



Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

November 2020

Veterinary Epidemiology

Paper 1

Perusal time: **Twenty (20)** minutes

Time allowed: **Four (4)** hours after perusal

Answer **ALL FOUR (4)** questions

All four questions are of equal value.

Answer **FOUR (4)** questions each worth 60 marks.....total 240 marks

Paper 1: Veterinary Epidemiology

Answer all four (4) questions

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

- a) You have conducted a cohort study to determine the long-term consequences of surgical treatment of condition X in racehorses. Twenty-seven of 174 horses with condition X who had surgery experienced a fall during a race during the follow-up period. Twenty-three of 103 horses with condition X who did not have surgery had a fall during a race during the follow-up period. From interviews with each of the trainers of each horse, you are able to estimate that the total race distance for the surgery group was 5,677 km and the total race distance for the non-surgery group was 2,569 km.

Assume the two groups of horses are exactly comparable with respect to baseline characteristics. Assume that there is no misclassification present in the study.

Answer **both** parts of this sub-question: (10 marks)

- i Present the data provided above in a 2×2 table.
 - ii Estimate the influence of surgery on the incidence of a fall while racing. Justify the measure that is used.
- b) Male Labradors have a substantially higher incidence of prostate cancer compared with male German shepherds. Let's say there is a variant of the androgen receptor gene that results in a doubling of the incidence of prostate cancer in dogs with that gene. The gene is present in 50% of Labradors and 30% of German shepherds.

If we let x equal the incidence risk of prostate cancer in dogs without the androgen receptor gene, an expression for the incidence risk of prostate cancer in a population of German shepherds would be:

$$(0.7 \times x) + (0.3 \times 2x) = 1.3x$$

Answer **both** parts of this sub-question: (10 marks)

- i Provide the corresponding expression for the incidence risk of prostate cancer in a population of Labradors.
- ii What is the relative incidence of prostate cancer in Labradors versus German shepherds, if the genetic marker was the sole risk factor for this disease?

Question 1 continued over page

- c) In a study of preputial prolapse in bulls, you observe that 17% of cases in Hereford cattle are less than three years of age. For Angus cattle, 4.8% of cases are less than three years of age.

Assume that the ascertainment of cases of preputial prolapse was equally complete in the Hereford and Angus cattle study populations and that the above difference was not due to chance.

For this study population, does this finding necessarily imply that the risk of developing preputial prolapse is elevated in Hereford cattle less than three years of age compared to Angus cattle of similar age? Explain. (10 marks)

- d) The following quotation comes from a review of research on diet in relation to levels of serum selenium concentrations in dairy cattle:

Many (studies) were limited by having a small number of participants. Diet studies quoted to this day as authoritative have had as few as five subjects. If any enduring truth has emerged about cattle and their diets, it is that individual cattle are remarkably different, and studies that don't involve dozens if not hundreds of participants are of extremely limited value.

How is it possible for an epidemiologic study (of any question) that involves fewer than dozens or hundreds of participants to be of more than limited value? (10 marks)

Question 1 continued over page

e) The following questions relate to the data presented in the figure below:

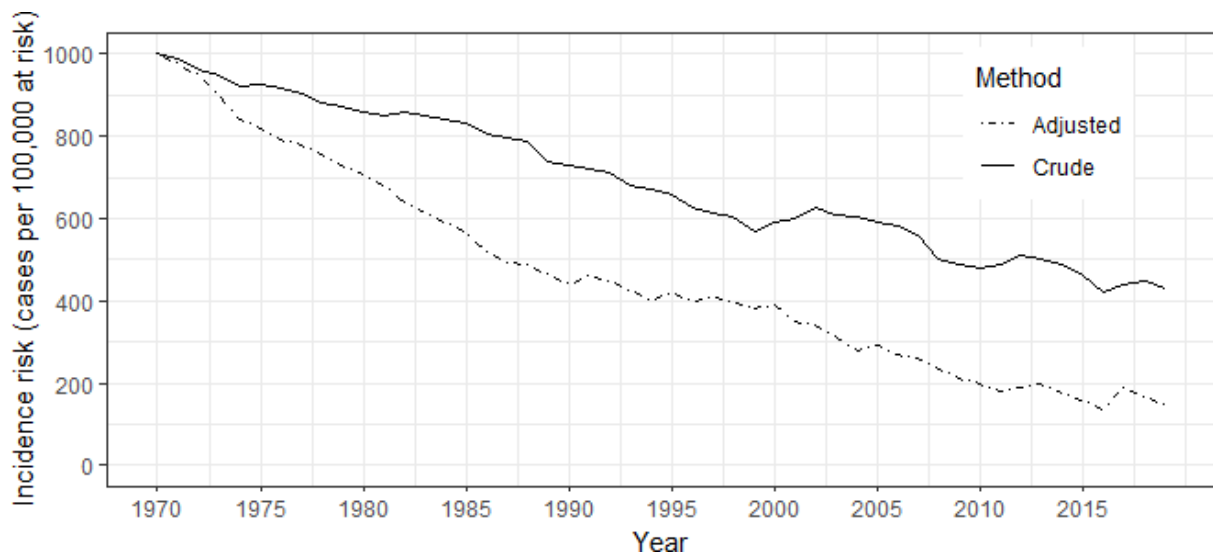


Figure 1: Crude and adjusted incidence risk of disease X in a hypothetical population of dogs, 1970 to 2019.

The figure above is a line plot showing yearly estimates of the crude incidence risk and the age-adjusted incidence risk of disease in a hypothetical population of dogs for the period 1970 to 2019.

Answer **both** parts of this sub-question: (10 marks)

- i What is the reason for the increasing disparity between the crude and age-adjusted incidence risks over time?
- ii For the purposes of age adjustment, can you tell which population distribution was used as a standard? Why, or why not?

Question 1 continued over page

- f) In a case-control study of risk factors of colon cancer, 430 cases were compared with 551 controls. The investigators used a questionnaire to obtain information about demographic variables, socioeconomic variables, weight, and height, among other variables. Using the self-reported weight and height information, body mass index [BMI, weight (kg)/height (m)²] values were calculated. Participants with BMI ≥ 30 kg/m² were considered ‘obese.’

Counts of obese and non-obese participants by case and control status are shown in the following table:

	Cases	Controls	Total
Obese	162	133	295
Non-obese	268	418	686
Total	430	551	981

Answer **all three** sub-questions: (10 marks)

- i Calculate the odds ratio relating obesity and colon cancer in this study.

Subsequently, the investigators obtained additional funds to conduct a validation study of some of the information obtained from the participants’ interviews. For the validation study, 100 participants (50 cases and 50 controls) were randomly selected and invited to attend a clinic, where diverse objective physical measurements and more extensive questionnaires were used in an attempt to estimate the validity of the self-reported information in the study. Despite intensive efforts for recruitment, only 60 of the 100 participants invited for the validation study agreed to the clinic visit. The participants who agreed to attend included a larger proportion of females and individuals of a higher educational level than those who declined.

Using objectively measured weight and height, BMI was recalculated in the 60 individuals in the validation study. Among the individuals who were classified as obese using measured weight and height, 90% of the cases and 95% of the controls had also been classified as obese by the BMI based on self-reported information; 100% of those classified as non-obese using measured weight and height had been classified as such by the self-reported information.

- ii Assuming that weight and height values did not change in the time between the interviews and the validation study, calculate the ‘corrected’ odds ratio based on the estimates obtained from the validation study. That is, estimate the odds ratio that would have been obtained if no misclassification of obese status based on self-reported weight and height information had occurred. Show your revised 2×2 table and show how you calculated the revised cell frequencies for the table.
- iii In addition to the need to assume no change in weight and height between interviews and validation assessment, what are, in your judgment, other important limitations of the use of the validation study (vis-à-vis the whole study) to estimate a corrected odds ratio?

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2. Answer **both** parts of this question:
- a) When building a regression model, discuss the approaches that can be used for selecting variables to be controlled-for where the objective is to infer whether there is a causal association between an explanatory variable and the occurrence of disease.
Include in your discussion factors such as assumptions, advantages and disadvantages that should be considered by the model builder. *(30 marks)*
- b) Discuss issues of causal inference in veterinary epidemiology. Include in your discussion how estimates of association from models contribute to causal inference. *(30 marks)*
3. For case-control and cohort studies, describe: *(60 marks)*
- i. The difference between dynamic and fixed source populations.
 - ii. The difference between dynamic stable populations and dynamic unstable populations.
 - iii. Different approaches for sampling in cohort studies and case control studies.
 - iv. How source population characteristics and study subject selection methods impact on estimated measure(s) of association.
4. Discuss the sources of systematic error that can occur in observational studies. When and how can quantitative bias assessment be undertaken to assess the impact of systematic error? What are the disadvantages of quantitative bias assessment?
(60 marks)

End of paper

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Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

November 2020

Veterinary Epidemiology Paper 2

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Answer **ALL FOUR (4)** questions

All four questions are of equal value.

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Paper 2: Veterinary Epidemiology

Answer all four (4) questions

1. OIE member countries that are free of classical swine fever (CSF) are expected to confirm their CSF freedom status annually. Current CSF surveillance in the pig industry in Australia relies on the legal obligation of herd managers and/or their veterinarians to notify authorities of suspicion of the disease, as well as an industry-funded on-farm disease investigation program.

