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Controlling equine influenza: policy networks and decision-making during the 2007 Australian equine influenza outbreak

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Summary

Rapid, evidence-based decision-making is critical during a disease outbreak response however compliance by stakeholders is necessary to ensure that such decisions are effective – especially if the response depends on voluntary action. This mixed method study evaluated technical policy decision-making processes during the 2007 outbreak of equine influenza in Australia by identifying and analysing the stakeholder network involved and the factors driving policy decision-making.

The study started with a review of the outbreak literature and published policy documents. This identified six policy issues regarding policy modifications or differing interpretations by different state agencies. Data on factors influencing the decision-making process for these six issues and on stakeholder interaction were collected using a pre-tested, semi-structured questionnaire. Face-to-face interviews were conducted with 24 individuals representing 12 industry and government organisations. Quantitative data were analysed using social network analysis. Qualitative data were coded and patterns matched to test a pre-determined general theory using a method called theory-oriented process-tracing.

Results revealed that technical policy decisions were framed by social, political, financial, strategic and operational considerations. Industry stakeholders had influence through formal pre-existing channels, yet specific gaps in stakeholder interaction were overcome by reactive alliances formed during the outbreak response but outside the established system. Overall, the crisis management system and response was seen as positive and 75–100% of individuals interviewed were supportive of, had interest in and considered the outcome as

good for the majority of policy decisions, yet only 46–75% of those interviewed considered that they had influence on these decisions.

Training to increase awareness and knowledge of emergency animal diseases and response systems will improve stakeholder participation in emergency disease management and preparedness for future emergency animal disease incursions.

Key words: emergency animal disease outbreak, policy decision-making, equine influenza, risk management, preparedness

Introduction:

Good preparedness and response is necessary for rapid and effective action in the case of an emergency animal disease (EAD) incursion in order to minimise adverse consequences such as financial losses, trade restrictions and social impacts.

EADs are diseases, which are likely to have a significant effect on livestock by potentially resulting in livestock deaths, production loss and in some cases impacts on human health and the environment. Equine influenza is classified an EAD in Australia as, prior to the 2007 outbreak, it had never been introduced to the general Australian horse population and it is considered to be in the national interest that the country remains free of the disease.

The risk of an EAD incursion has greatly increased in recent decades due to increased globalisation bringing with it higher volumes and more frequent importations of animals and animal products. An increasing frequency of incursions and the high costs of control warrant exploration of changes to traditional systems and models of risk management. In this study, we evaluated the appropriateness of technical policy decision-making processes during the 2007 equine influenza response and the drivers influencing these processes. Please note that the objective of this study was not to evaluate the 'correctness' or 'appropriateness' of the decisions made.

Rapid decision-making based on epidemiological data on disease distribution is critical during an EAD outbreak response; however, to achieve effective national disease control, epidemiological evidence must be placed in a broader framework – sometimes called macroepidemiology – which takes into account technical capability, socio-political support and economic justification (Hueston and Walker, 1993, Hueston, 2003, Cameron et al., 2005). For example, the importance of socio-political support was evident during the 2001 Foot- and Mouth Disease crisis in the United Kingdom, when mass culling led to an increase in suicide rates among farmers and general public uproar (Barclay, 2005).

The case for applying broader risk assessment frameworks is particularly strong when an emergency disease response relies heavily on producers' trust and their willingness to serve important roles in the prevention, detection and control of the EAD (Delgado et al., 2012). Success may rest on a careful identification of the interests and capabilities of all stakeholders at the policy development stage (Brugha and Varvasovszky, 2000) and maintaining good communications prior to, during and after an emergency (Conkey, 2004). Good stakeholder communications and relationships require advanced planning and preparation (Delgado et al., 2012). Being well prepared in advance for EAD outbreaks and then refining and implementing prior plans to constitute effective policies during an outbreak is critical to achieving control of a disease outbreak as promptly as possible and thereby minimizing its impacts.

Equine influenza is a highly infectious, viral respiratory disease affecting horses and outbreaks of this disease cause considerable financial losses and hardships to horse

industry participants (Hoare, 2011, Taylor et al., 2008). Sporadic outbreaks in countries with endemic disease are common, despite ongoing vaccination (Newton et al., 2006, Barbic et al., 2009, Martella et al., 2007). Cancellation of horse events and movement restrictions in addition to good hygiene practices and vaccination are the commonly used control strategies (Guthrie et al., 1999). In the following sections, we provide some background information about the 2007 equine influenza outbreak in Australia and the Australian EAD response system to provide a context for the readers before discussing methods and results of the current study.

The outbreak

For more than four months during 2007 in Australia, the equine influenza virus spread over an area of approximately 280,000 square kilometres, affecting horses in the two states of New South Wales (NSW)and Queensland, and infecting in total about 70 thousand horses on over nine thousand properties. The outbreak was first confirmed in the general horse population on 25th August 2007 and successful eradication was announced by animal health authorities on 30 June 2008 following the detection of the last known case on 11 January 2008 and substantial surveillance efforts (EI EISG, 2008). The direct costs of the outbreak response to the government were over A$350 million. Additional indirect costs to the industry were far higher but difficult to estimate (Webster, 2011).

The virus inadvertently entered the Sydney quarantine station on 8 August 2007 in infected vaccinated horses imported for breeding from Japan (Callinan, 2008). The disease spread undetected from these imported horses to local horses, yet the exact means of virus escape has not been determined despite being the subject of a thorough legal inquiry (Callinan, 2008). The initial outbreaks amongst local horses were mostly in rural areas, some distance from Sydney. The first local horses infected with equine influenza were competing in an equestrian event at Maitland, NSW between 17 and 19 August. Some of the competing horses were subsequently moved long distances whilst incubating the disease. At least one infected horse likely infected horses competing at another event nearly 400km away at Narrabri NSW, the following weekend (24-26 August). Horses returning home from this event spread the virus further and interstate into southeast Queensland. Most subsequent cases were either linked to these two events or were the result of local spread over distances of around 2–8km from premises infected in the first few weeks of the epidemic (Cowled et al., 2009, Davis et al., 2009, Firestone et al., 2011).

Following the confirmation of the first case in local horses on August 25th, the national Consultative Committee for Emergency Animal Diseases (CCEAD) recommended an initial national horse movement ban of 72 hours in accordance with the pre-existing national response policy, the AUSVETPLAN for Equine Influenza. Subsequent voluntary implementation of the horse movement ban by the states and territories occurred at various times later that day, including legal enforcement of it in NSW. However, the state of Queensland did not legally enforce the movement ban until 26th August and the Northern Territory waited until 27th August (EI EISG, 2008). Initially, animal health authorities identified and quarantined infected properties by implementation of restricted areas surrounding infected premises with a 10km radius and controlling access. On 17th September, the National Management Group endorsed CCEAD's decision for vaccination as a control strategy and variation in the response plan to introduce risk-based zoning. Animal health authorities in the two affected states introduced colour-based restriction zoning with different levels of movement restrictions in different zones depending on risk (Scott-Orr, 2011). In the state of NSW only, a special restricted area with free internal horse movement was implemented from late September in areas of high horse density and infection. The special restricted area was modified in mid October from two initially separate areas to one large special restricted zone (Scott-Orr, 2011).

