

Social network analysis of poultry movements in markets of Sikasso. Implication for surveillance of HPAI in Mali



Molia S¹*, Boly I¹, Duboz R¹, Fournié G²

¹ CIRAD, UPR AGIRs, Montpellier, France
² RVC, London, UK

INTRODUCTION

Live bird markets: a key role in the dissemination of HPAI virus

- Poultry movements, especially through live bird markets, have been responsible for the dissemination of highly pathogenic avian influenza (HPAI) virus in South-east Asia and Africa
- In Mali, Sikasso is the most important region of production of poultry for meat consumption and the most important supplier of live birds for markets in Bamako, the capital city
- We therefore aimed at using social network analysis tools to better understand the structure of animal movements in the Sikasso region and its possible impact on disease spread

- ⇒ Objectives:
- Decipher the web of poultry movements in the Sikasso region
 - Identify markets of interest for surveillance and control of infectious disease
 - Quantify flows of poultry



METHODS

Social network analysis (SNA)

Field survey (April – July 2010)

- Preliminary survey (April-May) to identify markets in the Sikasso region and test questionnaire
- Cross sectional survey (May-July) to visit all markets & interview poultry traders (PT) present on the markets



- Information collected on: origins of the poultry (geographic location, persons it was bought from, number usually bought from that location/person every month) and destination of the poultry sold (geographic location, person it was sold to, number usually sold to that location/person every month)

Data analyses

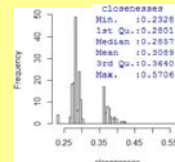
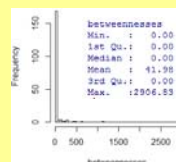
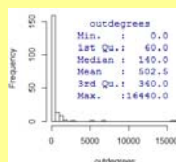
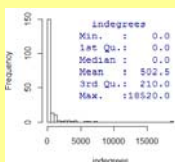
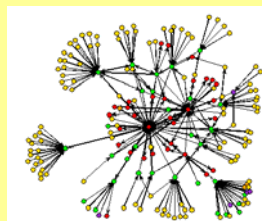
- Included classical SNA techniques: graphing the network, calculating measures of centrality (degree distributions, betweenness and closeness) and measures of cohesion (density, clustering coefficient and average path length), identifying cohesive subgroups (giant strong and giant weak components), and calculating flow measures
- All analyses were performed using R

RESULTS

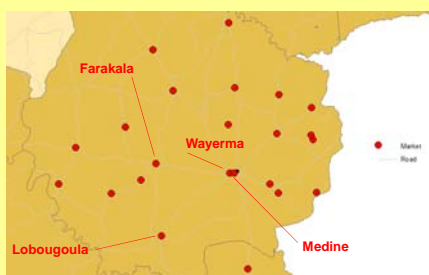
Poultry movement network

Highly hierarchical network

- The network was highly hierarchical, with low density (0.007), low mean cluster coefficient (0.043), an average geodesic length of 3.8, and overdispersed distributions of centrality measures



4 hubs identified for targeting surveillance and control



- Removal of those 4 markets (see map) from the network entailed a more than 50% decrease of the size of the giant weak component

Large poultry flows to Bamako

- > 50,000 birds go monthly through Sikasso markets, of which 30% stays in the region, 63% goes to Bamako and 7% to Ivory Coast

DISCUSSION

Towards improvement

- SNA = valuable set of tools increasingly used in veterinary epidemiology
- One of the major constraints to its use in developing countries is the lack of animal movement recording systems
- This creates the need for extensive field work and innovative methods to account for missing data



- Our network may not be totally complete but influential nodes can nevertheless be identified by degree centrality measures without requiring assessment of entire networks
- Further work will analyse the relationship between geographical distance, the proportion of linked nodes and the number of poultry traded

Acknowledgments: We thank the French Ministry of Foreign Affairs for funding this work and staff from the Directions Nationale and Régionales des Services Vétérinaires et des Productions et Industries Animales for participating to investigations

For more information: sophie.molia@cirad.fr or <http://avian-influenza.cirad.fr>