To augment this largely ‘passive’ surveillance portfolio, a one-off, proactive, targeted surveillance project to assess the level of exposure of domestic pigs to CSF virus was developed by the Victorian Department of Economic Development, Jobs, Transport and Resources.

In brief, pigs were tested at the time of slaughter in commercial abattoirs using a CSF antibody ELISA. The CSF Ab ELISA has a diagnostic sensitivity of 80% and an unknown but presumed greater than 90% diagnostic specificity.

Care was taken to ensure that samples of pigs from large, medium and small holdings were sampled in each of the three major agricultural areas of Victoria. A total of 391 blood samples were obtained and tested with the CSF Ab ELISA. All tests returned a negative result. Numbers of pig herds and numbers of pigs sampled, stratified by holding size region are shown in the table below.

Table 1: Number of pig holdings (and total number of pigs) sampled for the classical swine fever serological survey (a total of 23 holdings and 391 pigs), stratified by Agriculture Victoria region and holding size.

Holding size	Region			Total
	Northern	South-West	South-East	
Small (≤ 50 pigs)	2 (20)	1 (10)	-	3 (30)
Medium (51-500 pigs)	4 (98)	2 (24)	2 (8)	8 (130)
Large (> 500 pigs)	7 (129)	4 (80)	1 (22)	12 (231)
Total	13 (247)	7 (114)	3 (30)	23 (391)

Question 1 continued over page

Answer **all** parts of this question:

- a) Define and explain the term ‘design prevalence’. (10 marks)
- b) Describe your approach to estimating an appropriate number of pigs to test for this study. (10 marks)
- c) List, and briefly describe the sampling strategies that could have been used for this study. What are the advantages and disadvantages of each of the sampling strategies you have listed? (10 marks)
- d) Describe your approach to analysing these data. Include in your answer details of software and sources of information that you would use if you were carrying out this analysis. (10 marks)
- e) Based on the findings from this study is it appropriate to conclude that the prevalence of CSF antibody exposure in the Victorian pig population is zero? Justify your answer. (10 marks)
- f) Describe how you would present your findings and their interpretation to the Victorian Chief Veterinary Officer (who, in turn, will report these results to the OIE). (10 marks)

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2. During late 2019, several members of a Facebook cat breeding group reported signs consistent with vestibular disease in their cats. In early 2020, six cats with vestibular signs were investigated at a large university referral clinic.

All six cats presented with a pronounced head tilt and nystagmus that had not resolved over time. Apart from neurological examination that confirmed the presence of vestibular disease, complete physical examinations, radiology and additional testing identified no significant findings. Detailed questioning of owners found that all routinely fed a particular brand of cat food.

Following additional reports of vestibular disease in cats fed this diet, the product was recalled from the market by its manufacturers in early 2020.

Answer **all** parts of this question: (60 marks in total)

- a) How would you determine that an ‘outbreak’ of feline vestibular disease had actually occurred in Australia, and wasn’t a pseudo-epidemic arising from social media chatter? (10 marks)
- b) The cat breeders that are members of the Facebook group commission you to carry out an investigation into this outbreak. They provide you with a generous, but not unlimited budget. What options are available to you in terms of study design? What are the advantages and disadvantages of each? (10 marks)
- c) You decide to carry out a case-control study. Describe the information you require to determine an appropriate number of cases and controls to take part in your study. (10 marks)
- d) How will you select cases to take part in the study? How will you select controls? List the source of the likely biases that might arise in a study of this type. What steps would you take to minimise the biases that you have listed? (10 marks)
- e) Describe your approach to analysing the data from the case-control study. The Facebook group have requested that you publish your findings as a peer-reviewed journal article. List the captions for each of the tables and figures that you will include in your manuscript. For each of the proposed tables, list the column headers and row names. For each of the proposed figures list the titles for the horizontal and vertical axes. (10 marks)

Question 2 continued over page

- f) This outbreak generated a large amount of media attention and concern amongst cat owners, particularly in relation to the brand of food that was putatively the cause of the outbreak.

What type of bias affecting observational studies would be of concern in this situation? What effect would this bias have on the results of your case-control study? What steps would you take to reduce or eliminate the effect of this bias?