Vaccination supplies arrived in Australia on 28th September. Vaccination commenced in NSW and Queensland on the 29th September and in Victoria on the 1st October (EI EISG, 2008). The emergency vaccination strategy in NSW included ring vaccination in a buffer zone around infected areas, targeted vaccination of high-risk enterprises (such as racing precincts) and blanket vaccination within affected areas. In Queensland, in addition to targeted vaccination, animal health authorities originally planned ring vaccination starting 10km from the nearest infected property and around major clusters of infection, yet, the plan was changed on 26th September to a single outer vaccination buffer zone surrounding the entire area of infection. From 16th October, an inner vaccination buffer zone was established and further strategic vaccination commenced on 25th October. Between October and December mass, blanket vaccination was performed in Queensland (EI EISG, 2008).

The Australian emergency animal disease response system

Australia's political framework is a federal constitutional parliamentary democracy, in which there is an overarching federal parliament and states or territories with their own parliament. Responsibility for an EAD outbreak is shared between Federal and State/Territory governments in a complex way (Post et al., 2004, Animal Health Australia, 2008).

The structures of the system during normal operations and during an emergency animal disease outbreak are shown in Figure 1[1].

A member of the AHC, Animal Health Australia, is a not-for-profit public company with government and industry members, which coordinates collaborative animal health programs, administers finances and audits program effectiveness. During the 2007 equine influenza outbreak, Animal Health Australia also undertook an operational role in obtaining and distributing vaccine from overseas (Perkins et al., 2011). As part of the Emergency Animal Disease Preparedness Program, Animal Health Australia oversees the government and livestock Industry Cost Sharing Deed in respect of Emergency Animal Disease, referred to as the Emergency Animal Disease Response Agreement (EADRA) and the Australian Veterinary Emergency Plan (AUSVETPLAN), which includes specific response strategies for >30 diseases (Animal Health Australia, 2011).

Prior to the 2007 equine influenza outbreak, Animal Health Australia had prepared an AUSVETPLAN for technical control of an incursion as well as a specific cost-sharing agreement for equine influenza. However, horse industry input and commitment to both of these was uneven. Compared to other Australian livestock industries, the horse industry is unique in that it is comprised of multiple sectors and groups such as several breeding and sporting associations and societies, equestrian sports, recreational activities and racing. However only three horse industry groups were members of Animal Health Australia at the time of the 2007 outbreak, namely the Australian Racing Board, representing thoroughbred racing, Harness Racing Australia and the Australian Horse Industry Council, representing the racing, performance and pleasure horse industries (Glanville and Christie, 2011).

Despite the national arrangements emergency preparedness arrangements, the responsibility for disease control within state or territory jurisdictions lies with the relevant CVO, who acts in concurrence with the jurisdiction's disease control headquarters, one or more local disease control centres and state emergency arrangements including services such as police, transport and community departments (Animal Health Australia, 2008).

Despite the existence of well-established Australian emergency disease preparedness and response programs (which included industry representation), to our knowledge no objective and independent evaluation of stakeholder involvement in an EAD outbreak response has been previously conducted, despite such stakeholder involvement being critical for an

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

effective response (Conkey, 2004, Conkey et al., 2004). Two established risk-based frameworks for animal health or primary industry policy decision-making were available from two Australian jurisdictions (Cameron et al., 2005, Jenner, 2008), however no information was available about whether these frameworks equally apply to exotic animal disease response and in other Australian jurisdictions. The two available frameworks were used as a basis in this investigation to, inductively, identify potential gaps in existing theory.

In this study, a mixed methods approach was used to ascertain and describe stakeholder relationships and sources of risk influencing technical policy decision-making processes during the 2007 equine influenza response. The study results will inform models of risk management and initiatives to increase preparedness for future EAD incursions.

Methods:

Identification of stakeholders and policy decisions

To focus the study on specific policy decisions and to identify relevant stakeholders, the available literature on the 2007 EI outbreak in Australia was reviewed. Stakeholders in this study were defined as "Individuals, groups and organisations, who have an interest and the potential to influence the policy direction" (Brugha and Varvasovszky, 2000). All individuals, groups and organisations mentioned in the literature in connection with the specific policy issues were identified in order to invite their participation in the research interviews. In addition, during the interviews, participants were shown a list of all stakeholders considered and asked whether any additional stakeholders as per definition should be contacted for participation in the study.

The pre-existing national policy document – the equine influenza AUSVETPLAN, which outlines a technical response plan for an equine influenza outbreak (Animal Health Australia, 2007) – was compared to decisions made during the actual EI outbreak, based on a preliminary report from an equine influenza epidemiology support group to the CCEAD (EI EISG, 2008). Six policy decisions, marking deviations from the pre-existing AUSVETPLAN policy or differing interpretations by different states, were identified and used to frame subsequent semi-structured interviews.

Questionnaire design and implementation

A semi-structured questionnaire was developed to collect both quantitative and qualitative data for a parallel mixed analysis, since quantitative methods alone are limited in describing social phenomena and hence require supplementation by qualitative data analysis (Yin, 2011). The questionnaire was pre-tested with three individuals, representing the NSW Department of Primary Industries, and modified according to the feedback obtained. The final questionnaire consisted of 12 questions and on average took 40 minutes to conduct. Half of the questions were quantitative in nature and explored stakeholder group's self-rated level of *support* of, *interest* in and *influence* on six selected policies as well as the nature of *impact* caused by the policy and their relationships with other stakeholders using ordinal response categories. The other half of the interview comprised qualitative exploration of driving factors and risk perceptions regarding the six identified policy decisions. All interviews were conducted face-to-face and when permitted by the interviewee, were audio-recorded. Interviewees were asked about their professional background and involvement in the 2007 equine influenza outbreak, their organisation's influence on various policy developments and decisions, the reasoning for decisions and some perceptions on the influence and interest of other stakeholder groups as well as their own organisation's representation in the decision-making processes.

In total, 15 Australian mainland based organisations were identified as stakeholders and all 15 were approached to participate in this study. Interviewees were recruited by an invitation sent to each stakeholder organization that requested the individuals who had been active in the EI outbreak be identified to participate in an interview. If no response was received after 10 working days of initial sending, a reminder email was sent and if no response to this then no further attempt to contact the organisation was made.

Quantitative data analysis

Contingency tables were prepared – policy issues versus stakeholder responses – from individual level data. Due to many cells with zero counts, the categories of responses were collapsed to create binary outcomes representing stakeholder's level of support of, interest in and influence on the six selected policies. Generalised linear mixed model analyses were then conducted to evaluate differences in stakeholder responses for various policy issues by including organisations as a random effect.

