Meeting 2: Patterns of disease

Reading

- Thrusfield 2nd Edn or 3rd Edn Chapter 5 (Determinants of disease)
- Thrusfield 2nd Edn or 3rd Edn Chapter 6 (Transmission and maintenance of infection)
- Thrusfield 2nd Edn or 3rd Edn Chapter 7 (The ecology of disease)
- Thrusfield 2nd Edn or 3rd Edn Chapter 8 (Patterns of disease)
- Thrusfield 2nd Edn, pp 54-59 or 3rd Edn pp 67-74 (mapping)

Presentations

1. Methods of disease transmission and maintenance of infectious diseases with examples
2. Host factors and disease occurrence with examples
3. Use of geographical information systems with examples of their application to animal health
4. Patterns of disease in time

Exercises

1. Discuss and analyse the factors that have contributed to the development of emerging diseases and their importance eg SARS, avian influenza, Nipah, West Nile virus or another topical disease
2. Discuss the Reed-Frost model – application, advantages and limitations
3. Example examination question 1. Need to consider:
    - Occurrence (time, space and population),
    - Cause (agent characteristics, host factors, environmental factors), source,
    - Susceptibility
    - Transmission (effective contact),
    - Cost
    - Control management or eradication options

Example examination questions

1. Select a topical disease for three (3) of the four options below. Explain how features of the epidemiology of each disease you have selected are relevant to its control, management or eradication
    a. A food-borne zoonotic disease of wildlife or companion animals
    b. A parasitic disease of wildlife or companion animals
    c. A congenital disease of animals

   d. A viral disease of production animals (2005 written)

2. Briefly describe the essential features and application of
   a. Time series analysis
   b. Geographic information systems (2003 written)
3. Briefly describe the essential features and application of Reed-Frost models (2002 written)
4. Write brief notes to demonstrate your understanding of herd or population immunity
5. Using examples, write brief notes on methods of disease transmission (2002 written)
6. Write brief notes to demonstrate your understanding of temporal patterns of disease (2001 written)

Additional reading/resources

- Sergeant et al. (2004) Epidemiological problem solving, Ausvet Series in Epidemiological Skills for Animal Health Professionals, pp 25-29
- Epidemiological Skills in Animal Health, PGFVS Proceedings 143; pp 161-175 (ecology of disease), pp 239-254 (patterns of disease)
- McGinn et al (1996) Geographic information systems for animal health management and disease control. JAVMA 11(1): 1917-1921.
- Sanson et al. (1991) Geographic information systems: their application in animal disease control. Rev. sci. tech. Off. int. Epiz. 10(1): 19-195.
- Jackson et al. (2005) Epidemiology of the 2003-2005 Epidemic of Avian Influenza H5N1 in Asia. In: Proceedings of the Food Safety & Biosecurity and Epidemiology Branches of the NZVA, pp 87-99.
- Daszak P, Cunningham AA and Hyatt AD (2000) Emerging Infectious Diseases of Wildlife – Threats to Biodiversity and Human Health. Science, 287(5452): 443-449.
- Morse SS (1995) Factors in the Emergence of Infectious Diseases. EID 1(1). Available: http://www.cdc.gov/ncidod/eid/vol1no1/morse.htm
- 'Global Aspects of Emerging and Potential Zoonosis: a WHO perspective' Available: http://www.cdc.gov/ncidod/eid/vol3no2/meslin.htm

Meeting 15: Modelling and Risk Analysis

Reading

Modelling

- Thrusfield 2nd Edn, pp 296-311 or 3rd Edn pp 340-356
- Hurd H, Kaneene J (1993) The application of simulation models and systems analysis in epidemiology: a review. Prev Vet Med 15: 81 - 99.

Risk Analysis

- McDiarmid S (1991) Risk analysis and the importation of animals. Surveillance 18(5): 8-11.
- Biosecurity Australia (2003) Import risk analysis handbook, Agriculture, Fisheries and Forestry– Australia, Canberra.
- Pharo HJ (2002) Foot-and-mouth disease: an assessment of the risks facing New Zealand. New Zealand Veterinary Journal 50(2): 46-55.
- MacDiarmid S and Pharo H (2003) Risk Analysis: assessment, management and communication. Rev. sci. tech. Off. Int. Epiz 22(2) 397-408

Presentations

1. Examples of where simulation modelling has been useful in devising methods to control disease or enhance production in animals (e.g. foot-and-mouth disease, classical swine fever, UDDER, AusPIG).
2. Mathematical vs simulation models – advantages and disadvantages.
3. Deterministic vs stochastic models – advantages and disadvantages.
4. Terms used in risk analysis: hazards, risk assessment, risk management, risk communication. Applications, principles and components of risk analysis.
5. An overview of The Sanitary and Phytosanitary Agreement and The Technical Barriers to Trade Agreement from the Uruguay Round of World Trade Organisation negotiations.
6. Advantages and disadvantages of qualitative, semi quantitative and quantitative risk analysis methods.

