# Characterising the live pig trading network in Cambodia

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## Background

- Pig production is intensifying across Southeast Asia, increasing opportunities for disease emergence/spread[1]. This is of concern with the recent incursion of African Swine Fever into the region.
- A better understanding of the structure of pig value chains is needed to increase our understanding of infectious disease transmission dynamics in pigs, and to inform risk-based surveillance and control strategies.

## Aims

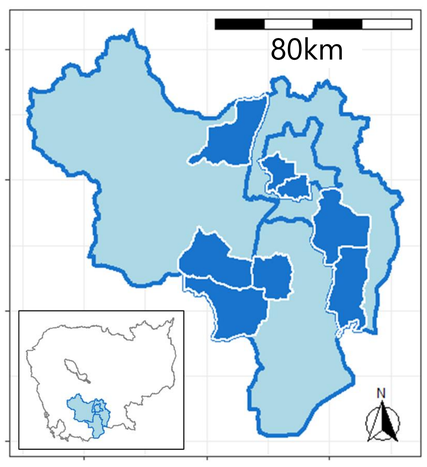
- To quantitatively characterise the live pig movement/trading network in south-central Cambodia across all actors identified via previous value chain analyses.
- To assess the roles of different nodes or node classes in the pig movement/trading network to inform risk-based surveillance and control strategies.

## Study framework

**1. Study site selection:**

Provinces: purposively selected to capture diversity of production
Districts: probability proportional to pig population size
Villages: probability proportional to number of smallholders.

**2. Stratified sampling of actors (n~ 438):**



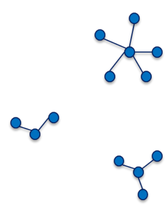

| | |
|---|---|
| Provinces (n=4) | Traders (n~64)<br>Boar service (n~20) |
| Districts (n=8) | Slaughterhouse (n=18)<br>Butchers (n=47)<br>Farms (n~100) |
| Villages (n=16) | Smallholders (n=176) |

**3. Electronic questionnaire:**

- Characterisation of the personal ('egocentric') network
- Reporting of trade partners (cross-sectional)

**4. Simulating a complete network from egocentric data:**

- Statistical modelling of the network – recent advances[2] permit the fitting of ERGMs to egocentric data (without alter-alter tie data)

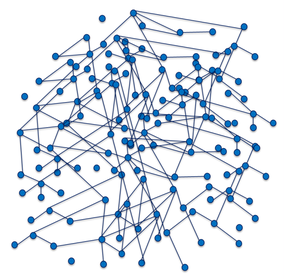


Egocentric ERGM[2]

Dependent variables:

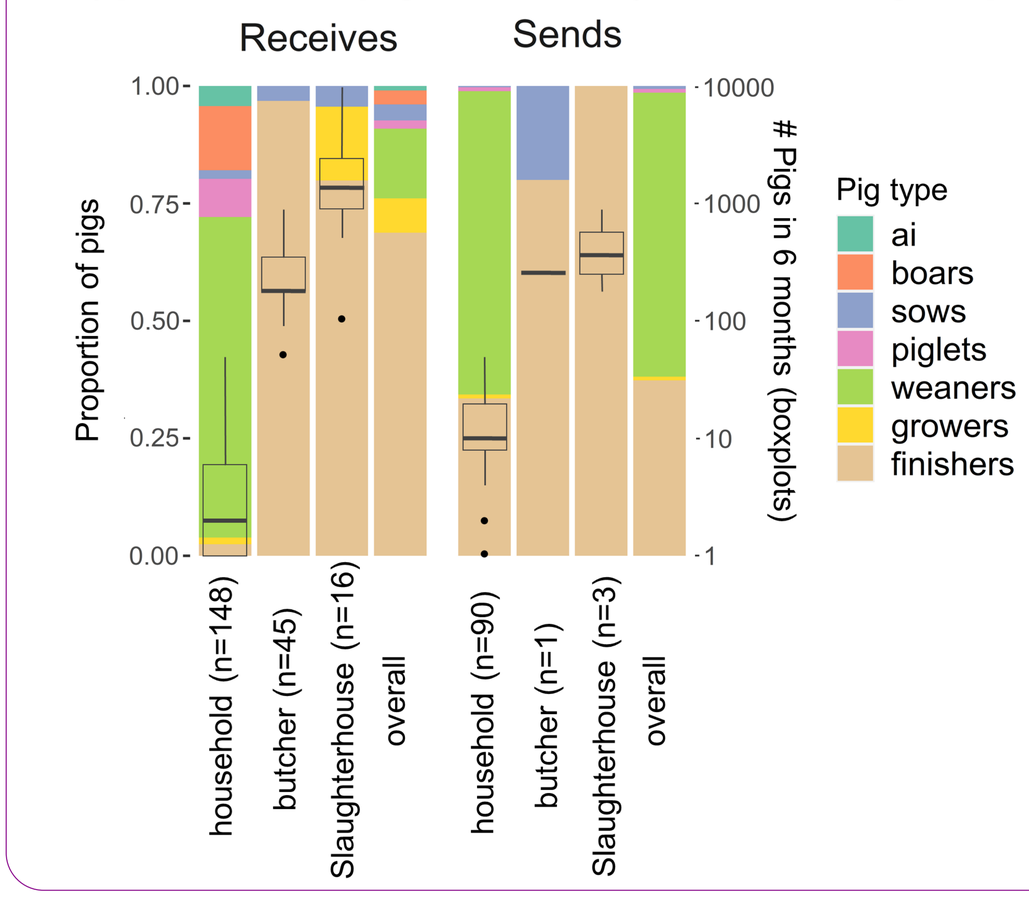
→ Degree distribution
→ Node factors
→ Assortativity
→ Node difference e.g. distance