The data from questions with ordinal response categories were also used to describe stakeholder's level of support of, interest in and influence on selected policies in a heat map using spreadsheet software (Microsoft Office Excel, 2007). In this analysis, data were presented at the organisational level and in cases in which more than one person responded from an organisation, the data used represents the percent of respondents supporting a particular position.

Additionally, these data were used to conduct policy network analyses (Ucinet 6 for analysis; (Borgatti et al., 2002) and the identified networks illustrated (Netdraw; (Borgatti, 2002). Again, data were at the organisational-level and in cases in which more than one person responded per organisation the median response was used for network analyses.

Analysis of qualitative data

Theory-oriented process tracing was used to analyse qualitative data to explore whether technical decision-making for equine influenza control exemplified the previously suggested general framework for endemic animal health decision-making (Cameron et al., 2005). This method relies on the theoretical proposition that factors other than classical epidemiological evidence (data on infected premises, spatiotemporal pattern of infection, predictions of outbreak duration and spatial extent) such as social, political or financial factors drive technical decision-making during an EAD outbreak.

The management and analysis of the qualitative data were performed using QSR-NVivo software (QSR International Pty Ltd. Version 9, 2010), as illustrated by others (Bringer et al., 2006, Hutchison et al., 2010). This software allowed documented coding and characterising of large amounts of narrative texts or recordings, data pattern matching to the pre-defined theory (Cameron et al., 2005) and creation of data display graphics (Yin, 2003).

The University of Sydney Human Ethics committee approved the study protocol (project number: 12916).

Results:

Identification of stakeholders and policy decisions

Of the 15 stakeholder groups that were approached based on the initial document review, 12 agreed to participate, two did not respond and one did not agree to participate. Five of these stakeholder groups were from industry, four were from government, two were service providers and one was a public company (Table 1). Semi-structured interviews were

conducted between February and May 2011 with 24 individuals representing the 12 organisations.

The pre-existing national AUSVETPLAN policy framework for an equine influenza incursion (Animal Health Australia, 2007) was compared with a subsequent summary report of available literature that outlined the course of decision-making during the outbreak (EI EISG, 2008). Six policy issues were identified that represented modifications or differing interpretations of AUSVETPLAN by state government authorities (Table 2). First, at the initial start of the outbreak, the commencement times of the voluntary movement ban, and subsequently of legal enforcement of the compulsory movement ban in the affected states differed between jurisdictions. Second, in NSW, the case definition used for an infected property changed from laboratory based to non-laboratory based during the peak of the outbreak. Third, risk-based zoning was not considered in the pre-existing AUSVETPLAN, nor was the fourth issue, use of a special restricted area. Fifth, in a similar manner, pre-emptive vaccination in non-infected jurisdictions was not discussed in the national policy. The last issue of differing interpretations by different jurisdictions referred to the Queensland vaccination strategy of implementing an outer and an inner vaccination buffer zone.

Stakeholders' position on identified policy issues

Of the 24 individuals interviewed, 75-100% supported, had interest in and considered the outcome as good for the four policy decisions: implementation of a national horse movement ban, alteration of NSW case definition, implementation of risk-based zoning and of a special restricted zone extension (Table 3). However, only 46-75% of those interviewed considered that they had influence on the six different decisions.

Although a lower proportion of the interviewees supported, had interest in or perceived the outcome to be good for the other two policy decisions – vaccination in non-combat states and Queensland vaccination strategy – the differences were not statistically significant.

A description of each stakeholder group's position on the six identified policy issues is presented in Table 3. Overall, there was a high level of interest in all policy issues, yet the case definition change in NSW and the vaccination strategy in Queensland elicited less interest from government agencies in other jurisdictions and the Australian Horse Industry Council. Despite some organisations perceiving a neutral or negative outcome about the movement ban and case definition, there was wide support for both decisions. Similarly, the two zoning issues were largely supported and seen as a good outcome by all industry group representatives. Vaccination in non-combat states was not (neutral or opposed) or only partially supported by Animal Health Australia, the service providers (Australian Animal Health Laboratory and Equine Veterinarian Association), the combat state agencies and the Australian Horse Industry Council, yet the other industry groups were supportive and most accepted that it was a good outcome.

The Australian Racing Board was the only industry group to rate itself as influential regarding all decisions made. All other industry groups rated themselves to have been influential on the special restricted zone extension in NSW and vaccine distribution to non-combat states, except Harness Racing Australia whose representatives did not rate the organisation as influential regarding the zone extension (Table 3).

Stakeholder interactions

Stakeholder network diagrams indicating formal relationships and level of communications between stakeholders are shown in Figure 2. Combining strong and weak relationships (Figure 2a/c), both networks have a diameter of two maximum links to connect each node and both networks are very dense (density = 0.91 and 0.83, respectively) providing good coverage (Table 4). The median in- and out-degrees approach the maximum of 11

connections from and to each organisation. However, further examination of the non-existing formal relationships identified gaps between animal health departments of uninfected/non-combat states, the two service providers, and the equestrian and thoroughbred breeding industry groups (Figure 2b). Similar gaps were present for the level of communications except that the Equine Veterinary Association had communication channels with the other stakeholders (Figure 2d).

Qualitative data analyses revealed that during the outbreak, government and industry stakeholders interacted through pre-existing / pre-planned organisational structures and communication arrangements such as Animal Health Australia, the National Management Group and the CCEAD as well as through alliances formed in reaction to the outbreak. Five of nine industry interviewees broadly supported and praised Animal Health Australia regarding their professionalism, logistics and communications role during the outbreak control as illustrated in this comment:

> *"Animal Health Australia were terrific! They used their existing industry forums and newsletters to communicate with the horse industry."*

However, Thoroughbred Breeders Australia and the Equestrian Federation Australia were not directly represented through Animal Health Australia and, based on interviews, did not feel adequately represented through the existing structures. Under strong individual leadership by their president, Thoroughbred Breeders Australia directly addressed the federal minister making a business case for horse movement being required for breeding activities. This action was followed by the Equestrian Federation Australia, which made a business case for high-level performance horses needing to travel in order to partake in qualification events for the 2008 Olympic Games. The other industry sectors considered Thoroughbred Breeders Australia and the Australian Racing Board as preferentially treated (n=9 interviewees) and their perception was also recognised by some interviewees representing government authorities (n=5 interviewees):

> *"The thoroughbred breeders were the squeakiest wheel and perhaps received preferential treatment."*

In response to the Equestrian Federation Australia's direct request to the minister, regarding movement/travel of horses considered 'Olympic hopefuls', they were appointed as an observer on the National Management Group despite not being a member of Animal Health Australia.

