Survey of Australian equine veterinarians evaluating their biosecurity training and perceptions and opinions about the management of the 2007 equine influenza outbreak

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Objectives To evaluate the level of biosecurity training among Australian equine veterinarians, to assess their biosecurity and infectious disease perceptions and their opinions about the 2007 equine influenza outbreak management.

Design Cross sectional study.

Procedure A survey was conducted among equine veterinarians attending the 2010 annual conference of the Equine Veterinarian Association (EVA) in Australia. Data were collected using a selfcompleted questionnaire and analysed using Fisher's exact tests to assess veterinarians' level of biosecurity training, infectious disease perceptions and views regarding the 2007 equine influenza outbreak management.

Results A total of 46 out of the 196 attending veterinarians (23.5%) completed the questionnaire. Significantly greater proportions of recently graduated veterinarians received theoretical and practical biosecurity training at veterinary schools than their counterparts The majority considered their likelihood of spreading infectious diseases from one client's horse to another to be low (84%). More than half (58%) of the veterinarians considered that hand-washing/ wearing gloves was very effective in preventing disease spread. However, around a

quarter (27%) reported a degree of reservation about the practicality of performing general biosecurity practices in everyday working life. Overall veterinarians were satisfied with the equine influenza outbreak response but had mixed opinions about the control measures used and communications.

Conclusion Levels of biosecurity training and the frequency of biosecurity advice provided by veterinarians have increased over time, although practicality of biosecurity practices is a concern for some of the veterinarians. Further investigations of the barriers for the use of various biosecurity practices are required in order to inform training programs.

Keywords: equine, veterinarians, biosecurity, perceptions, equine influenza, training.

Abbreviations:

EAD emergency animal disease
EI equine influenza
EVA Equine Veterinarians Australia
PPE personal protective equipment

Introduction

Infectious disease spread and its prevention are critical for animal health at the individual, herd and national level. Veterinarians as the interface between owners, animals and government animal health authorities play an important role regarding infection control and biosecurity in both day-to-day practice and during the response to an emergency animal disease outbreak. This study examines veterinarians' level of biosecurity training, their biosecurity and infectious disease perceptions as well as their views on the 2007 equine influenza outbreak response and future incursions.

In recent decades, more emphasis has been put on the importance of biosecurity and infection control training of veterinarians globally. Overseas, many studies have identified the need for prevention of nosocomial and zoonotic infections in clinical settings.[1-5] In Australia, the emergence of zoonotic Hendra virus has lead to calls for better risk assessment and biosecurity practices of Australian equine veterinarians in the field [6]. The 2007 equine influenza outbreak also raised equine veterinarians' awareness of the need for good biosecurity and hygiene practices to prevent the spread of infectious diseases from client to client.[7, 8] More recently, substantial efforts have been undertaken by the Australian Veterinary Association to provide guidelines for veterinary personal biosecurity for both clinical and field use.[9] However, only a little research has examined veterinarian's biosecurity training and behaviour. A recent study identified that most zoonoses among veterinarians from Oregon had occurred in the past in older veterinarians during their final year of veterinary school and their first three years after graduation, yet in that study no recent graduates (1-2 years after graduation) and few skilled veterinarians (3-5 years after graduation) reported zoonotic infections, suggesting that the effectiveness of infection control training at veterinary schools has improved.[10]

Wright et al.[2] assessed the knowledge and use of infection control practices among US veterinarians and found that equine veterinarians displayed lower stringency of infection control practices if they did not work in a teaching or referral hospital or if their practice did not have written infection control policies. A recent Australian study established baseline data on zoonotic disease risk perceptions and personal protective equipment use by Australian veterinarians; finding a low uptake of appropriate personal protective equipment use compared to levels recommended in industry guidelines.[11]

The equine influenza outbreak in 2007 in Australia is a recent example of a large infectious disease outbreak. The disease spread approximately 280,000 square kilometres to over 9,000 properties, infected over 70,000 horses and cost the government over A$ 350 million in addition to severe financial losses to the horse industry.[12] The subsequent control response was the single largest animal disease emergency in Australia's history requiring coordination of government and industry stakeholders, yet private Australian veterinarians were not formally represented in the emergency animal disease response arrangements.[13] Despite their lack of formal contribution to outbreak response decision-making, private veterinarians played a substantial role, as government departments requested them to provide diagnostic and vaccination services.[14]

The 2007 Australian equine influenza outbreak highlighted the importance of collaborative interaction between government and equine veterinary service providers during an emergency outbreak response (J. Gilkerson, personnel communication). It is important to understand equine veterinarian's perceptions of the outbreak management, as successful management of an emergency animal disease crisis requires consideration of all stakeholders and good communications.[15, 16] Veterinarians can contribute through good infection control practices in the field and by giving biosecurity advice to clients.

