Part 2: Describing vehicle movement patterns within a production system in the Midwest

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Key Points:

- Twelve vehicles transporting weanling pigs and culled sows can interconnect a third of the premises within a Midwest swine system of more than 300 farms.
- The system is highly inter-connected, with three identified clusters ("communities")
- Each farm can be reached (after passing) through 3 farms within the system-network.

This week's science page continues to build off of the preliminary analysis of transport data from a Midwest swine production system that was described last week. Previously, basic characteristics of the data such as distribution of trips over season and farm type, farm type destination, and stop duration were described as some of the beginning steps for understanding biosecurity and disease management potential available in transportation data. This week the analysis focus is on basic network analysis, farm connectivity, and what this means for disease transmission and management.

A preliminary network analysis showed that the production system is a highly interconnected network as it was expected. Every farm in the system can be reached through 3 farms, in other words, farms are 3 stops away from each other. This is extremely important as it increases the potential for pathogen dissemination through pig flow or if biosecurity measures such as cleaning and disinfection are not properly performed. Furthermore, we identified 3 "communities" (Fig. 1) where farm connectivity is stronger between the farms within a community than those in the other two communities. In the case of disease spread this can be an invaluable piece of knowledge. It allows the production system to purposefully segregate these communities from each other and reduce or prevent disease spread should an emergency occur. Essentially it allows for a system-level "physical distancing" within the production system as part of the system's biosecurity program.

This basic analysis sheds important and useful light on the nature of the production system's high connectivity through vehicle movement. A further analysis needs to be conducted to understand these connections in more detail. However, it is clear that connectivity is not random within the system and some movements (e.g. vehicles) can be targeted when a disease outbreak occurs to reduce the risk of transmission throughout the whole system.

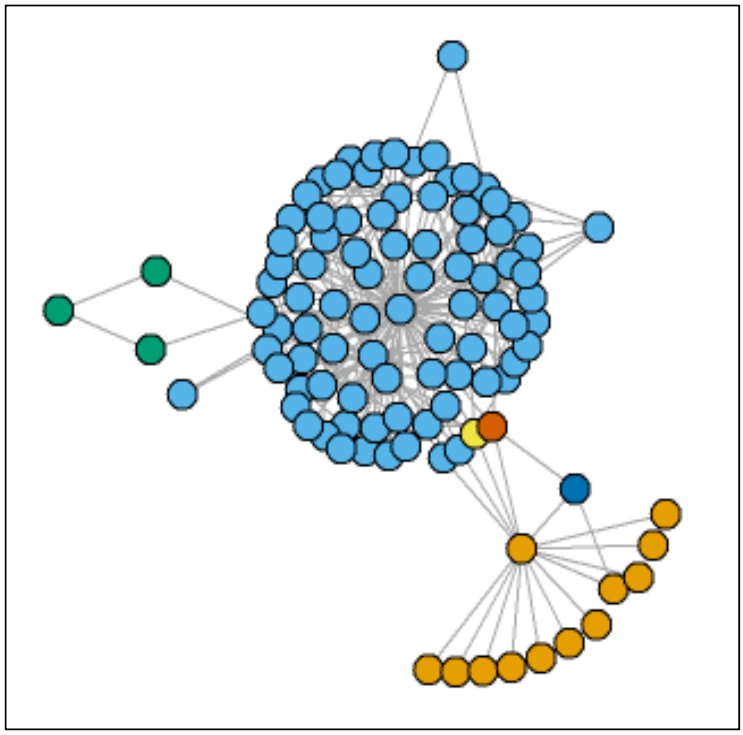

Figure 1: Each circle represents a landmark (farm, truckwash, etc) within the system, and the lines represent the vehicles connecting them. The orange, blue, and green circles represent sub-communities within the system. The yellow, dark orange and blue circles are farms that fall evenly between the blue and orange systems and could be included in either. The farther away a circle is from the main sub-community cluster, the less connected it is within the community.