Differences in emergency disease preparedness of different states were observed, as interviews revealed that existing government-industry liaison officers were employed in the states of Victoria (which conducted an equine influenza simulation exercise in 2005) and in Queensland (based on previous outbreaks of endemic Hendra virus in that state).

Based on interviews, under-representation of the non-racing sectors of the industry through the pre-outbreak national arrangements (CCEAD and NMG) was compensated through reactive alliances. The two states with active infection formed a state Ministerial Taskforce (in NSW) and the Performance and Pleasure Horse Industry Crisis Committee (in Queensland) in order to specifically represent the non-racing sector's diverse interests in each state.

In addition to issues raised regarding under-representation, other criticisms of existing organisational structures raised by 10 interviewees included technical discussions at CCEAD being too lengthy. These were important for non-combat states to understand the full picture and to continue supporting the national cost sharing, yet too time-consuming for combat state representatives. Interviewees argued that due to individual state implementation of policy and different local conditions and disease foci, the operational focus of CVOs at the

CCEAD should have been of a strategic nature. Technical details should be part of each jurisdiction's disease headquarters' responsibility for implementation. At the same time, the lack of uniformity in movement policies between neighbouring states was lamented as it caused confusion and frustration among horse owners. However, although each jurisdiction is responsible for disease control within its boundaries, the response is governed by a national cost-sharing agreement. Novel policy departures, such as the introduction of risk-based zoning, must be established as a concept at the national level first, followed by national approval of implementation in the individual jurisdictions in order to ensure funding under the national arrangements.

Other criticisms of existing structures included a limited number of working groups to discuss technical issues, which were then discussed in detail at CCEAD distracting from decision-making and untimely or ineffective communication between the CCEAD, National Management Group and industry due to poor communication structures or signed confidentiality agreements. Interviewees also stated that private veterinarians/members of Equine Veterinarian Association represented a sought-after human resource for Animal Health Australia and state departments, particularly for vaccination rollout due to their local knowledge, technical skills and ability to communicate technical issues to owners. However, issues emerged for veterinarians concerning different salaries and regional procedures.

Factors influencing technical decision-making

The stakeholder interviews revealed five distinct sources of risk that influenced the technical decision-making processes: social, political, financial, operational and strategic (Figure 3). These interplayed to various degrees depending on the policy issue:

Implementation of national horse movement ban

Implementation of the national horse movement ban by the different states was influenced by different levels of disease surveillance and preparedness. During the early stages of the outbreak equine influenza appeared to be limited to NSW. With these relatively manageable boundaries, the CCEAD/National Management Group committees made a strategic decision in accordance with the AUSVETPLAN policy to attempt eradication. A major industry player, the Australian Racing Board, supported this by cancellation of race meetings prior to announcement of the national horse movement ban.

Alteration of NSW case definition

Changing the case definition from laboratory-based to clinical signs only in high risk areas or where there was high-risk contact during the peak of the epidemic was considered by most stakeholders as a NSW DPI strategic decision. It allowed targeting of resources on the periphery of the outbreak as well as benefiting operational resource constraint (time to take samples and wait for results and number of veterinarians required to collect samples) and lessening the nationally shared financial burden associated with laboratory diagnosis (due to the cost-share agreement).

Implementation of risk-based zoning

Based on the collected data, the idea of risk-based zoning appeared to have originated in several different organisations. It was seen as a strategic decision to create a barrier ahead of the disease front, bringing operational benefits such as freeing staff and quarantine equipment resources. In addition, there were calls from industry stakeholders to mitigate the impacts of disease by allowing movement outside the restricted areas to ensure business continuity and to limit social impacts.

Special restricted zone extension in NSW

The NSW DPI implemented a decision to link two special restricted areas to allow for horse movements within this larger area and to mitigate industry impacts. The linkage occurred following socio-political lobbying to gain financial benefits through business continuity. It was also a strategic decision technically because horse movement within these areas of high horse density and high disease incidence allowed quick virus 'burn-out' in that the virus could no longer spread due to lack of susceptible horses. It also reduced some social impacts, letting owners get back to their normal routine.

Vaccination in non-combat states

Delivery of vaccine to non-combat states was a contentious issue. Initial vaccine stocks were limited and combat states fighting acute disease demanded vaccine to support their eradication campaigns, whilst non-combat states wanted pre-emptive vaccination to protect horses, particularly valuable stock such as racehorses and horses short-listed for the Olympic Games. Delivery of vaccine to Victoria was viewed as being influenced by financial / political motivation due to the running of the Melbourne Cup and Victorian racing spring carnival and the associated government revenue (through tourism and gambling). In addition, the spring carnival provided a source of income for the Australian Racing Board who undertook profit sharing among the states; hence, it was also seen as benefitting members of the affected racing industries in NSW and Queensland. Despite initial fears of vaccine shortage in the combat states, interviewees also viewed the decision as strategic as it maintained political will and kept non-combat states and the racing industry (who asked for ongoing vaccination) on-side with the eradication campaign funded under a national cost-sharing agreement. Furthermore, it was seen as good public policy because it benefitted Victorian taxpayers.

Queensland vaccination strategy

Regarding the vaccination strategy in Queensland, consideration of local knowledge of private veterinary practitioners was instrumental for a change from the initial vaccination strategy, which was considered ineffective in controlling disease spread. The interviewed stakeholders were wary that resources may have been wasted by the wide outer buffer zone, but admitted that Queensland had different topographic and horse density conditions compared to New South Wales and the ideal buffer size was difficult to judge at the time, yet overall it achieved its purpose of disease eradication.

The most frequently mentioned issue associated with policy development and implementation was managing public expectations and delivering information, thereby reacting to or proactively dealing with public and political pressure. Twelve interviewees stressed the social impacts of the disease incursion, including the novel methods required to deal with community expectations – such as Facebook, Twitter and monitoring and rectifying false rumours on internet forums for horse owners (n=8 interviewees). The importance of consideration of social impacts in decision-making underlined the importance of government–industry communications.

Discussion:

This study was conducted to elucidate stakeholder involvement and factors influencing technical policy decision-making processes during the control of the 2007 Australian outbreak of equine influenza. Australia's animal health authorities were well prepared for an equine influenza outbreak, yet there was generally an underestimation of the size and scope of the industry evident from the fact that not all industry stakeholder groups were involved in prior efforts to prepare for an exotic disease incursion, which was counteracted by political interference during the outbreak. Movement restrictions to control the outbreak resulted in

immediate economic and political crisis (Hoare, 2011) requiring a risk management approach to alleviate impacts as much as possible. A lack of connection between the risk management process and the emergency management process hinders primary industry emergency management and transparency in decision-making (Jenner, 2008). Transparent action, mitigation of impacts and good coordination and collaboration within and across sectors are features of successful emergency risk management (Boin and t'Hart, 2010).