This study was carried out to document the level of biosecurity training among Australian equine veterinarians, to assess their biosecurity and infectious disease perceptions and their views of the management of the 2007 equine influenza outbreak.

Materials and methods

The target population for the study was registered Australian veterinarians with a special interest in equines and the source population consisted of the veterinarians attending the 2010 Equine Veterinary Association (EVA) conference in the Hunter Valley, New South Wales on 12th to 16th of July 2010. EVA is a formalised special interest group of Australian equine veterinarians under the Australian Veterinary Association umbrella. This annual conference is attended by equine veterinarians from across the country. Equine veterinarians from overseas or those not registered to practice in Australia were excluded. Note that the source population was a convenience subset of the target population, and therefore, may not be truly representative of it. However, the EVA represents approximately 80% of veterinarians who are conducting substantial horse work in Australia (J.Gilkerson, personal communication).

The questionnaire, containing 28 questions, requested information on equine veterinarians' personal and practice demographics, biosecurity training as well as their biosecurity and infectious disease perceptions (21 questions). Additionally, questions were asked about their attitudes towards the 2007 equine influenza outbreak management and future disease outbreak control (7 questions). Most questions were close-ended, except for three which were open-ended and another two questions allowed respondents to provide comments. The three open-

ended questions asked about veterinarians' own definition of biosecurity and about perceived strengths of weaknesses of the management of the equine influenza outbreak in 2007. The questionnaire was piloted with two equine veterinarians. A copy of the questionnaire is available from the corresponding author upon request.

Conference attendees were provided with hard copies of the questionnaire in the conference satchel and they were requested to return completed questionnaires anonymously via a drop-box. Conference organisers made regular announcements to alert conference participants to the study in order to increase the response. Additionally an email reminder was sent to all conference participants on the first business day following the conference, together with a link to an online version of the questionnaire. Another email reminder was sent after 15 days and the online version was available for 30 days during August-September 2010.

Data from the questionnaires were entered into a purpose-built Microsoft Access 2007 database (Microsoft Corporation, Redmond, WA, USA). Data were cleaned and analysed using SAS statistical software (release 9.2 © 2002-2008, SAS Institute Inc., Cary, NC, USA). All the variables were categorical and were summarized by calculating overall frequencies and proportions. In addition, contingency tables of all variables were prepared by age, gender, years since graduation and employment status (owner versus employee). Contingency tables for each biosecurity and infectious disease perception variable were also prepared by each of the remaining perception variables. Chi-squared tests and Fisher's exact tests were performed on cross-tabulated data.

Qualitative responses to the three open-ended questions were read carefully three times to ensure familiarity with the data and then coded into thematic categories using content analysis.[17] The coding followed an interpretive approach without using pre-determined categories.[17] The study protocol was approved by the University of Sydney's Human Ethics Committee (#12895).

Results

A total of 38 out of the 196 attending veterinarians completed a hard copy of the questionnaire at the conference and a further eight completed it online giving an overall response rate of 23.5%. One of the 46 respondents was excluded from analyses due to being trained and practicing overseas only. The age, gender and state distribution of respondents is shown in Table 1[1] and is also compared to reference data of all EVA members (n=982) at the time of conduct of the study.

Approximately three-quarters (n=33, 73%) of respondents were practice owners compared to approximately 16% of all EVA members with a practice ownership interest (EVA, personal communication). Close to one third were sole operators (n=13), 43% worked in practices employing between 2-4 full time equivalent staff (n=19) and 27% worked in practices employing more than 4 full time equivalent staff (n=12). About a quarter (n=12, 27%) of the practices had less than 50% equine clients and 44% of practices exclusively had equine clients. The 44% of veterinarians in the sample who exclusively worked in equine practice compares favourably with the 38% of EVA members who exclusively work in equine practice. Just over a quarter of respondents (n=12, 27%) indicated that the majority (>50%) of their equine clients were from

[1] All tables and figure are located at the end of this document.

the horse breeding sector, 18% of veterinarians had clients predominantly involved in the racing sector (n=8) and 55% had clients representing a mix of horse industry sectors (n=25).

