Acta Tropica 147 (2015) 38–44

Contents lists available at ScienceDirect

Acta Tropica

journal homepage: www.elsevier.com/locate/actatropica

When private actors matter: Information-sharing network and surveillance of Highly Pathogenic Avian Influenza in Vietnam

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ARTICLE INFO

Article history:
Received 21 November 2014
Received in revised form 16 March 2015
Accepted 27 March 2015
Available online 3 April 2015

Keywords:
Disease reporting
Social networks
Vietnam
H5N1 virus
Private sector
Participatory research
Influenza

ABSTRACT

The effectiveness of animal health surveillance systems depends on their capacity to gather sanitary information from the animal production sector. In order to assess this capacity we analyzed the flow of sanitary information regarding Highly Pathogenic Avian Influenza (HPAI) suspicions in poultry in Vietnam. Participatory methods were applied to assess the type of actors and likelihood of information sharing between actors in case of HPAI suspicion in poultry. While the reporting of HPAI suspicions is mandatory, private actors had more access to information than public actors. Actors of the upstream sector (medicine and feed sellers) played a key role in the diffusion of information. The central role of these actors and the influence of the information flow on the adoption by poultry production stakeholders of behaviors limiting (e.g. prevention measures) or promoting disease transmission (e.g. increased animal movements) should be accounted for in the design of surveillance and control programs.

1. Introduction

The performance of public surveillance systems depends on their ability to access health information from the animal husbandry sector. Therefore, among the requirements for effective surveillance networks, the acceptability of the system (i.e. willingness of actors to participate in the system) is of particular importance (Hoinville, 2011).

Highly Pathogenic Avian Influenza virus (HPAI) (H5N1) is present in Vietnam since the first epizootic in 2003. Notification of any HPAI (H5N1) suspicions to veterinary authorities is mandatory (MARD and MOH, 2011). The case definition of HPAI (H5N1) suspicion in poultry is based on a 5% mortality in one poultry flock over 2 days along with specific symptoms such as cyanosis, swelling of the head and diarrhea (Department of Animal Health, 2011). This case definition is common with velogenic Newcastle Disease also circulating in Vietnam (OIE, 2014). Despite strong coverage of veterinary authorities in the field at all levels (village, commune, district and province), under-reporting of HPAI suspicions has been recognized by the authorities as a major limitation in the effectiveness of any HPAI (H5N1) control programs in place (Minh et al., 2011).

In order to ensure acceptability and sustainability of the surveillance and control programs, accounting for the needs of all stakeholders becomes critical. In order to do so, a good understanding of health information sharing pathways between stakeholders is essential. Network analysis has been widely applied to study complex socio-economic interactions such as the spread of influence and knowledge (Jackson, 2008; Wasserman and Faust, 1994).

Abbreviations: HPAI, Highly Pathogenic Avian Influenza; PP, proportional piling.

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http://dx.doi.org/10.1016/j.actatropica.2015.03.025
0001-706X/

In the field of animal health, this method has been mainly used to identify actors contributing the most to the spread of contagious diseases through live animal trading networks (Fournie et al., 2013; Rasamoelina-Andriamanivo et al., 2014; Vallee et al., 2013). Participatory Epidemiology methods proved efficient in gathering reliable information while addressing questions related to the perception of local actors on animal disease issues (Catley et al., 2012).

The aim of this study was to apply network analysis approach to understand the information sharing network in case of HPAI (H5N1) suspicion. A participatory epidemiology approach was implemented to identify the main actors involved in the information sharing networks of HPAI (H5N1) suspicions in Vietnam and to investigate the patterns of information sharing between the actors.

2. Material and methods

2.1. Study areas

Rural communes from two Provinces of Vietnam were selected according to their HPAI (H5N1) risk level and poultry production characteristics: Hải Dương province, in the Red river delta, Northern Vietnam, was classified as high risk by the Department of Animal Health of Vietnam and with high density of semi-commercial chicken broiler farms (General Statistics Office of Vietnam, 2012). Đồng Nai province, in Southeast Vietnam, was classified as low risk and with numerous large-scale duck and chicken broiler commercial farms.