This study identified five categories of risk considered in equine influenza technical decision-making processes, namely strategic, operational, financial, political and social. These categories are consistent with the theoretic framework regarding policy decision-making for endemic animal disease control in the state of Victoria (Cameron et al., 2005) and other work regarding preparedness for primary industries emergencies in the state of South Australia (Jenner, 2008). No additional risk sources were identified, yet the context in which decisions were made was also an important influence, as supported by a commonly used policy analysis framework (Walt and Gilson, 1994).

Interviewees in this study identified mitigation of socio-political impacts and collaboration with the horse industry as the most critical factor during equine influenza control. Political interference, as identified in this study, is recognised as a disabler of primary emergency preparedness as it tends to occur in response to public pressures – exaggerated by media exposure – and results in decisions made at the political level, which are not in accordance with established response plans and systems (Jenner, 2008). Better communication of priority decision-making may also prevent perceptions of favouritism of one sector as observed in this study (Boin and t'Hart, 2010).

As reported in the results, two industry groups were not directly represented through AHA at the national level. This lead to both organisations making a business case to the federal minister and subsequently one of them (Equestrian Federation Australia) was appointed as observer on the National Management Group. Additionally, other alliances (state Ministerial Taskforce in NSW and Performance and Pleasure Horse Industry Crisis Committee in Queensland) were formed during the outbreak at the state level between the non-racing horse industry sectors and the state ministers/animal health departments. Hence, reactive alliances and political interference during the response were associated with some stakeholders' lack of prior involvement in the system and dissatisfaction with the response and not in accordance with the EAD control model arrangements. Dissatisfaction was possibly also derived from an ineffective risk communication strategy (Delgado et al., 2012). Furthermore, the outbreak context was important for the forming of those alliances and social pressure on animal health authorities: the outbreak occurred concurrently with the start of the horse equestrian event season, including Olympic qualification events, the spring racing carnivals and the thoroughbred breeding season, all which were dependent on horse movements (Hoare, 2011). In Victoria, equine influenza control policy was dominated by potentially disastrous impacts on the Melbourne Cup, with wider repercussions for Victorian business and the public. At the time of the 2007 outbreak of equine influenza the Australian federal Minister for Agriculture (which included responsibility for plant and animal quarantine) was a Victorian and a member of the National Party (which represents rural interests). The minister had a personal interest in the thoroughbred breeding and racing industries and following his political career he has worked for both, the Australian Racing Board and the Thoroughbred Breeders Australia.

Good political, government, industry and community awareness of the potential impacts of a an EAD incursion are important for a successful response as it encourages people to take mitigation measures more serious (Jenner, 2008). The pre-existing equine influenza technical response plan and government-industry relations facilitated by Animal Health Australia are evidence of the outbreak risk awareness and preparedness at the national level (Animal Health Australia, 2007), together with ongoing collaborations of all CVOs on the

Animal Health Committee. Also, the 2005 equine influenza simulation exercises raised additional awareness as well as establishing important government-industry relationships in the state of Victoria (Horse Alert Victoria, 2006), yet the other jurisdictions' government and industry organisations may have been less aware of the implications of an equine influenza outbreak prior to 2007. Arguably, the strong initial support from one of the key industries – the Australian Racing Board – marked by cancellation of all race meetings, was influenced by the conduct of the simulation exercise (co-funded by the state organisation under the Australian Racing Board umbrella) which raised general awareness. As a result, the rapid industry support for the 2007 disease eradication can be attributed, among other factors, to good preparedness. A long history of preparedness planning (Animal Health Australia, 2008) together with successful experiences of major livestock disease eradication built on strong collaborations and trust between government and industry (Lehane, 1996), contributed to Australia's animal health agencies being unified in their decision to eradicate the disease, despite this having never been achieved in any other country.

Good preparedness was also displayed in dense stakeholder networks facilitated by Animal Health Australia, yet there were noticeable gaps between the non-Animal Health Australia member industry organisations, the Thoroughbred Breeders Australia and the Equestrian Federation Australia and the uninfected, non-combat state government departments. Qualitative analyses supplemented quantitative network analyses by identifying direct approaches to these groups by the combat state agencies and the groups' establishment of critical links directly to the federal agency to make their case for business survival, relying on horse movements (thoroughbred breeding and travel of Olympic hopefuls), despite being formally represented through Australian Horse Industry Council as part of the broader horse industry. Stronger engagement of those groups in the future is recommended for a more effective response.

Descriptive quantitative analyses also revealed discrepancies between Australian Horse Industry Council's and other industry groups' position, particularly regarding vaccination in non-combat states and in Queensland. These may suggest poor representation of industry organisations by the Australian Horse Industry Council, which is supported by their own lament about a fragmented industry (AHIC, 2011). It can also be argued that the Thoroughbred Breeders Australia and Australian Racing Board represent each other's interests, as nearly 85% of breeders are involved with racehorse ownership and breeders have an interest in 63% of racehorses in training (Geelen, 2010). The thoroughbred racing and breeding sectors were viewed by other industry sectors as being treated preferentially, yet this can be explained by their comparatively well-structured and well-supported industry providing human resources and demographic information as well as performing services such as vaccination on behalf of the animal health authorities (Arthur and Suann, 2011, Glanville and Christie, 2011). In addition to under-representation of industry sectors through the pre-existing structures, there were other weaknesses regarding the system mentioned. Lack of correct understanding about roles was an issue, with differing interpretations of what constitutes a technical issue for decision and implementation at a state level versus a technical issue that required national discussion and approval. Misinterpretation of roles and responsibilities is recognised to hinder emergency management, as non-standard roles are adopted and training of roles, responsibilities and systems is required (Jenner, 2008).

Many interviewees agreed that the pre-existing AUSVETPLAN provided good technical guidance and that one of its strengths lay in flexibility of interpretation by each jurisdiction depending on the local context. However, differences in response by jurisdictions need to be communicated carefully to avoid confusion and frustration, leading to unwillingness of stakeholders to support the response (Conkey, 2004, Conkey et al., 2004). In addition the existing system allows for disease control concepts not considered in the AUSVETPLAN to be flexibly integrated into the response after national approval, as was the case with the equine influenza control zoning: Firstly the process required establishment of a national

framework for disease control zoning in the case of an equine influenza incursion and secondly each infected state had to apply for approval of zoning implementation according to the national framework. The national framework is required to make the decision-making process objective and to proof decisions made during the response for critical review by a royal commission following the campaign. At an operational implementation level, this process was viewed as too slow for effective action. Yet, overall the system was perceived as working very effectively, demonstrated through the overall success of the campaign and the quantitative results that most respondents were supportive of the major decisions made and considered most policy outcomes as good.