Biosecurity training

Respondents had obtained undergraduate veterinary training at the University of Sydney (n=14, 31%), University of Melbourne (n=12, 27%), University of Queensland (n=11, 24%), Murdoch University (n=5, 11%), or other overseas institutions (n=3, 7%). Year of graduation ranged from 1966 to 2009, with 18% of the sample (n=8) graduating less than 5 years ago. The level of theoretical and practical biosecurity training at the undergraduate level by years since graduation is shown in Table 2. Theoretical training has significantly increased over time with 56% of those who graduated more than 20 years ago (n=10) having no reported theoretical training, whilst all (n=8) of those who graduated less than 5 years ago had at least some theoretical training. Likewise, practical biosecurity training has also increased from no training for 78% (n=14) of those graduating more than 20 years ago to some training for half of those graduating less than 5 years ago (n=4). Only one participant reported a lot of practical training.

Nearly half of respondents (n=20, 44%) had attended extracurricular biosecurity training in the five years prior to the survey. Of all the training recorded, only one training event occurred prior to the 2007 equine influenza outbreak, about half (n=9, 47%) were conducted during the 2007 equine influenza response and 15% (n=3) involved recent graduates (graduated within the last five years). Most (n= 16, 80%) reported that biosecurity training involved both theoretical (e.g. lectures) and practical modes (e.g. putting on personal protective equipment), although 20% (n=4) reported that biosecurity training involved only biosecurity theory. Three respondents (7%) had attended two training sessions in the last five years, whilst another two (4%) had a second training event scheduled in the next six months. All biosecurity training was perceived as useful, irrespective of the training content (theoretical and/or practical) or the provider.

Biosecurity perceptions and practices

When asked to define the meaning of biosecurity, the majority of veterinarians (n=34, 76%) described it broadly in terms of infection control and national and premise level quarantine practices, 7% (n=3) specifically described zoonotic control only, two veterinarians (4%) considered it bureaucratic or unimportant, whilst six (13%) did not provide an answer.

Besides their own understanding about biosecurity, veterinarians were also asked about horse owners' expectations of the biosecurity knowledge and practice of veterinarians. The majority of veterinarians thought that horse owners expected them to 'provide up-to-date, relevant and practical advice' (n=26, 59%), to 'act responsibly to prevent infectious disease spread' (n=25, 57%) and to 'ensure high levels of cleanliness including clothing and equipment (n=5, 11%). Some (n=6, 14%) stated that horse owner biosecurity expectations vary between clients and may differ significantly with varying knowledge of infectious diseases. Four (9%) veterinarians stated that owners expect 'miracles', i.e. considered veterinarians to be completely responsible for infectious disease control.

Biosecurity and infectious disease perceptions are shown in Table 3. Of the respondents, 19 (42%) and 25 (56%) considered themselves to be somewhat or very vulnerable to endemic and emerging zoonotic diseases, respectively. However, only 7 (16%) of the respondents considered the likelihood of themselves spreading infectious diseases from one client's horse to another as at least 'somewhat' likely. Just over half of the veterinarians (n=26, 58%) considered that hand-washing/ wearing gloves was very effective in preventing disease spread. However, 27% (n=12) expressed concerns about the practicality of performing biosecurity in everyday working life.

Cross-tabulations with age, gender, years since graduation and employment status (owner versus associate) revealed no significant associations with equine veterinarians' biosecurity and infectious disease perceptions except that the perceived practicality of biosecurity measures in everyday working life was associated with age (Fisher's exact test: $p<0.036$). More than half of participants older than 54 years (n= 3, 60%) indicated that biosecurity was very practical to perform compared to around a quarter (n= 7, 24%) of 35-54 year olds and none of the participants under 35 years old (n=10). Those who regarded biosecurity as more practical in everyday practice were also more likely to regard hand-washing/glove wearing to be more effective (Fisher's exact test $p=0.018$). In contrast, greater proportions of participants who reported that it was 'somewhat likely' that they might spread infectious diseases from client to client also considered biosecurity to be less practical in everyday working life (Fisher's exact test $p=0.025$) and hand-washing/glove wearing less effective (Fisher's exact test $p=0.025$).

