Poultry trading networks in Bangladesh: implications for control and surveillance of avian influenza.

Royal Veterinary College University of London

Contact: nmoyen3@rvc.ac.uk

N.Moyen[1*], G.Ahmed[2], S.Gupta[2], R. Khan[2], I. Khan[2], N.Debnath[2], M.Yamage[2], D.Pfeiffer[1,3], G.Fournie[1].

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Background and objectives

- Poultry trading networks, and **live bird markets** (LBMs) in particular are **key** to the **spread and maintenance of avian influenza viruses (AIV).**
- In Bangladesh **AI is endemic**, **90%** of the **poultry** is **marketed through LBMs** and poultry meat represents 50% of the country's meat production.
- In this study we **described poultry trading networks and practices according to poultry breeds and species**. Based on their role in the network, we **then identified key LBMs** that could be targeted for control and surveillance of AI.

Methods

- **Cross-sectional market survey**: 849 poultry traders interviewed in 138 LBMs, in 17 districts (Fig.1).
- **Trading practices** of traders and LBMs were **compared according to poultry type**.
- Poultry types considered: industrial white-feathered broilers, sonalis (crossbreed Fayoumi x RIR), deshis (local breed, backyard rearing system) and ducks.
- **Social network analysis** applied to poultry-type specific networks.
- **Impact of targeted node removal** on network metrics of nodes was assessed.

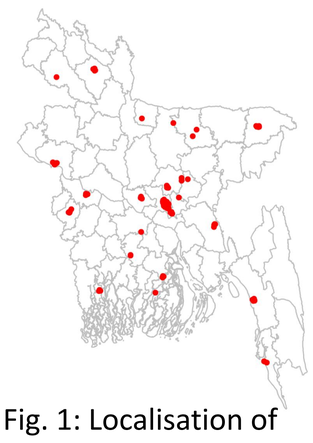
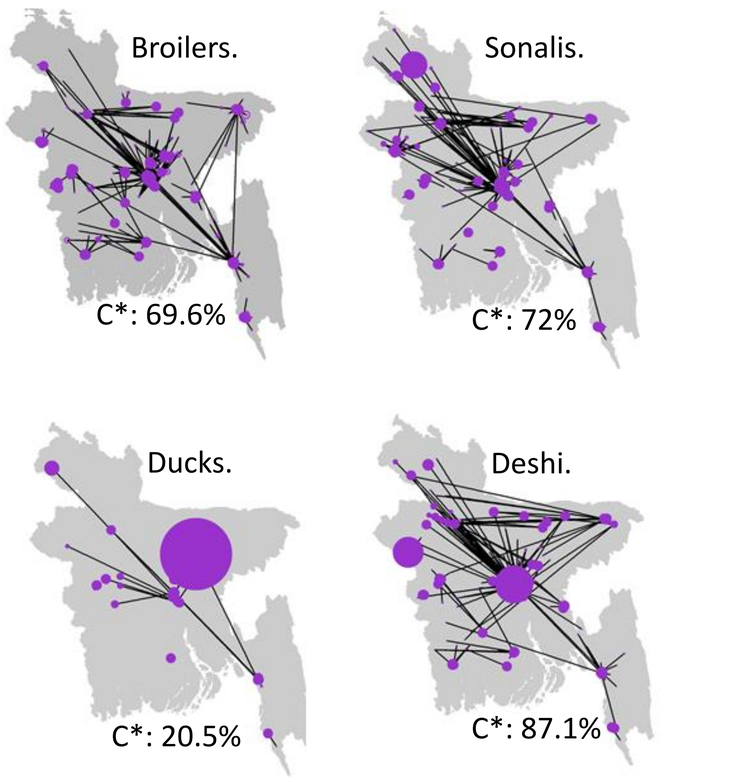


Fig. 1: Localisation of LBMs across the country



C: Connectedness

Fig. 2: Poultry type specific trading networks. Dots size are proportional to the number of poultry they supply to the network.

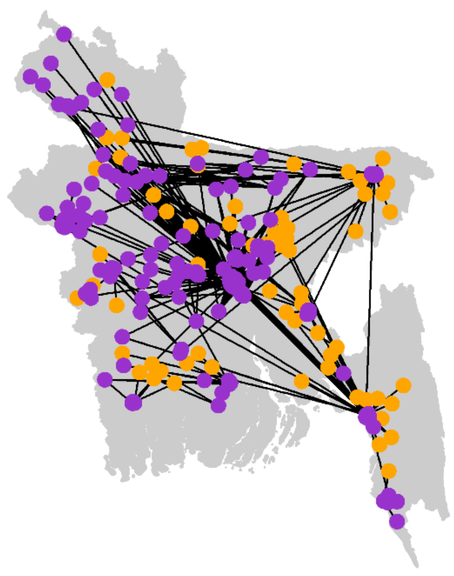


Fig. 3: Entire poultry trading network (undirected). Nodes are LBMs (purple), or farms (orange).