The study results are strengthened by the use of triangulation of data sources and methodologies to create complementing and converging lines of inquiry (Yin, 2003). Gaps in quantitative policy network analyses illustrated missing linkages between stakeholders, which were then explained through qualitative analyses. Qualitative data analyses further described stakeholder interaction not obvious from the quantitative data and explained the policy context. The study is focused on interactions between stakeholders at the top-level nationally. Yet, the scope of this study was to assess technical decision-making marking deviations from or modifications to AUSVETPLAN and hence the decisions of interest are subject to national cost-sharing arrangements and scrutiny at the national level.

The quantitative policy network analyses performed in this study illustrates stakeholder relationships visually, yet they were subject to a number of limitations. The networks presented are incomplete due to some organisations refusing to participate. Some additional horse industry organisations were seen as stakeholders by some participants, despite not meeting the study definition as directly having influence or having the power to influence the policy issues discussed in this study. Another limitation is the representation of entire organisations – including different units within an organisation – by one or a few representatives. The industry bodies were contacted through their national representative body as these were on NMG and CCEAD committees, yet during the course of the study it became apparent that the state branches of industry bodies were very active and directly dealing with their respective animal health department, particularly so in NSW and Queensland. The self-reported levels of influence of national organisations thus may or may not be a realistic perception of the industry sectors influence; however, it reflects a perception of their representation in decision-making.

The qualitative analyses used in this study are transparent through the use of QSR NVivo software (Bringer et al., 2006, Hutchison et al., 2010). However, these types of analyses are prone to three types of bias: information bias may be present because interviewees are more likely to report events closer to their role and areas of responsibility and technically more available to them; confirmation bias, as an interviewer may want to confirm a known hypothesis or a interviewees may want to confirm a theory; and ‘predictable world bias’, where people seek order where it may not exist. Despite its limitations, the qualitative approach has its strengths in complementing the conducted quantitative analyses and in reflecting the perceived reality of participants and their views on organisation who did not participate in this study.

In conclusion, using a mixed method approach this study described pre-existing and reactive stakeholder relationships and risk areas (strategic, operational, socio-political and financial) influencing animal health policy decision-making processes as well as the policy context. The findings support existing theory and stress the need for stakeholder consideration and the utilisation of risk management principles in developing animal health policy. Recommendations arising from this work include training to increase awareness and knowledge of potential EAD impacts as well as of existing response systems such as national committees, Ausvetplans and cost-sharing agreements.

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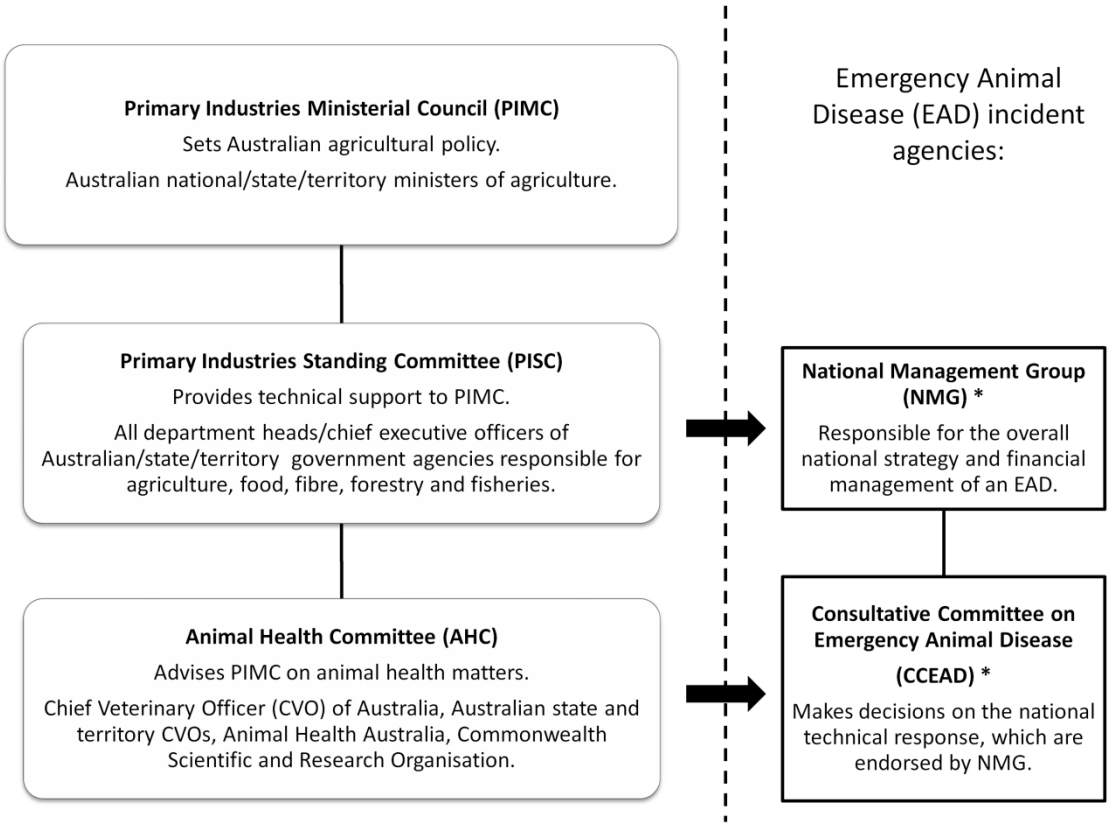

Figure 1: Simplified diagrammatic representation of Australian national animal health arrangements in general and during an emergency animal disease (EAD) incident, adapted from Animal Health Australia (2012).
*Includes industry representation based on industry organisation's membership of Animal Health Australia.