Exercises

1. List the potential disease hazards that should be considered when importing adult cattle from Australia into New Zealand. The following resources might be useful:
   - The HandiStatus page and the International Animal Health Code on the OIE web site: http://www.oie.int.
   - Various risk analyses on the MAF New Zealand web site: http://maf.govt.nz.
   - Market access and biosecurity documents on the Australian Government Department of Agriculture Fisheries and Forestry web site: http://www.affa.gov.au.
   - Disease status of Pacific Island countries - see the Secretariat of the Pacific Community web site: http://www.spc.org.nc/.

2. You have been asked to qualitatively assess the risk that Parma ham (from Parma, Italy) will be infected with classical swine fever at the point of import into your country. Consider the following information:

   Pigs for Parma ham come from the Parma region of Italy. Classical swine fever is endemic in Italy. Experimental evidence suggests that classical swine fever virus is inactivated within Parma hams over a period of around 6 months. The minimum curing time for Parma ham is 12 months. Parma ham, as it will be imported into you country will be designated 'Prosciutto di Parma' and qualifies for official certification. Ham contains mainly muscle meat, and experimental studies show that classical swine fever virus is present in high concentrations in muscle.

   Draw a diagram to outline the release risk pathway. For each step of the pathway, make an assessment of the probability that classical swine fever virus might be present. Make an overall assessment of the probability of the risk that Parma ham will be infected by classical swine fever virus at the point of import into your country. Set your results out in a transparent qualitative risk assessment format.

3. Using the concepts in the paper by Carpenter develop (on paper/whiteboard) a model for the spread of disease of an infectious disease relevant to your work. What inputs need to be included, what outputs would you like to generate and how could the model assist you to make decisions.

Example exam questions

1. Briefly describe the essential features, applications and limitations of epidemiological simulation models (2005 written).
2. Using examples, write brief notes on the advantages and disadvantages of quantitative risk analysis models (2003 written).
3. As a government epidemiologist, you have been asked to undertake an import risk analysis for the importation of horse semen from South America. Describe how you would proceed (2002 written).
4. The risk of animal or zoonotic disease is an important consideration for countries importing agricultural products. Under the WTO-SPS Agreement, it is important that any restrictions placed on trade for animals, plant, or human health are based on international standards or on the outcomes of a scientifically sound import risk analysis. It is also important that countries considering health risks do so in a way that is consistent across all imports.

   a. The OIE Terrestrial Animal Health Code (the Terrestrial Code) provides proctocols relating to the management of the risks associated with a range of important diseases. The Terrestrial code also provides an explanation of the steps required for a scientifically sound import risk analysis, for those cases where disease-specific propotcols do not exist or are not considered sufficient to meet an importing countries accepted level of risk. Explain the key steps in carrying out an import risk analysis, as described in the Terrestrial Code.

   b. One of the questions facing import risk analysts is the decision to carry out a qualitative or quantitative assessment of likelihood. What do you see to be the advantages and constraints of each approach, and in what situations might each be most appropriate.

c. A critical step in any import risk analysis is the evaluation of a risk estimate. What do you feel to be the important components of an import risk estimate? How might these components be combined? How might the import risk estimate be evaluated? IN answering these questions, consider methods or approaches for qualitative and quantitative components, as you see relevant.

d. A final step in many import risk analyses is the specification of risk management options. What do you understand by the principle of 'least trade restrictive measures', and how would you ensure these are specified? What do you understand by the principle of equivalence?

Additional reading/resources

- De Jong M (1995) Mathematical modelling in veterinary epidemiology: why model building is important. Prev Vet Med 25: 183-193.
- Nairn ME, Allen PG, Inglis AR, Tanner C (1996) Australian Quarantine, Department of Primary Industries and Energy, Canberra, ISBN 0 642 25971 2, pp 83 - 113.
- Noordhuizen J, Frankena K, van der Hoofd C, Graat E (1997) Application of Quantitative Methods in Veterinary Epidemiology. Wageningen Pers, Wageningen pp 247 – 270.
- Taylor N (2003) Review of the use of models in informing disease control policy development and adjustment (London, Defra). URL: http://www.defra.gov.uk/science/documents/publications/2003/UseofModelsinDiseaseControlPolicy.pdf
- Murray N (2002) Import risk analysis: animals and animal products. New Zealand Ministry of Agriculture and Forestry, Wellington New Zealand.
- Murray N (2004) Introduction and Qualitative Risk Analysis, Vol 1. Office International des Epizooties, 59 p.
- Murray N (2004), Quantitative Risk Assessment, Vol 2. Office International des Epizooties, 126 p.