Australian and New Zealand College of Veterinary Scientists

Fellowship Examination

June 2014

Veterinary Epidemiology

Paper 2

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

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

Answer **ALL <u>FOUR (4)</u>** questions

All four questions are of equal value.

Answer **FOUR** questions each worth 60 marks .....total 240 marks

Paper 2: Veterinary Epidemiology

Answer all four (4) questions

1. Assume that you are the research veterinarian working for a swine production company, and have been asked to design a randomised controlled trial to assess the effect of a new vaccine product on bodyweight gain, post weaning.

   The production system where the trial will be conducted uses multiple barns, each with 20 pens; each pen houses 50 pigs.

   Pigs are moved to one of the barns on the day they are weaned (at five weeks of age) and arranged in weight groups of equal number.

   For the first five weeks after weaning, the piglets are restricted to a smaller section of their pen using partitions. These partitions are removed after five weeks i.e. when the pigs are 10 weeks of age. Pigs may be moved between pens from weaning to slaughter to maintain even stocking of pens i.e. if there is high mortality in one pen, other pig/s may be moved there to even out the numbers across pens. Pen movement data is available for all animals.

   Pigs with the same weaning date are sold to slaughter in three marketing groups. Once pigs are near market weight, the manager selects for slaughter those that have reached market weight based on his/her experience. Pigs that do not appear to have attained market weight when the third marketing group is selected are slaughtered regardless of weight.

   The primary objective of the trial is to determine whether the new vaccine improves average daily bodyweight gain from weaning to slaughter. The vaccine target is a highly infectious disease of swine that infects piglets in the post-wean period. The vaccine is a killed product and is administered once when piglets are weaned.

   The expected difference in average daily gain from weaning to slaughter is +30 grams in animals vaccinated with this product, compared to those not vaccinated with this product.

   The current mean average daily gain for this production site from weaning to slaughter is 690 grams with standard deviation of 100 grams in unvaccinated animals.

   For your study, you will work with a single barn. The barn is filled with piglets over a 48-hour period. You will not have littermate information.

Question 1 continued over page

Answer **all** parts of question one:

a) Discuss the advantages and disadvantages of using the pen as both the unit of allocation and the unit of outcome measurement for the intervention, as compared to using the piglet as both the unit of allocation and the unit of outcome measurement for the intervention. Justify **each** point. *(20 marks)*

b) Describe appropriate approaches(s) to data analysis if the trial was conducted with the piglet as the unit of allocation and the unit of outcome measurement. Provide a rationale for the approach(s) proposed. *(20 marks)*

c) Describe appropriate approach(s) to data analysis if the pen is the unit of allocation and the unit of outcome measurement. Provide a rationale for the approach(s) proposed. *(20 marks)*

Question 2 begins on the next page

2. Bovine respiratory disease (BRD) is a common and expensive disease in beef feedlot cattle. Prompt treatment is required to minimise body weight loss, animal suffering and risk of death in affected cattle.

A one or two stage monitoring process is used:

- Twice daily, feedlot staff ('pen riders') inspect cattle for clinical signs of disease. Cattle are confined to their pen but not placed in a crush for these inspections. This is the first stage of the monitoring process.
- Cattle suspected as being unwell by pen riders are moved from their pen to the hospital pen. Depending on the particular feedlot protocol, animals identified by pen riders may be treated for BRD (a one-stage process) or subject to a more detailed examination in a crush in the hospital pen, and only treated if they meet further criteria indicative of BRD such as elevated temperature (stage two of the two-stage monitoring process).

The diagnosis and treatment protocol is based on the recommendation of the feedlot veterinarian. Staff are trained by consulting veterinarians, but it is impractical for all suspect animals to be examined by a veterinarian. During treatment, animals may be returned to the original pen or placed in the hospital pen until recovery. Recovered animals may be returned to their original pen, or fed elsewhere until sold.

Assume that you have been asked to evaluate a novel device that has been developed to assist in the diagnosis of bovine respiratory disease in feedlot cattle.

The company that manufactures the device says that the device, which is a micro GPS (geographic positioning system) device implanted in the animal like a microchip, can be used to track the posture and location of individual cattle in feedlots. The company proposes that the device would be integrated into the software system of feedlots, and would automatically flag cattle that have behaviours (postures and spatial and/or temporal movement patterns) that are indicative of respiratory disease.

The data provided by the device for each animal includes postural data (standing still, sitting, standing moving) and location.

