WALKING THE DOG
Contact network studies between dogs in a community

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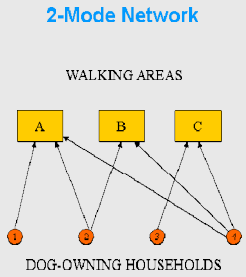
Introduction

- There are approximately 6.8 million dogs owned in the UK (PFMA, 2004).
- Dog-dog and dog-human interactions could transmit infectious diseases, including zoonoses, through the population.
- Many dogs are walked in regular places at regular times, giving opportunity for investigation of contact networks formed between dogs through common use of public space.



Social Network Analysis

- Relatively novel methodology in veterinary science.
- Enables investigation of patterns in which individuals (**nodes**) are linked in small groups and as part of a larger network.
- Links between individuals termed **edges** or **ties**.
- A **two-mode** network uses two distinct sets of nodes where each can only link to the other, in this case dog-owning households and walking areas.

Data collection

- A doorstep interview survey of a community of 1278 households in Cheshire identified 260 dog-owning households (Westgarth *et al.* 2007). This area is on the edge of a town and was selected because it: is reasonably well defined by natural boundaries; has a mixture of medium and low-density housing; has public amenities including parks; and is near to sports fields, a wildlife reserve and agricultural land.
- A further detailed questionnaire survey of dog-owning households included investigation of walking preferences. A map of the local area was provided and owners were asked to draw on any regular routes walked.
- The map was divided into 125m by 125m units using superimposed grid. For each household, it was noted which grids were entered and data recorded in a matrix of households by grid areas.

Results

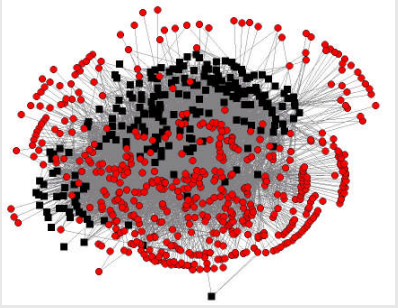


Figure 1. Two mode network of households and grid areas visited. Multi-dimensional scaling plot.
Red circles = households, and black squares = grid areas.

- 214 completed maps were received.
- A two mode network of grid areas and households was constructed (Figure 1).
- Households reported using between 1 and 258 grid areas (median 25). In network terms this is defined as the **household degree**.
- However this data was highly skewed with most households reporting only using a few areas but a few households reporting large numbers.
- There was a significant association between the number of dogs in the household and the number of areas visited (P=0.01).
  - One dog household – median 23
  - Two dog household – median 31
  - Three dog household – median 50

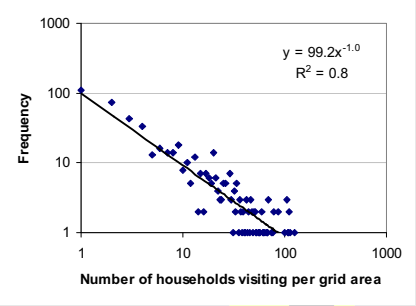


Figure 2. Distribution of number of households visiting each area (grid degree).

- For each grid area the number of households reporting to use them (**or grid degree**) was also highly skewed, approximating a power law or **scale-free** distribution (Figure 2).

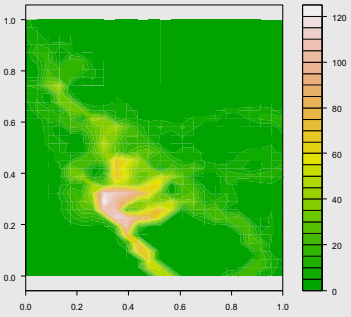


Figure 3. Spatial use of area for dog walking.
Scale - numbers of households walking through that area, white high to green low.

- There were a small number of highly visited areas (Figure 3) which may act as foci for interactions between dogs.

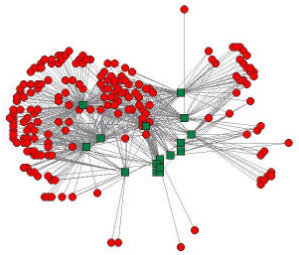


Figure 4. Two-mode network of households and green areas visited. Multi-dimensional scaling plot. 21 households isolated.
Red circles = households, and green squares = green areas.

- The data were analysed using areas of park/field/footpath (termed 'green areas') where dogs would be more likely to be off lead and free to interact.
- A two-mode network constructed using these 'green areas' suggested two clusters of walking areas and three clusters of households (Figure 4).
- As no ties are possible within node sets for 2-mode data, the maximum ties possible is therefore the number of nodes in the first set multiplied by the number of nodes in the second set. The density of the green areas network was 0.34 (i.e. 34% of the possible ties are present).

Conclusion

A high level of *potential* contact exists between dogs in a small community through the utilisation of public space. Given the level of connectivity between members of the population, even if only a proportion of these potential contact events resulted in actual contact, there would likely remain considerable connectivity. Although this study could not determine whether dogs actually came into physical contact, for many diseases exposure to the excretions of other dogs may pose a risk of transmission. The heterogeneity evident in these networks is likely to increase R^0 of pathogens for any given values of the probability of transmission, duration of infectivity and average contact rate .

References

PFMA (2004) Pet Food Manufacturers Association. Pet ownership trends. http://www.pfma.com/public/petownership.htm

Westgarth *et al.* (2007) Factors associated with dog ownership and contact with dogs in a UK community. BMC Veterinary Research *Submitted*