2.2. Sampling frame

In each study area, participants were contacted with the help of veterinary authorities and commune or village officials. Focus group interviews were conducted with poultry farmers belonging to different production types present in the study area: backyard poultry farmers (flock size: <100 animals), small broiler chicken farmers (flock size: 100–1000 animals), large broiler chicken farmers (flock size: >1000 animals), large broiler duck farmers (flock size: >1000 animals). This first step aimed at investigating the information delivered by farmers in case of HPAI suspicions in their farms. Each focus group comprised 7 to 20 farmers of the same production type. Then other categories of actors where progressively included in the sample using the snowball sampling approach (Sadler et al., 2010). New categories of actors mentioned by the participants were included in the sampling. For each new category of actor, participants were asked to mention names of individuals they considered critical contacts. Then these critical contacts were asked for an interview. Individual interviews of selected poultry farmers ($n = 4$ per focus group) were also performed. Some of the selected critical contacts refused to be interviewed, the proportion of refusals varying from 0 to 40%. Critical contacts who refused the interviews were replaced by other actors of the same category, practicing their activity in the same area.

2.3. Data collection

Data were collected by teams of 2–5 researchers and veterinary students. Interview team members were previously trained using participatory epidemiology approaches.

In the first phase of the study, semi-structured interviews and proportional piling (PP) (Mariner and Paskin, 2000) were conducted with focus groups of poultry farmers to identify the names of the poultry diseases that farmers perceived as causing the highest and quickest mortality in poultry flocks. Proportional piling consisted in asking participants to draw circle corresponding to items like disease names and distributing 100 counters in each circle (according to rate of mortality and rapidity of the disease). Participants were then asked an estimate of the rate of mortality and duration of diseases which were given the highest scores. Disease names participants associated with at least 50% mortality in poultry flocks in less than 5 days were used to refer to HPAI (H5N1) suspicions in subsequent interviews. Using the disease suspicion definition, participants were asked to identify the different types of actors they exchanged information with when this event occurred. The relative likelihood of information exchanges was quantified using PP technique: participants were asked to distribute 100 counters within circles representing the different categories of actors they had previously listed. Participants were also asked the reasons of the information exchanges and the differences in priority given to each one. They also were asked if they were interested in receiving such information and if so the reason why they considered such information useful. In the northern study area, individually interviewed participants were also asked the names and location of the individuals they shared information with. In the southern study area, they were also asked to estimate the number of day between the time they would get the information and the time they would transmit it.

2.4. Data analysis

Directed weighted networks were built using categories of actors as nodes and exchanges of information about suspicions as links between nodes (Jackson, 2008). Links were weighted according to the results of the PP on the relative probabilities of information sharing between the different categories of actors. The category which received the highest score was considered to be contacted with certainty whereas the others were given relatively less priority. All scores were divided by the highest score, such that the category which ranked first then had a score p of 1, and other categories had a score ranging from 0 to 1.

Several individuals or groups of individuals from a given category were separately interviewed, generating several estimations of the relative probability of information-sharing between 2 given categories of actors. These variations in the estimation of each probability were taken into account by building all possible resulting adjacency matrices and calculating all possible resulting measures of centrality.

Two types of links were considered: (i) the transmission of information by a given farmer on disease suspicions happening in his farm (primary information), this information was considered of good quality, and (ii) the transmission of information from a given actor on disease suspicions happening in other farms (secondary information), which was considered of lower quality (loss of precision).

In order to take into consideration both types of links, Bonacich's alpha centrality measure was used as an indicator of the quantity of information each category of actor could obtain when a disease suspicion occurred (Bonacich and Lloyd, 2001). The Alpha centralities correspond to the solution to the following matrix equation:

$$x = \alpha \cdot A^T \cdot x + e$$

A^T is the transpose of the adjacency matrix A which only accounts for secondary exchanges. x is the vector of alpha centralities of the network's nodes; e is the vector of exogenous influences on nodes of the network that do not depend on the structure of the network and α is a parameter that corresponds to the relative importance of the network topology.

It was assumed that each node i had exogenous sources of information ei that directly came from owners of affected farms. In other words, each value ei was the indegree of the node i when only