Locations are calculated using new GPS technology with high accuracy and one-metre precision. GPS data are captured constantly. Using location data, distance moved can be calculated and summarised as distance travelled in metres (or kilometres) in each minute, hour or day. It is also possible to summarise total distance travelled within set periods of time e.g. between 8.00 am and 10.00 am.

A confidential proprietary method has been developed to record the animal's posture at the start of each minute. These data can be aggregated by any time period preferred by the investigator; aggregated data are expressed as proportions for the specified time period e.g. % of time sitting between 8.00 a.m. and 10.00 a.m. (number of time points when the animal was sitting divided by the total number of time points where posture data were collected for the animal). At each time point, the animal can be in only one of the three possible postures (standing still, sitting, standing moving), and for any time period, the % of time points spent in each posture will sum to 100%.

Very large amounts of data can be rapidly collected and stored.

Question 2 continued over page

The device manufacturing company wants you to design a study to assess the diagnostic sensitivities and specificities of various behavioural variables for detecting cattle with respiratory disease under commercial feedlot conditions.

The device is cheap as is data collection; therefore numerous animals can be enrolled.

Answer **both** parts of question two:

a) Describe in detail the study objective(s) and all relevant aspects of your proposed design. *(30 marks)*

b) Describe the major threats to you reaching conclusions from this study that differ from the true situation, **and** describe how these could be addressed in your study. *(30 marks)*

Question 3 begins on the next page

3. Sarcomas are not new forms of cancer in cats. However in 1991, veterinarians began to notice a higher than expected number of sarcomas occurring on cats' bodies in places where vaccines are commonly injected. Subsequently, using retrospective cohort studies and case control studies, researchers have reported an association between vaccine administration and sarcoma development.

   In the United States, the strongest links have been made between the use of combined adjuvanted rabies and feline leukaemia virus (FeLV) vaccines (i.e. both vaccines in the same product) and sarcoma development.

   In Australia little research has been conducted on vaccination-associated sarcoma. Further, as rabies vaccination is not used in Australia, it is unclear how the US-based studies translate to Australia. Currently, two classes of FeLV vaccine are on the market in Australia – one with and one without adjuvant.

   Although sarcomas are relatively rare, an industry funding body has invited submissions of research proposals to investigate this issue. The submitted proposals will be evaluated by a committee with relevant industry and technical expertise, and evaluated in terms of the quality of research outcomes and the cost-effectiveness of the project.

   You are tasked by your research group to develop a study that will describe the incidence (risk or rate) of sarcoma and evaluate the putative association between sarcoma development incidence and vaccination with each of the adjuvanted and non-adjuvanted FeLV vaccines.

   This study design will be submitted to the funding body in response to its call for submission of research proposals.

   For this study, you will be able to partner with a large veterinary hospital company that owns multiple practices.

   The centralised medical record system used by the company ensures that owners can visit any of the company's practices and the patient record is always available to all veterinarians and hospital staff in all practices.

   The record system can be modified for your project.

   The company is going to charge for each animal whose record they allow you to access in their database, but once you have access to an animal's record, you have access to all the data available for that animal.

   Question:

   Describe the study design that you would develop for submission to the funding body.

   (60 marks)

