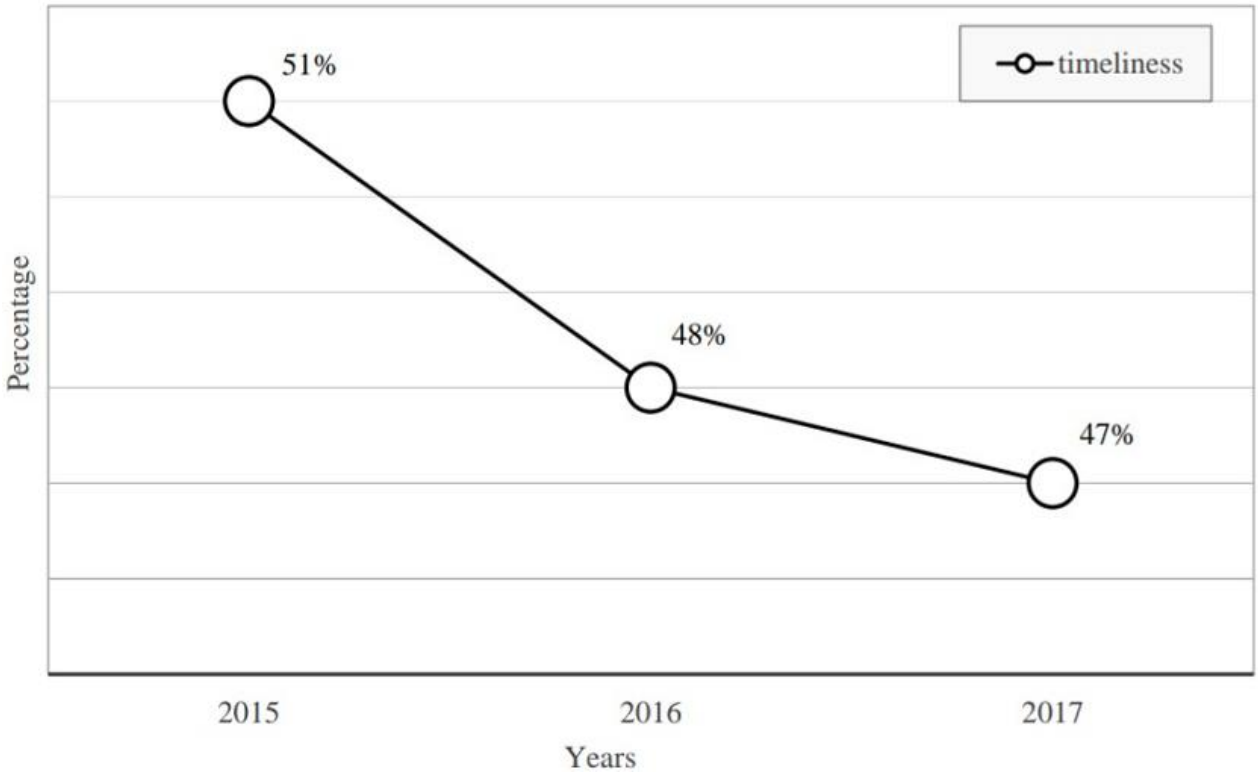

Figure 5: annual timeliness of submitted reports 2015-2017