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## Exploring disease transmission risk through network analysis

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Knowledge of swine populations (location and disease status) is necessary for effective regional disease eradication. Swine populations, however, are dynamic, with animals frequently moving between premises, particularly in multiple site systems. Webb investigated such a risk potential network of English sheep populations<sup>1</sup>.

The goals of this study are to use methods of social network analysis to describe and analyze pig movement patterns and to assess the potential impact of pig movement on disease spread in an area. Farms enrolled in the Rice and Stevens County PRRS Project were surveyed to gather animal movement information. Farm capacity, farm type, movement frequency, animals per movement, and type of animal moved were collected for all farms in the study areas. Data were processed and presented for analysis with network analysis software (UCINET<sup>2</sup> and NetDraw<sup>3</sup>). Measures of centrality (in-degree and out-degree centrality) reflect the annual number of pig shipments from or to a site. Visualization of pig movement patterns was accomplished with GIS software (ArcGIS<sup>4</sup> and Flow Mapper<sup>5</sup>). Geographic coordinates for each location were also used to calculate inter-farm distances.

Preliminary analyses indicate a high prevalence of multi-site production in the study regions, a high prevalence of outside-of-county relationships (figure1), a highly skewed distribution of travel distances (figure2), and high second-degree connectivity amongst farms through markets (figure3). Non-parametric statistics (Wilcoxon Rank Sum and Kruskal-Wallis AOV) demonstrate significant differences between counties (table1).

These observations indicate that regional disease control efforts may be complicated by the high frequency of pig movements to, from, and within regions and regional movement patterns are likely to be important determinants of the success of control efforts.

figure1) Pig Movements for Two MN Counties

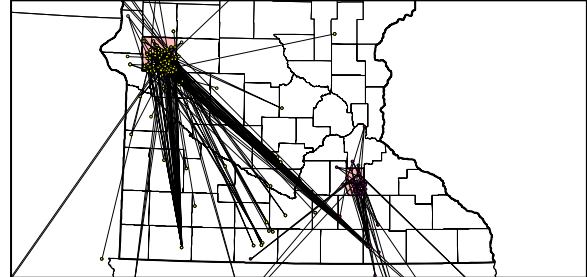


figure2) Histogram of Pig Movement Distances

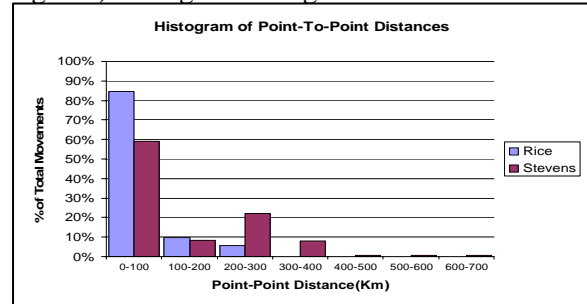


figure3) Network Graph for Stevens County

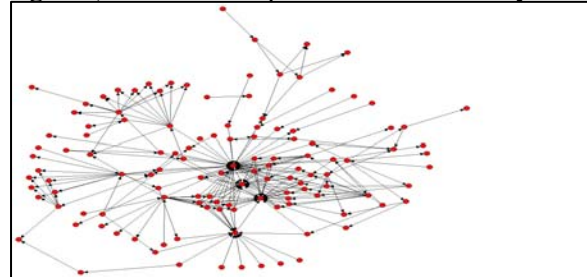


table1) Farm Connectivity in Two MN Counties

Connectivity (Loads/Yr)	Rice	Stevens	Wilcoxon Rank	Kruskal-Wallis
			Sum P-value	AOV P-value
InDegree Centrality	2.3	26.8	<0.00001	<0.00001
OutDegree Centrality	3.4	46.1	<0.00001	<0.00001

### References

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