A hands-on workshop on network analysis and modelling for epidemiologists

ISVEE post-symposium workshop, 2022

This workshop will give participants an understanding of the concepts underpinning the network paradigm and apply a range of statistical and mathematical methods for describing and analysing network data. The workshop schedule will include presentations on theoretical concepts followed by their practical application through a hands-on approach using R software and sample datasets.

Who should attend?

This workshop will be valuable for people who are interested in applying network analysis and mathematical modelling in their research, and for people who already have some experience in this area and seek to expand their knowledge and skills. There is no pre-requisite to attend the course. Participants without any experience with R are encouraged to familiarise themselves with the software. Beforehand, they will be provided with material presenting how to conduct basic commands that will be used during the workshop. Participants are required to bring their own laptop.

Workshop content

Days 1 and 2 will provide participants with an overview of the analysis of network data. After completion of this part of the workshop, participants will be able to:
- Describe the characteristics of network data and the concepts underlying network data analysis
- Build and visualize a network
- Analyse the structure of a network at different levels, from nodes to the network as a whole
- Combine epidemiological and network data to test hypotheses

Day 3 will focus on network simulation models, and models simulating disease transmission through networks. After completion of this part of the workshop, participants will be able to:
- Describe how different models can be used to simulate networks based on empirical data or assumptions about the network configuration
- Develop mathematical models simulating the spread of diseases through networks and the impact of surveillance programs and control interventions
- Describe the impact of network structure on disease dynamics and the effectiveness of surveillance programs and control interventions

Workshop details and registration

The workshop will be delivered in English. Practical sessions will use the software R (http://www.r-project.org). Beforehand, workshop participants will be sent instructions on how to install R and required packages, and to conduct basic commands that will be used during the workshop, so they can familiarise themselves with R. Lecture notes, key references, datasets and detailed instructions for the practical sessions, including R scripts, model answers and comments, will be provided in an electronic format. Registration is available on the conference website.

Instructors

Guillaume Fournié DrVetMed MSc PhD (Royal Veterinary College, UK) https://bit.ly/3clZrfL
Role: workshop organiser, lecturer, discussion facilitator and lab instructor
Guillaume is a veterinarian and an epidemiologist. He has applied network analysis and mathematical modelling of disease transmission to a range of diseases and husbandry systems to assess the influence of the trade of animals and their products on the spread of animal and zoonotic pathogens.

Dirk Pfeiffer DrMedVet PhD MANZCVSc DipECVPH FHEA (College of Veterinary Medicine and Life Sciences, City University of Hong Kong) https://bit.ly/3DmzWq8
Role: lecturer, discussion facilitator
Dirk is Chair Professor of One Health. His research has been varied and includes translation of science into policy, advanced multivariate techniques, spatial and temporal analysis of epidemiological data, development of animal health information systems, computer modelling of animal disease, and field ecological research methods. Dirk also holds a part-time position at the Royal Veterinary College (UK).

Younjung Kim, DVM MSc PhD Candidate (College of Veterinary Medicine and Life Sciences, City University of Hong Kong) https://bit.ly/3kstoPl
Role: lecturer and lab instructor
Younjung is a veterinarian and epidemiologist. Younjung has applied network analysis and mathematical modelling to investigate the role of socio-economic, cultural, and epidemiological risk factors shaping zoonotic and animal infectious disease transmission dynamics, including Rift Valley fever and African swine fever.

Beth Savagar, BSc (Royal Veterinary College, UK) https://bit.ly/3wFe5I1
Role: lecturer and lab instructor
Beth is a PhD student in veterinary epidemiology. Beth has applied network analysis to study the role of trade networks in disease transmission, her PhD uses mathematical modelling to study the transmission of Peste des Petits Ruminants Virus in different endemic settings.

William Leung, MSc PhD Candidate (London School of Hygiene and Tropical Medicine, UK)
https://bit.ly/3qxMPue
Role: lecturer and lab instructor
Will is a molecular biologist and epidemiologist. He has applied network analysis methods and mathematical modelling to characterise swine trading networks in Cambodia, and to investigate the implications of intensified swine production on infectious disease dynamics.

Contact details

If you would like to ask for further details about the course content, please contact Guillaume Fournié:
gfournie@rvc.ac.uk

Workshop schedule

Day	Time	Activity/Contents	Details
1	08:30-09:00	Registration	
	09:00-09:15	Presentation of the workshop, introduction of the trainers and trainees	Discussion
	09:15-10:00	Network paradigm: what has it brought to the study of animal and public health?	Lecture
	10:00-10:30	Coffee break	
	10:30-11:15	Network construction and visualisation	Lecture
	11:15-12:00	Data manipulation and network construction	Computer lab
	12:00-13:00	Lunch break	
	13:00-13:30	Network visualisation	Computer lab
	13:30-14:30	Analysis of individual nodes and centrality	Lecture
	14:30-15:00	Coffee break	
	15:00-16:00	Analysis of individual nodes and centrality	Computer lab
	16:00-16:30	Q&A session	Discussion

Day	Time	Activity/Contents	Details
2	08:30-08:45	Review of Day 1, Q&A session	Discussion
	08:45-10:00	Network cohesion, distances, clustering and partitioning	Lecture
	10:00-10:30	Coffee break	
	10:30-12:00	Network cohesion, distances, clustering and partitioning	Computer lab
	12:00-13:00	Lunch break	
	13:00-14:00	The nature of network data, implications for hypothesis testing	Lecture
	14:00-14:30	Hypothesis testing on networks (1/2)	Computer lab
	14:30-15:00	Coffee break	
	15:00-16:00	Hypothesis testing on networks (2/2)	Computer lab
	16:00-16:30	Q&A session	Discussion

Day	Time	Activity/Contents	Details
3	08:30-08:45	Review of Day 2, Q&A session	Discussion
	08:45-09:30	Mathematical models of disease transmission: basic concepts	Lecture
	09:30-10:00	Simulating disease transmission through a network (1/2)	Computer lab
	10:00-10:30	Coffee break	
	10:30-11:15	Simulating disease transmission through a network (1/2)	Computer lab
	11:15-12:00	Network simulation models	Lecture
	12:00-13:00	Lunch break	
	13:00-14:00	Increasing model complexity, simulation of surveillance and disease control scenarios	Lecture
	14:00-14:30	Simulating surveillance and disease control scenarios (1/2)	Computer lab
	14:30-15:00	Coffee break	
	15:00-15:45	Simulating surveillance and disease control scenarios (2/2)	Computer lab
	15:45-16:15	Q&A session, other topics in modelling and analysis of network data	Discussion
	16:15-16:30	Workshop evaluation	Forms and Discussion