Those who perceived themselves to be vulnerable to emerging zoonotic disease, also indicated that they felt vulnerable to endemic zoonotic disease (Fisher's $p<0.001$).

Only about half of the veterinarians (21/42; 50%) provided biosecurity advice prior to the 2007 equine influenza outbreak but these proportions increased to over 82% (37/45) following the equine influenza outbreak(Figure 1). No respondents indicated that they had decreased the frequency of giving biosecurity advice over time.

Perceptions of the 2007 outbreak management

When asked about the most useful sources of information during the 2007 equine influenza outbreak, participants frequently nominated the EVA (n=32,73%), state DPI (n=29, 66%) and other veterinarians (n=17, 39%). The internet (n=9, 20%), media (including television, newspaper, radio; n=6, 13%), DAFF (n=3, 7%) and other sources (n=3, 7%), including clients, the Australian Horse Industry Council and the Australian Racing Board website, were less frequently mentioned. Greater proportions of employed veterinarians (9/12 ;75%) nominated other veterinarians as a useful source of information compared to 25% (8/32) of practice owners (Fisher's exact test $p=0.005$).

Table 4 shows veterinarians' level of satisfaction with specific aspects of the 2007 equine influenza response. Female participants (17/22, 77%) were more likely to be satisfied with the outbreak information provided by their state primary industry department than men (10/20, 50%; Fisher's exact test $p=0.035$). Practice owners were more likely (16/26, 62%) to be satisfied with remuneration for vaccination and testing services than employees (1/12, 8%; Fisher's exact test $p=0.016$).

Comments made by 34 of the 45 (76%) participating veterinarians in response to open questions regarding strengths and weaknesses of the 2007 equine influenza outbreak control were classified (Tables 5 and 6, respectively). Communications and control measures used during the

outbreak were both criticised and praised. Participants criticised the initial national quarantine failure that lead to the outbreak, but also praised the successful response to the outbreak in the general horse population leading to national disease eradication. The raising of awareness among the many sectors of the horse industry regarding exotic disease risks and response systems was another positive outcome mentioned.

The majority (35/42, 83%) of participating veterinarians would like to see a future outbreak of equine influenza contained, controlled and eradicated using zones, movement control and vaccination, similar to the response to the 2007 outbreak. A further 12% (5/42) would like to see the disease controlled that way if possible, however if it spreads too widely, the campaign should be abandoned. Two veterinarians (5%) would like to see the disease spread naturally with voluntary vaccination. The bulk of participants (33/42, 79%) accepted equine influenza vaccination as an outbreak control measure, but not as a routine measure outside an emergency response. The remainder preferred different scenarios of routine vaccination on an ongoing basis: two veterinarians (5%) wanted it to be compulsory for all horses, five veterinarians (12%) wanted it to be compulsory for racehorses only and voluntary for other horses, and another two (5%) wanted vaccination to be voluntary for all horses. Most (26/43, 60%) felt that the equine influenza vaccine was effective with approximately a quarter of those feeling the vaccine was very effective.

Discussion

This study evaluated equine veterinarians' biosecurity training, biosecurity and infectious disease perceptions and views of the 2007 equine influenza management. The increasing levels of biosecurity training of Australian veterinary students observed in this study appears to be motivated by the profession's recognition of the importance of biosecurity due to the 2007 equine influenza outbreak and the increased frequency of Hendra virus infections in recent years.[7, 8, 18] Generally, the results suggest a stronger onus on theoretical rather than practical aspects of biosecurity during undergraduate training. Although not statistically significant, interestingly this study also found that younger veterinarians reported biosecurity measures to be less practical to perform in everyday practice than older veterinarians. These findings suggest scope for the introduction of more practical biosecurity training in future to complement the perceived increase in theoretical biosecurity teaching. Practical class exercises on a horse premise imitating routine practice, and a mock disease outbreak, might be a way of demonstrating and emphasising the practicality of biosecurity and to better prepare equine veterinarians to implement it in clinical practice. The findings of this study are supported by a previous study with Australian veterinarians, which also suggested the need for more practical biosecurity training as it found little uptake of appropriate personal protective equipment use in practice.[11]