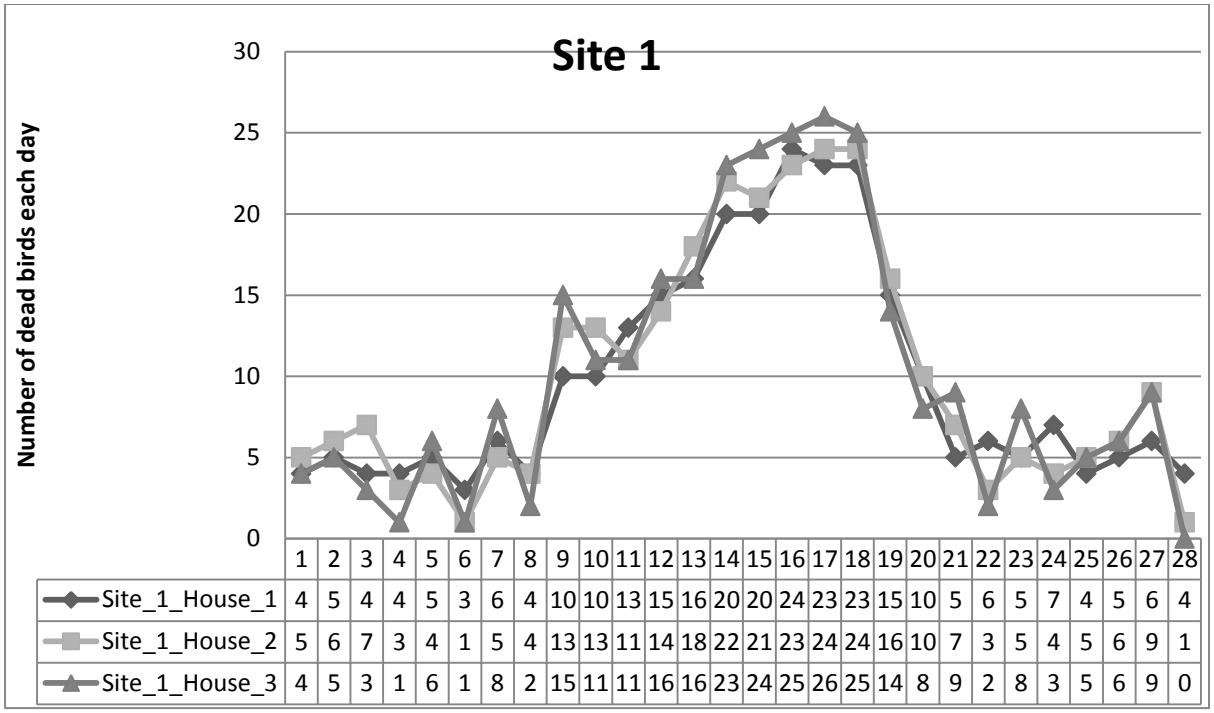
Question 4 begins on the next page

4. Acting as the local New South Wales government officer you are called upon by a local private veterinary practitioner to provide guidance and leadership into the investigation of an outbreak of disease at a broiler (grower chicken) business.

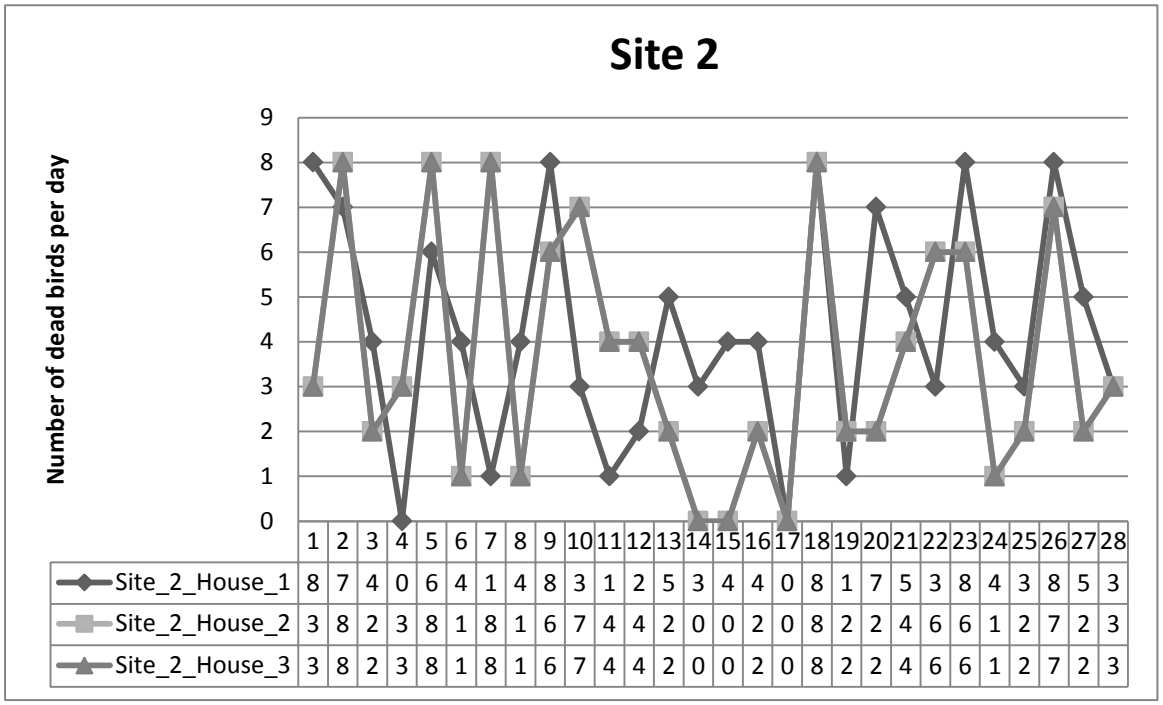
   You are provided with the following history:

   - The business has grower chickens at three geographically separate sites.
   - On each site, there are three sheds ('houses'). Each house contains around 5000 birds.
   - The production cycle is 42 days long.
   - Within each site, each house is filled over a few days and all birds are removed approximately 42 days later (this may take several days) before the houses are restocked with day-old chicks.
   - Between production groups the house is empty for one week and water-lines and feed-lines cleaned.
   - The litter in a house is reused for several production cycles and replaced every 12–18 months. Each site is filled with chicks over a five day period.
   - Several days ago the client reported increases in the daily number of mortalities in two of three houses at Site three.
   - The client called the veterinarian who has just graduated. The veterinarian conducted a short investigation, which included submitting birds for post-mortem to the state veterinary laboratory, and conducted a quick analysis of the data.
   - According to the history provided by the client, he noticed an ‘uptick’ in the number of deaths in Site one but this didn’t concern him until he saw the same thing happening in Site three.
   - Upon examination of the animals in each house at Site three, in house one and two the veterinarian found that between 5-10% of the birds were huddled in groups and reluctant to stand. When forced to move these birds became exhausted easily and gasped.
   - The bird's vents were generally clean; and their foot pads were normal for their ages.
   - Ten exhausted birds and 10 apparently normal birds were sacrificed and submitted for post-mortem from house two at Site three.
   - No such 'huddles' of birds were found in house three.
   - The analysis was conducted in excel and some results are provided on the following two pages. The data collected were for the three sites for the four-weeks prior to today, the day you are presented with this history.
   - A schematic of the arrangement of houses at Site three is also provided to you.
   - The closest neighbouring farm with poultry is five kilometres to the north of Site three. No unusual signs have been reported from this farm. The veterinarian has not visited this farm yet.
   - The veterinarian has not visited the other two sites owned by the client either.
   - The results of the post-mortem examinations are not available yet.

Question 4 data results on following two pages

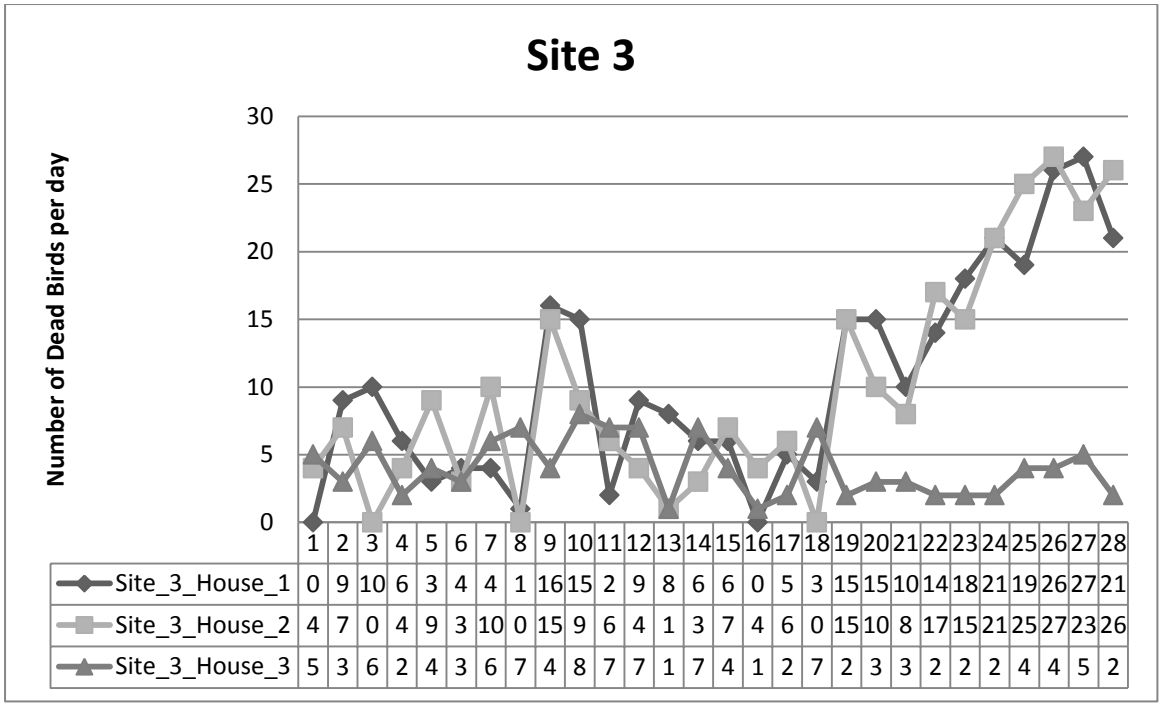


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Site_1_House_1	4	5	4	4	5	3	6	4	10	10	13	15	16	20	20	24	23	23	15	10	5	6	5	7	4	5	6	4
Site_1_House_2	5	6	7	3	4	1	5	4	13	13	11	14	18	22	21	23	24	24	16	10	7	3	5	4	5	6	9	1
Site_1_House_3	4	5	3	1	6	1	8	2	15	11	11	16	16	23	24	25	26	25	14	8	9	2	8	3	5	6	9	0