(10 marks)

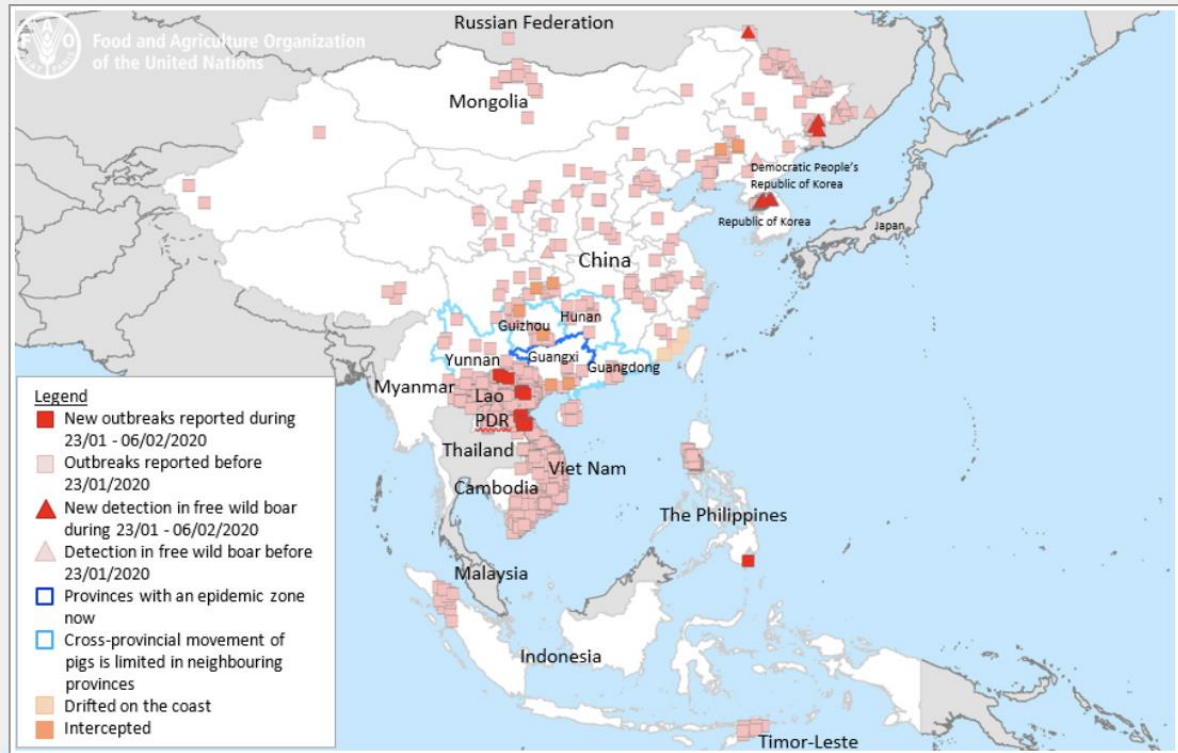
3. *Moraxella bovoculi* is a putative causal organism for infectious bovine keratoconjunctivitis (IBK- pinkeye) in the USA and Australia. To date the evidence for *M. bovoculi* as a causal organism is equivocal in the USA.

You have been asked to design a study to determine the causal role of *M. bovoculi* in IBK in Australia. Provide a justification for your study by comparing it to the information gained relative to alternative studies and which of Hill's causal criteria will be 'met' by the study. Further, provide the interpretation and next steps if the null hypothesis is rejected or if the null hypothesis is not rejected. (60 marks)

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4. African swine fever (ASF) has recently been diagnosed in Asia. The map showing the spatial distribution of ASF-positive premises, published by the Food and Agricultural Organization of the United Nations on 6th February 2020, is shown below.

Map 1. ASF situation in Asia (August 2018 to date)



Click to enlarge - Source: China: MARA, Viet Nam: WAHIS & media information, Republic of Korea, the Philippines, Indonesia, Timor-Leste: WAHIS and government websites, Other: WAHIS.

Map of Asia showing the location of ASF outbreaks in Asia over a two-year period. (Image does not enlarge if clicked.)

Answer **all** parts of this question:

- List and briefly explain the different ways ASF might have initially entered China. (10 marks)
- List and explain the ways an infectious disease like ASF might spread from farm to farm. (10 marks)
- List and briefly explain the analytical techniques you could use to shed light on the relative importance of each of these spread mechanisms in this particular outbreak. (10 marks)
- You have been asked to chair an international committee whose brief is to develop a plan to bring the Asian ASF outbreak under control. Make a list of the agencies and specific categories of professional expertise who should be represented on this committee, briefly explaining your decision for each. (10 marks)

Question 4 continued on the next page

- e) The first of three two-day meetings is to be held four weeks from today. Make a list of agenda items for this first meeting, providing a justification for each item. *(10 marks)*
- f) The opinion of meeting participants after the first meeting is that ASF is too widely dispersed across Asia for eradication to be feasible for individual affected countries. List and briefly describe the strategies that might be implemented to limit the impact of ASF in affected countries in Asia. *(10 marks)*

End of paper

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