



Australian and New Zealand College of Veterinary Scientists

Membership Examination

June 2019

Veterinary Epidemiology Paper 1

Perusal time: **Fifteen (15)** minutes

Time allowed: **Two (2)** hours after perusal

Answer **ALL EIGHT (8)** questions

Answer **EIGHT** questions, each worth 15 marks total 120 marks

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Paper 1: Veterinary Epidemiology

Answer all eight (8) questions

1. Answer **both** parts of this question:

- a) Draw a partial causal web diagram for a disease that you are familiar with. Include in your answer at least **three (3)** risk factors and make sure to identify the disease to which you are referring. (8 marks)
- b) Describe **three (3)** ways that epidemiologists can use causal web diagrams to better understand putative causal relationships. (7 marks)

2. You visit a pig herd that seems to have an increase in tail-bite injuries in finisher pigs since changing the configuration of their pens. In July, there were 130 pigs affected with new tail-bite injuries, across a total of five pens that each hold 20 pigs. In August, after the changes were made, there were 156 pigs affected with new tail-bite injuries, across a total of eight pens that each hold 15 pigs. All pens were at capacity throughout both months.

Answer **both** parts of this question:

- a) Explain the difference between an incidence risk and an incidence rate, including the data required to calculate each. (5 marks)
- b) Calculate an appropriate measure of incidence to assess whether, in the above example, the incidence of tail-bite injuries has actually changed between July and August. Describe and interpret your finding(s). (10 marks)

3. Describe the critical steps that should be undertaken as part of an import risk analysis. (15 marks)

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4. Answer **both** parts of this question:
- a) List **three (3)** uses of a geographic information system (GIS) in epidemiology and give an example of each. *(6 marks)*
 - b) Describe key stages in the development of a simulation model for assessing the spread of disease. *(9 marks)*
5. Answer **all** parts of this question:
- a) Contrast the differences between selection bias, information (misclassification) bias and confounding bias. *(9 marks)*
 - b) List **three (3)** issues that may occur when using an online questionnaire that could lead to selection or misclassification biases. *(3 marks)*
 - c) Describe how the Mantel-Haenszel method can be used to control confounding bias. *(3 marks)*
6. Answer **both** parts of this question:
- a) Identify and briefly describe **three (3)** common objectives of disease surveillance. *(6 marks)*
 - b) For **one (1)** of the objectives named in part 6 a), briefly describe **two (2)** surveillance activities that can contribute to the identified objective. Make sure to state in your answer the objective to which you are referring. *(9 marks)*

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7. A fictitious cohort study investigating the association between rabbit breeds with different ear types and dental disease produced the following data:

Breed	Dental disease present	Dental disease absent	Total
Floppy-eared	22	164	186
Straight-eared	7	333	340
Total	29	497	526

Using this data, calculate the following measures of effect and, for each one, provide an explanatory interpretation of the result:

- a) attributable risk (4 marks)
 - b) population attributable risk (3.5 marks)
 - c) attributable fraction (4 marks)
 - d) population attributable fraction. (3.5 marks)
8. Answer **all** parts of this question:
- a) Explain **four (4)** key differences between a case-control study and a prospective-cohort study. (8 marks)
 - b) Provide **two (2)** examples of when you might choose a case-control study over a cohort study. (4 marks)
 - c) Select and justify the most appropriate study type to assess the efficacy of a new drug to treat congestive heart failure in dogs. (3 marks)

End of paper



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Paper 2

Perusal time: **Fifteen (15)** minutes

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Answer **ALL THREE (3)** questions

Question 3 requires the review of excerpts from the journal article provided.

Answer **THREE** questions, each worth 40 marks..... total 120 marks

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Paper 2: Veterinary Epidemiology

Answer all three (3) questions

1. Anthrax is an important zoonotic disease of livestock. The anthrax immunochromatographic test (ICT) has been developed as a rapid diagnostic test for use in the field.

A study was conducted to evaluate the diagnostic performance of the rapid test. Archival samples from animals confirmed to have died due to anthrax by culture (n=57) and from animals not infected with anthrax (n=222 culture-negative) were tested with the rapid test. None of the animals that were culture-negative tested positive on the ICT. Fifty-four of the animals that were culture-positive tested positive on the ICT.

Answer **all** parts of this question:

- a) Calculate and interpret the diagnostic sensitivity and specificity of the ICT, considering culture, in this context, to be a 'gold standard'. (12 marks)
- b) The 95% confidence interval (95% CI) for the diagnostic sensitivity was estimated to be 0.86 to 0.98. Please provide an interpretation of this confidence interval. (5 marks)

Question 1 continued over page

- c) A dead cow has tested negative on the ICT. Based on the regional incidence and epidemiological features, the pre-test probability of this being due to anthrax was considered to be 60%.

Answer **both** subparts of this question:

- i. Using the appropriate formula from those provided below, and the estimates of diagnostic sensitivity and specificity that you calculated above, explain the likelihood that this test result is a false negative. (5 marks)

Positive predictive value (PPV):

Negative predictive value (NPV):

$$PPV = \frac{TP \times Se}{(TP \times Se) + (1 - TP) \times (1 - Sp)}$$

$$NPV = \frac{(1 - TP) \times Sp}{TP \times (1 - Se) + (1 - TP) \times Sp}$$

- ii. Concisely explain the implications and interpretation of these results to a farmer in an anthrax region whose cow was suspected to have died from anthrax, but tested negative using the rapid test. Your response should include any relevant advice regarding disease control. (5 marks)
- d) For this serious zoonotic disease, it is imperative that a truly positive case is detected appropriately so that field veterinarians can take appropriate precautions. In addition to the ICT, common laboratory tests used include blood smear and bacterial culture.

Answer **both** subparts of this question:

- i. To minimise false negatives, state and briefly justify whether sensitivity or specificity should be maximised. (5 marks)
- ii. Identify and briefly discuss the advantage of using additional tests to the ICT, such as a peripheral blood smear, to improve diagnostic accuracy. Your answer should briefly contrast the general differences of using tests in series versus parallel. (8 marks)

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2. You are a farm-consultant epidemiologist who has been commissioned to design a cohort study of bacterial enteritis in weaner Merino sheep in an extensive, pasture-based production system on a single farm. You are primarily interested in the causal association between weight at weaning (at three months of age) and the incidence of bacterial enteritis over the subsequent 12 months of their lives. Presumed confounders of this association are sex and worm burden.

Describe your proposed study design, outlining and justifying the essential design features. Your design should include: *(40 marks)*

- the aims for your proposed study,
- your sampling strategy,
- method/s to measure and compare disease frequency,
- strategies to minimise bias, including confounding, and any further anticipated limitations of your study.

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3. Evaluate the scientific publication provided in **attachment 1 (not included)** on the following page.

Answer **all** parts of this question:

- a) Identify the study design used in this publication and briefly assess the suitability of this study design in relation to the objective of the research. *(5 marks)*
- b) Briefly describe the **two (2)** groups of animals that were used in this study and assess how selection bias could have affected the study. *(8 marks)*
- c) Briefly describe how outcomes were measured in this study and assess how measurement bias could have affected the study. *(6 marks)*
- d) Describe **three (3)** weaknesses in the experimental design of this study. These should be different to your answers to sub-questions 3 b) and c). In your answer, provide an explanation of how these design weaknesses could have affected the observations made. *(9 marks)*
- e) Discuss the internal validity of this study. Provide a detailed rationale of your conclusion and give specific examples. *(6 marks)*
- f) Discuss the external validity of this study. Provide a detailed rationale of your conclusion and give specific examples. *(6 marks)*

End of paper