Younger veterinarians may have lower levels of biosecurity compliance similar to younger horse owners[19]. Implementing biosecurity measures might be perceived as a greater inconvenience by younger veterinarians due to the associated costs in terms of time and effort, making it less practical for them to perform than for older veterinarians. Alternatively, based on their undergraduate training, the range of personal protective measures and equipment that constitutes biosecurity to the younger veterinarian, and the number of situations in which these should be applied, may be greater than for older veterinarians.

Veterinarians, who regarded biosecurity as practical to perform in every-day practice also considered it more frequently as effective. Other studies have found that impracticality of biosecurity in everyday practice is a key barrier to personal protective equipment use, for example where it restrains safety, time or causes heat stress.[11, 20] Benedict et al.[3] also suggested veterinarians are inconvenienced by biosecurity practices and that this may prevent veterinarians from performing these practices unless they understand the need and value of them. This suggestion is consistent with cognitive behaviour theories such as the Protection Motivation Theory, which outlines that a person's perceptions of a behaviour's practicality and effectiveness are linked to their motivation and compliance with the behaviour.[21, 22] Consistently, a previous study linked horse owner's perceptions of biosecurity effectiveness to compliance with recommended measures following the 2007 equine influenza outbreak[19] and in the current study we found that those reporting hand-washing/ glove wearing to be ineffective and biosecurity to be not practical, also considered it somewhat likely that they themselves spread infectious disease from one client's horse to another. It is evident that greater emphasis needs to be placed on the practical aspects of implementing biosecurity measures and how to overcome deterrents in future biosecurity training for students and practicing equine veterinarians.

Over time the equine veterinarians in this survey reported an increase in the biosecurity advice given to their clients. Prior to and following the 2007 equine influenza outbreak, practice owners and older veterinarians gave more advice, respectively. Veterinarians mentioned that clients' expected them to provide accurate biosecurity information and advice and be responsible for minimizing infectious disease spread, complementing the results of a previous study which found that equine veterinarians played an important role as a useful and trusted source of infection control information providers during the 2007 equine influenza outbreak.[23] This previous study was based on cognitive behaviour theory and suggested that infection control information delivered by a veterinarian is linked to horse owner's motivation and uptake of biosecurity practices.[23] Other studies have also suggested that veterinarians play an important role in promoting public health through education of clients about zoonotic diseases.[2, 24]

Regarding the response to the 2007 equine influenza outbreak, whilst overall the veterinarians were satisfied with the equine influenza outbreak response they had mixed opinions about the communications and control measures used. Qualitative comments revealed that communications were seen as both positive and negative, a finding consistent with horse owner's views on the same topic.[25] Women were more satisfied with the outbreak information provided by their state department of primary industries, than men. Other studies concerning health information seeking behaviour have found similar differences between males and females.[26-28]

A positive outcome of the outbreak as commented on by many veterinarians was the raising of awareness of emergency animal disease risks and response systems. Awareness is recognized as a key element of good emergency animal disease preparedness.[15]

Similar to communications, the execution of control strategies was seen as both positive and negative. The need to better enforce compliance with regulations and to avoid inequality in vaccine allocation were issues that were also raised by horse managers and discussed in previous work[25], which reported men to be more likely to lament poor enforcement than women. Interestingly, a higher frequency of practice owners than employees reported satisfaction with remuneration for testing/vaccination services. Also, greater proportions of practice owners than employees considered the equine influenza vaccine effective. If related,

these two views possibly suggest a positive perception of the vaccine, based on financial gain of practice owners, which may not have been shared with employees. Alternatively, differing perception of vaccine efficacy may be due to different information sources being accessed regarding the issue.