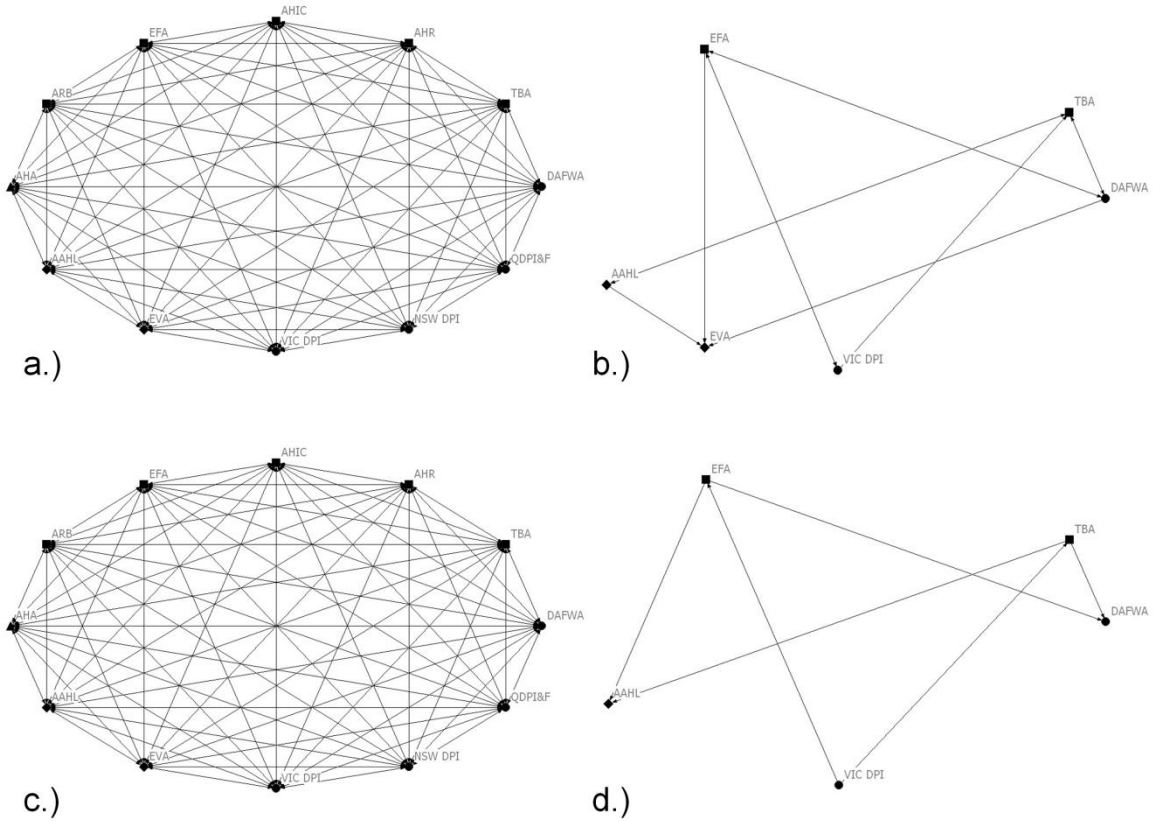

Figure 2: Network diagrams illustrating a.) all self-rated formal relationships, b.) highlighting non-existing formal relationships, c.) all self-rated communication channels and d.) highlighting no communications between stakeholders in the technical control of equine influenza during the 2007 outbreak in Australia. Circle = government organisation; square = industry organisation; triangle = public company; diamond = service provider. NSW DPI = New South Wales Department of Primary Industries; QDPI&F = Queensland Department of Primary Industries & Fisheries; VIC DPI = Victorian Department of Primary Industries; DAFWA = Department of Agriculture and Food, Western Australia; CSIRO AAHL = Commonwealth Scientific and Industrial Research Organisation, Australian Animal Health Laboratory; EVA = Equine Veterinarians Australia; AHA = Animal Health Australia; AHIC = Australian Horse Industry Council; EFA = Equestrian Federation Australia; ARB = Australian Racing Board; TBA = Thoroughbred Breeders Australia; AHR = Australian Harness Racing Council.

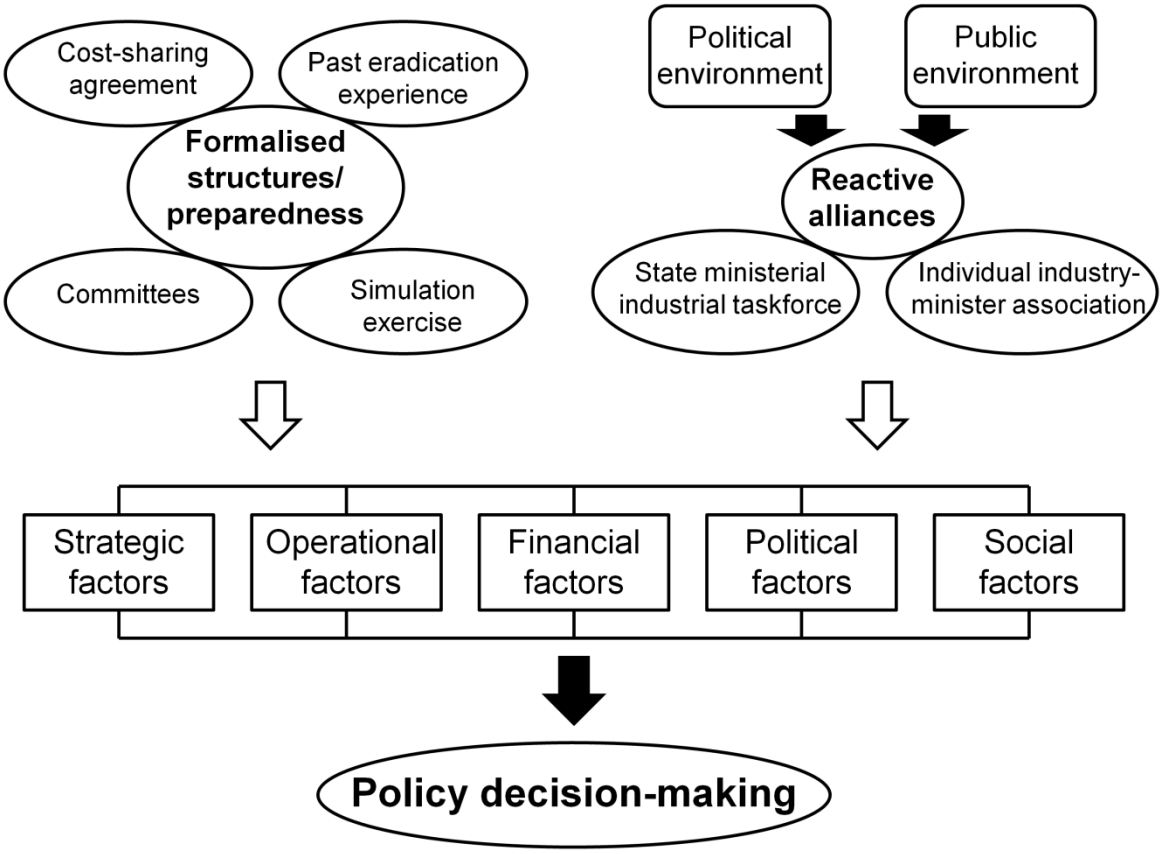

Figure 3: Diagram of concepts explaining policy decision-making during the 2007 technical equine influenza control in Australia. Filled arrows indicate influences; non-filled arrows indicate considerations; ovals = stakeholder interactions; rounded squares = policy environmental conditions; squares = influencing factors.