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Site_2_House_1	8	7	4	0	6	4	1	4	8	3	1	2	5	3	4	4	0	8	1	7	5	3	8	4	3	8	5	3
Site_2_House_2	3	8	2	3	8	1	8	1	6	7	4	4	2	0	0	2	0	8	2	2	4	6	6	1	2	7	2	3
Site_2_House_3	3	8	2	3	8	1	8	1	6	7	4	4	2	0	0	2	0	8	2	2	4	6	6	1	2	7	2	3

Question 4 data continued over page



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Site_3_House_1	0	9	10	6	3	4	4	1	16	15	2	9	8	6	6	0	5	3	15	15	10	14	18	21	19	26	27	21
Site_3_House_2	4	7	0	4	9	3	10	0	15	9	6	4	1	3	7	4	6	0	15	10	8	17	15	21	25	27	23	26
Site_3_House_3	5	3	6	2	4	3	6	7	4	8	7	7	1	7	4	1	2	7	2	3	3	2	2	2	4	4	5	2

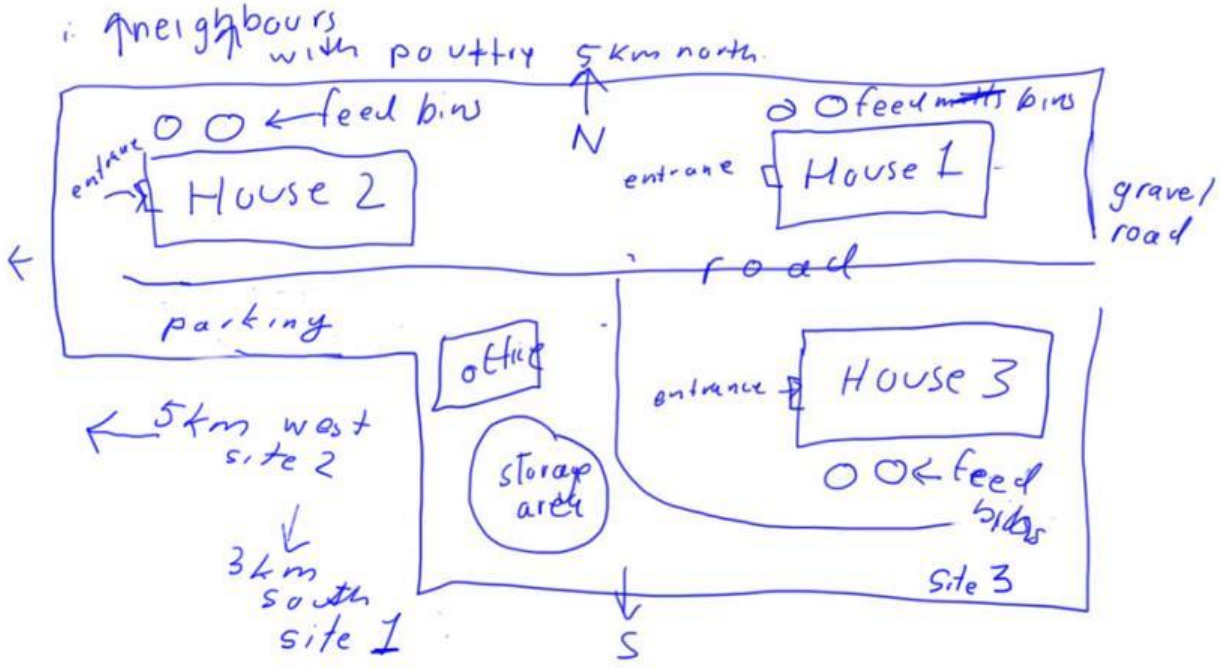


Figure 1: Veterinarians schematic of the arrangement of Site 3

Question 4 continued over page

Answer **all** parts of question four:

a) Based on this information, describe and briefly justify the steps you would conduct in this outbreak investigation. *(30 marks)*

b) Based on the epidemic curves, how would you describe this epidemic and what do you hypothesise as possible causes: infectious, toxic, environment, etc. Provide a rationale for your responses. *(15 marks)*

c) Based on the information provided at this early stage of the investigation describe your recommendations to the owner of the business. Provide a rationale for your recommendations. *(15 marks)*

End of paper