The view of the majority of participants in this study conducted in 2010, concerning a future response to equine influenza, is consistent with the emergency response arrangements agreed to by government animal health authorities and the horse industry in March 2011.[29]

This study has several limitations. The most important is the poor response rate which could not be increased despite repeated announcements made by conference organisers. Low response rate had two impacts: (a) it reduced sample size, and therefore, the power of the study to identify associations; and (b) it could have caused non-response bias which occurs if those who responded had different perceptions and practices than those who did not respond. Nonetheless, veterinarians who responded to this survey and veterinarians who are EVA members had similar demographics, except for age distribution (Table 1). The second limitation was the selection of a convenience sample: the Australian registered veterinarians attending the EVA conference. The EVA estimates that approximately 80% of veterinarians with substantial horse work are members of the EVA (EVA, personal communication), suggesting that EVA members represent a reasonable sampling frame. Comparing the demographics of the veterinarians in the sample to the demographics of EVA members, it is evident that middle-aged veterinarians and practice owners are over-represented, however, the gender and state distributions are similar. The study design may inflict some sampling bias in that participating veterinarians may be more interested in or have greater financial resources for continuing education and hence may be more likely to practice biosecurity due to the value of their patients and the veterinarian's reputation. Therefore, the results should be interpreted to the whole population of equine veterinarians in Australia with caution. Thirdly, like other cross-sectional studies and surveys, the associations determined in this study are not likely to be causal. Finally another source of bias in this study is recall bias: Undergraduate teaching may be a long time ago and the 2007 equine influenza outbreak occurred three years prior to the study. However, the outbreak was such a memorable event invoking strong opinions that recall bias should be negligible in this case.

The concept of biosecurity has become more prominent and more strictly defined in the veterinary literature over the last two decades. It is likely that the undergraduate training of older veterinarians was not only less in terms of quantity but also not presented under the banner of biosecurity, rather as measures implemented in surgery and clinical procedures. This may have impacted on recall for older participants.

This study of Australian equine veterinarians confirmed the increasing importance of biosecurity in veterinary settings, as both undergraduate training and frequency of advice given have increased over time. The results also revealed differences in biosecurity perceptions among veterinarians, likely to influence their biosecurity performance. Additionally, differences in outbreak information retrieval for different employment statuses (practice owner versus employee) as well as differences in information appraisal by males and females were detected.

Given the identified need for better and more consistent biosecurity behaviour and the limitations of this opportunistic study, it is recommended that these differences in biosecurity perception and practice are further investigated to inform the development of improved biosecurity training with a greater emphasis on practical and applied training at the undergraduate level and at professional development courses for clinical veterinarians.

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Table 1: Description of 45 [a] Australian equine veterinarian respondents to a survey of biosecurity training, biosecurity and infectious disease perceptions and views of the 2007 equine influenza outbreak conducted with Equine Veterinarians Australia conference attendees in 2010.

Variable	Level	Frequency	%	Reference % [b]
Gender	Female	23	52	46
	Male	22	48	54
Age (years)	18-34	10	23	65
	35-54	29	65	11
	≥55	5	12	24
State	New South Wales	19	43	37
	Victoria	9	20	21
	Queensland	8	18	23
	South Australia	4	9	5
	Western Australia	4	9	10
	Australian Capital Territory	0	0	1
	Tasmania	0	0	1
	Northern Territory	0	0	1
	Overseas	1	2	2

[a] One response was excluded from analysis due to the veterinarian being trained and practicing overseas.

[b] Reference data is for all Equine Veterinarians Australia members (n=982) at time of conduct of the study (as of 25 July 2010).

Table 2: Australian equine veterinarians' undergraduate theoretical and practical biosecurity training classified by years since graduation, based on a survey with Equine Veterinarians Australia conference attendees in 2010.

Undergraduate biosecurity training		Years since graduation			*Row Total*	Fisher's exact *p*
		<5 (%)	5-20 (%)	>20 (%)		
Theoretical						<0.001
None		0 (0%)	2 (11%)	10 (56%)	*12 (27%)*	
Some		6 (75%)	15 (83%)	8 (44%)	*29 (66%)*	
A lot		2 (25%)	1 (6%)	0 (0%)	*3 (7%)*	
	Column total	*8 (18%)*	*18 (41%)*	*18 (41%)*	*44*	
Practical						0.014
None		4 (50%)	11 (61%)	14 (78%)	*29 (66%)*	
Some		4 (50%)	6 (33%)	4 (22%)	*14 (32%)*	
A lot		0 (0%)	1 (6%)	0 (0%)	*1 (2%)*	
	Column total	*8 (18%)*	*18 (41%)*	*18 (41%)*	*44*	

Table 3. Australian equine veterinarians' biosecurity and infectious disease perceptions based on a survey with 45 veterinarians attending the Equine Veterinarians Australia conference in 2010.