Table 1: Description of stakeholders regarding technical disease control policies during the 2007 equine influenza outbreak in Australia

Stakeholder	Acronym	Organisation type	Description of stake
New South Wales Department of Primary Industries	NSW DPI	State government	Disease containment and eradication in NSW
Queensland Department of Primary Industries & Fisheries (now part of the Department of Employment, Economic development and Innovation)	QDPI&F	State government	Disease containment and eradication in Queensland.
Victorian Department of Primary Industries	VIC DPI	State government	Preventing disease spread into Victoria and national eradication.
Department of Agriculture and Food, Western Australia	DAFWA	State government	Preventing disease spread into Western Australia and national eradication.
Commonwealth Scientific and Industrial Research Organisation, Australian Animal Health Laboratory	CSIRO AAHL	Government service provider	Meeting demand for laboratory services.
Equine Veterinarians Australia	EVA	Industry service provider	Informing private veterinary practitioners.
Animal Health Australia	AHA	Public company	Providing information and managing vaccination.
Australian Horse Industry Council	AHIC	Industry	Ensuring the meeting of members needs.
Equestrian Federation Australia (now Equestrian Australia)	EFA	Industry	Ensuring the meeting of members needs.
Australian Racing Board	ARB	Industry	Ensuring business continuity for the thoroughbred racing industry.
Thoroughbred Breeders Australia	TBA	Industry	Ensuring business continuity for the breeding industry.
Australian Harness Racing Council (now Harness Racing Australia)	AHR	Industry	Ensuring business continuity for the harness racing industry.

Table 2: Technical policy issues identified as modifications to or different interpretations of the equine influenza AUSVETPLAN by different states during the 2007 Australian outbreak

Date	Policy issue	AUSVETPLAN 2007 policy description	Actual policy implementation
25-27 Aug	National standstill	"A rapidly implemented national horse movement standstill for a prescribed period could minimise the risk of further spread of EI while the nature and extent of an outbreak are being identified."	Different times of implementation and legal enforcement of the national standstill in different states and territories
7 Oct	NSW case definition	"A recommended case definition is a 'high morbidity respiratory disease in horses involving fever, coughing and nasal discharge, with or without a risk contact in the history."	Initial case definition based on laboratory testing only, followed by declaration of infected premises in high-risk areas or with high-risk contacts based on clinical signs
21 Sep	Risk-based zoning	Not indicated in AUSVETPLAN as a containment strategy, but zoning foreseen as a strategy to facilitate exports and for continuation of horse events outside infected areas	Variation in response plan by introducing risk-based zone containment strategy
19 Oct	Purple zone expansion	Not indicated in AUSVETPLAN	Further variation in the response plan
28 Sep	Vaccine supply to non-combat states	"Preemptive vaccination, which targets enterprises and populations that could be expected to contribute most to future spatial transmission of infection." "If an Australian outbreak were expected to spread rather than be contained, all racing horses outside the restricted area could be vaccinated prophylactically to enable racing to continue in unaffected areas while the eradication effort continues."	Controversial distribution to unaffected states.
27 Sep/ 25 Oct	Queensland vaccination strategy	"It may allow authorities to effectively contain the outbreak by creating a vaccinated buffer zone to reduce the risk of spread from the restricted area."	Vaccination of infected horses in buffer zones in NSW versus in an outer vaccination buffer zone in Queensland followed by an inner buffer zone.

Table 3: Heat map describing stakeholders' self-rated level of support, interest and influence on as well as impact caused by six policy decisions related to technical equine influenza control in Australia in 2007

Policy issue	Self-rated responses[a]	AAHL (n=1)	NSW DPI (n=5)	QDPI&F (n=3)	VIC DPI (n=2)	DAFWA (n=1)	AHA (n=1)	EVA (n=1)	AHIC (n=3)	EFA (n=2)	TBA (n=1)	ARB (n=1)	AHR (n=2)
Implementation of national horse movement ban	Being supportive	100	100	100	100	100	100	100	100	100	100	100	100
	Being interested	100	83	100	100	100	100	100	100	100	100	100	100
	Perceiving a good outcome	100	100	100	100	100	100	100	67	100	0	100	100
	Perceiving to have had influence	100	100	100	100	100	0	0	100	0	100	100	0
Alteration of NSW case definition	Being supportive	100	100	67	100	100	100	100	67	100	100	100	50
	Being interested	100	100	33	50	100	100	100	33	50	100	100	100
	Perceiving a good outcome	100	100	67	100	100	0	0	67	100	100	100	50
	Perceiving to have had influence	100	100	67	0	100	0	0	0	0	0	100	0
Implementation of risk-based zoning	Being supportive	100	100	100	100	100	100	100	100	100	100	100	100
	Being interested	100	100	100	50	100	100	100	100	100	100	100	100
	Perceiving a good outcome	100	100	100	100	100	100	100	100	100	100	100	100
	Perceiving to have had influence	100	100	100	50	100	0	0	0	50	100	100	50
Special restricted zone extension	Being supportive	100	100	67	100	100	100	100	100	100	100	100	50
	Being interested	100	83	33	100	100	100	100	100	100	100	100	100
	Perceiving a good outcome	0	83	33	100	100	100	100	100	100	100	100	100
	Perceiving to have had influence	0	83	33	0	100	0	0	67	100	100	100	0
Vaccination in non-combat states	Being supportive	0	50	33	100	100	0	0	33	100	100	100	100
	Being interested	100	67	67	100	100	100	100	100	100	100	100	100
	Perceiving a good outcome	0	50	0	100	100	0	0	33	100	100	100	50
	Perceiving to have had influence	0	33	33	100	100	0	0	33	100	100	100	100
Queensland vaccination strategy	Being supportive	0	83	100	100	100	0	0	33	100	100	100	100
	Being interested	0	67	100	50	100	100	100	33	100	100	100	100
	Perceiving a good outcome	0	83	100	100	100	0	0	67	100	100	100	100
	Perceiving to have had influence	0	83	100	0	100	0	0	0	50	100	100	50

[a] % being supported/ interested, perceiving a good outcome/to have influence as opposed to being neutral or opposed/ uninterested/ perceiving a bad outcome, perceiving to have no influence. AAHL = Australian Animal Health Laboratory; NSW DPI = New South Wales Department of Primary Industries; QDPI&F = Queensland Department of Primary Industries & Fisheries; Vic DPI = Victorian Department of Primary Industries; DAFWA = Department of Agriculture and Food Western Australia; AHA = Animal Health Australia; EVA = Equine Veterinarians Australia; AHIC = Australian Horse Industry Council; EFA = Equestrian Federation Australia; TBA = Thoroughbred Breeders Australia; ARB = Australian racing Board; AHR = Australian Harness Racing Council.

Table 4: Description of networks considering self-rated levels of a) formal relationships and b) communications among stakeholder groups regarding technical control policy decisions made during the 2007 outbreak of equine influenza in Australia.

	Network	
Parameter	**Formal relationships[a]**	**Communications[b]**
Network size		
Number of nodes	12	12
Number of directed links	120	109
Size	132	132
Diameter	2	2
Measures of centrality		
Median in-degree (range)	10.5 (8-11)	9 (7-11)
Median out-degree (range)	11 (8-11)	9.5 (6-11)
In-degree centralization	0.95	0.82
Out-degree centralization	1	0.86
Measures of cohesion		
Density (directed)	0.91	0.83
Median geodesic distance	1	1

[a] Weak and strong relationships versus no relationship
[b] Regular or frequent communication versus occasional or no communications.