Assess goodness of fit and statistical significance of variables

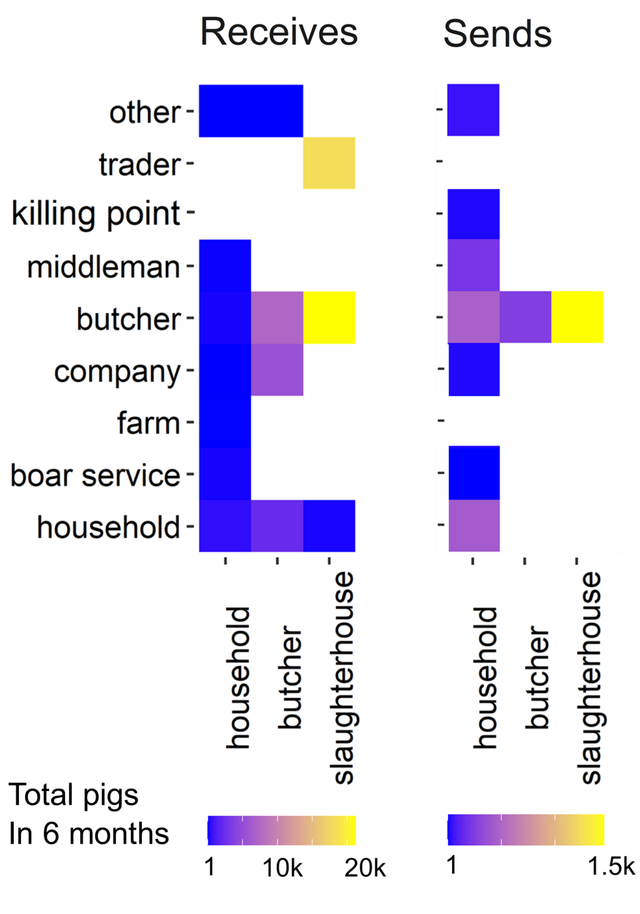


## Results (preliminary)

**1. Type and # of pigs moved by each actor group:**




**2. Who trades with whom?**




- Slaughterhouses may act as trade hubs (high in- & out- degree)
- Households trade the greatest diversity of pig types and are highly connected via boar lending:

  → 73 households (42%) hired boars from ≤21 lenders

## Conclusions

- Slaughterhouses are potential transmission hotspots, and boar lending is a high-risk practice among households.
- Work is ongoing to a) characterise the roles of other actors, b) use simulated networks to explore evolving influenza transmission dynamics under pig-sector intensification.

1. Coker, R.J., Hunter, B.M., Rudge, J.W., Liverani, M., Hanvoravongchai, P., 2011. Emerging infectious diseases in southeast Asia: regional challenges to control. Lancet Lond. Engl. 377, 599–609. https://doi.org/10.1016/S0140-6736(10)62004-1

2. Krivitsky, P.N., Morris, M., 2017. Inference for social network models from egocentrically sampled data, with application to understanding persistent racial disparities in HIV prevalence in the US. Ann. Appl. Stat. 11, 427–455. https://doi.org/10.1214/16-AOAS1010

Funders:

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