Variable	Not at all	A little	Somewhat	Very
Likelihood of veterinarians themselves spreading infectious diseases from one client's horse to another	11 (24%)	27 (60%)	7 (16%)[a]	0 (0%)[a]
Effectiveness of hand-washing/wearing gloves in preventing disease spread	0 (0%)[b]	2 (4%)[b]	17 (38%)	26 (58%)
Practicality of performing biosecurity measures in everyday working life	0 (0%)[c]	12 (27%)[c]	23 (51%)	10 (22%)
Vulnerability to endemic zoonotic diseases	3 (7%)[d]	23 (51%)[d]	13 (29%)	6 (13%)
Vulnerability to emerging zoonotic diseases	1 (2%)[e]	19 (42%)[e]	15 (34%)	10 (22%)
Likelihood of a future equine exotic disease outbreak	0 (0%)[f]	12 (27%)[f]	14 (31%)	19 (42%)

[a-f] Responses with the same super-script letter were collapsed for further evaluation using contingency tables.

Table 4: Australian equine veterinarians' level of satisfaction with specific aspects of the 2007 equine influenza outbreak response based on a survey with veterinarians attending the Equine Veterinarians Australia conference in 2010.

Variable	Very satisfied/ Satisfied	Neither satisfied nor dissatisfied	Dissatisfied/ Very dissatisfied
Information provided by state primary industries	27 (64%)	10 (24%)	5 (12%)
General communications by state primary industries	25 (60%)	9 (21%)	8 (19%)
General guidance from state primary industries	25 (60%)	8 (19%)	9 (21%)
Vet involvement in vaccination roll-out	27 (68%)	6 (15%)	7 (17%)
Compensation for business losses	10 (29%)	10 (29%)	15 (42%)
Remuneration for testing/vaccination	17 (49%)	11 (31%)	7 (20%)
Remuneration if worked for animal health authority	6 (28%)	10 (48%)	5 (24%)
Vet involvement in community meetings	12 (35%)	12 (35%)	10 (30%)

Not all questions in this section were applicable to all participants and non-applicable responses are not shown, resulting in varying numbers of responses per question.

Table 5: Identified strengths in EI management based on comments provided by 34 Australian equine veterinarians during the EVA conference in 2010.

Comment category	Category description	Number (%)
Good liaison and/or communication	Good interaction between affected government and industry groups and equine veterinarians; good communications to veterinarians and the public.	13 (38%)
Achieved successful eradication	Achieved successful disease control and eradication.	13 (38%)
Raising of awareness	Raised awareness across the horse industry and the community of equine emergency diseases, the need for response systems, biosecurity and quarantine and the impact of the horse industry on the economy.	11 (32%)
Effective control measures	Effective movement restrictions, vaccination and zoning strategies.	4 (12%)

Table 6: Identified weaknesses in EI management based on comments provided by 34 Australian equine veterinarians during the EVA conference in 2010.

Comment category	Category description	Number (%)
Poor quarantine	The national quarantine facility failed to contain the virus leading to the outbreak.	13 (38%)
Poor compliance with movement restrictions	The movement ban and restrictions were not enforced effectively, particularly at horse events at the initial announcement of the outbreak.	12 (35%)
Late and/or inconsistent vaccination	Vaccination commenced too late; Different horse breeds were treated differently; Animal health authorities used an inconsistent approach and should have used private veterinarian's local knowledge for vaccine distribution.	11 (32%)
Poor communication	Lack of communication with private veterinarians and the Australian Veterinary Association, should have provided information on disease occurrence in the national quarantine facility in order to promote surveillance in the general population and rapidly notified veterinarians when the outbreak was confirmed in the general population; Poor organisation and information resulted in too much bureaucracy and panic; Not all horse owners in the different industry sectors were reached with information.	8 (24%)

Figure 1: Australian equine veterinarians' (n=45) responses to the question "How often did you/do you give biosecurity advice to clients..." surveyed in association with the annual Equine Veterinarians Australia conference in 2010.

'Not often'/'never' responses not shown.