	Broiler	Sonali	Deshi	Ducks
Proportion of traders selling each poultry type.	64.9% (n=551)	47.9% (n=407)	46.5% (n=395)	4.5% (n=38)
No. of poultry traded per week per trader interviewed[1] (median and IQR[2]).	1,000 (420-2170)	650 (250-1575)	450 (200-1000)	50 (40-275)
Proportion of a trader's sales represented by each poultry type[1] (median % and IQR[2]).	77.5% (47.4-100)	40% (21-59.3)	38.5% (19.6-66.7)	5.5% (2.6-18.9)
Proportion of markets in which a type of poultry is sold.	94.9% (n=130)	76.8% (n=106)	71% (n=98)	14.5% (n=20)
Proportion of poultry of a given type sold in each market (median % and IQR[2]).	52.9% (31.8-78.8)	14.7% (1.6-33.6)	9.1% (0-23.6)	0% (0-0)
Proportion of poultry supplied to a LBM by another LBM[1] (% and IQR[2]).	48% (0-100)	78% (11.8-100)	100% (52.8-100)	100% (12.5-100)

1: Excluding traders who didn't trade the poultry type considered. 2: Inter quantile range

Table 1: Proportion and types of poultry traded, according to poultry type. Only the LBMs trading the poultry type considered were included in the calculations.

Key findings

- **Trading patterns varied according to poultry type** (table 1):
  Proportion of a traders trade represented by: broilers: 78%, sonalis or deshis: 40%, ducks: 6%.

  Proportion of poultry (per type) sourced less than 50km away: broilers: 70%, sonalis and deshis: 60, ducks: 20%.

  All deshi poultry and ducks were supplied to the surveyed LBMs by other LBMs.
- The **connectedness** (proportion of nodes included in the giant week component) of **poultry-type specific networks** was high (>70%), and **varied according to poultry types** (Fig.2). But the **overall poultry trading network** was **more connected (97%)** than the poultry type specific ones and **disassortative** (Fig. 3).
- **Removal** of the **nodes** with the **greatest betweenness** scores would have the **greatest impact on the network's connectedness**, and maximum output and input values: targets for control measures.

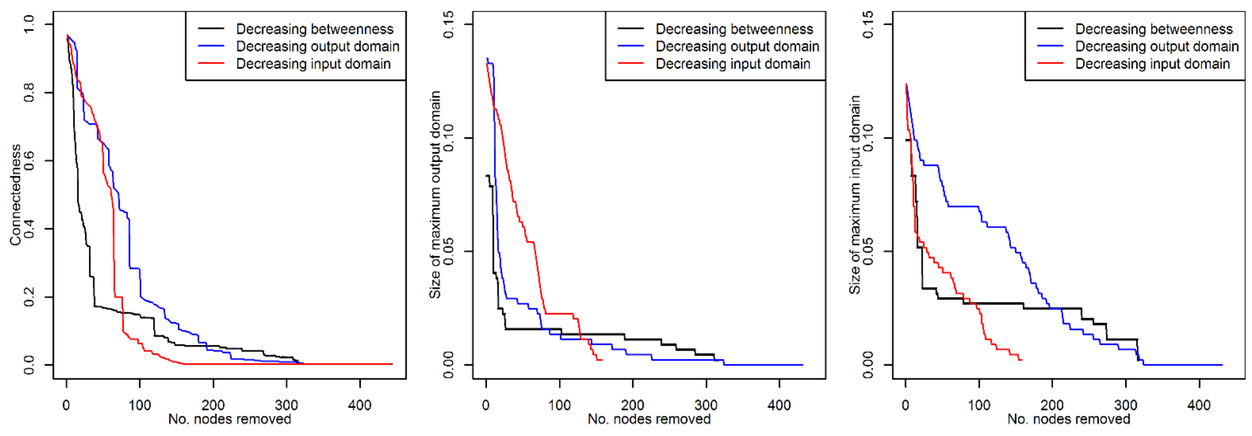


Fig.4: Comparison of the impact of node removal on network metrics. Nodes were removed from the network one after the other, in decreasing order of their betweenness, output or input domain values.

Conclusions: This 1st study comparing poultry trading practices and networks according to poultry type showed that:

- Poultry trading patterns vary according to the type of poultry traded and that it is the interaction between poultry type specific networks that resulted in a in an overall live poultry trading network within which almost all poultry production areas and LBMs identified during this survey were connected.
- Control interventions could be targeted at specific LBMs, feasibility and strategy need to be investigated further

[1]Veterinary Epidemiology, Economics and Public Health group, Royal Veterinary College, University of London, UK.
[2]Emergency Centre for Transboundary Animal Diseases, Food and Agriculture Organisation, Dhaka, Bangladesh.
[3]School of Veterinary Medicine, City University of Hong Kong, Hong Kong.

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