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Descriptive Epidemiologic Characteristics of Cases from the 2011 Multistate EHV-1 Outbreak and Summary of Epidemiologic Investigation

This report is a summary of a multistate EHV-1 outbreak. It includes highlights from the final outbreak situation report, and descriptive characteristics and temporal presentations of cases based on an epidemiologic investigation conducted by USDA–APHIS–VS.

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Abbreviations

AAEP	American Association of Equine Practioners
ACVIM	American College of Veterinary Internal Medicine
AHC	American Horse Council
APHIS	Animal and Plant Health Inspection Service (USDA)
AVIC	Area Veterinarian-in-Charge
CEAH	Centers for Epidemiology and Animal Health (USDA–APHIS–VS)
CNS	Central nervous system
DNA	Deoxyribonucleic acid
EHM	Equine herpesvirus myeloencephalopathy
EHV-1	Equine herpesvirus-1
NCHA	National Cutting Horse Association
ORF	Open Reading Frame
PCR	Polymerase chain reaction
SAHO	State Animal Health Official
SNP	Single nucleotide polymorphism
VS	Veterinary Services (USDA–APHIS)

Introduction

Equine herpesvirus (EHV-1) infection occurs in horse populations throughout the world.[1] Three syndromes are associated with this multifactorial (virus, host, and environment) disease in horses: 1) sporadic occurrence of mild respiratory disease associated with fever, primarily in horses less than 2 years of age; 2) abortion or neonatal infection; and 3) outbreaks of neurologic disease (equine herpesvirus myeloencephalopathy (EHM), outbreaks of which have been associated with extensive restrictions on horse movement and horse deaths.[1] Latency and reactivation of the virus are important aspects of the epidemiology of EHV-1 infection.[1] Current vaccines and management practices do not prevent EHV-1 infections in pregnant mares or initial infections in foals.[1] At equine breeding facilities, EHV-1 infection in foals occurs in the first weeks to months of life.[1]

In 2007, the U.S. Department of Agriculture–Animal and Plant Health Inspection Service–Veterinary Services (USDA–APHIS–VS) Centers for Epidemiology and Animal Health (CEAH) concluded that data related to EHM were insufficient and, therefore, more investigations were needed to better understand and identify factors that play a role in the potential emergence of the disease.[2] Further, it was concluded that identifying such factors could help control future outbreaks and, since the general ecology of this disease is not fully understood, additional research was needed.[2]

In a report summarizing the experiences of veterinarians involved in managing outbreaks of EHM from 2003 through 2007, veterinarians indicated a need for further study of EHM through the collection of epidemiologic data during future outbreaks.[3]

Because of the recent increased impact of EHM in North America, the American College of Veterinary Internal Medicine (ACVIM) released a consensus statement identifying key challenges to controlling EHM.[1] Nine major topics related to EHV-1 are addressed in the ACVIM consensus statement:

1) pathogenesis,
2) neuropathogenic strains of EHV-1 and their clinical implications,
3) epidemiology,
4) risk factors for disease,
5) diagnostic testing,
6) how and when to use commercial EHV-1 vaccines,
7) disease control and prevention,
8) outbreak response, and
9) treatment.

The consensus statement notes that advances in diagnostic testing to detect EHV-1, such as real-time PCR platforms, allow for more sensitive detection and greater specificity.[1] The statement goes on to say that PCR tests that distinguish between the two EHV-1 biovars or types are commercially available.[1]

One of the largest EHM outbreaks in North America occurred in horses that had attended the National Cutting Horse Association (NCHA) Western National Championship held April 29 to May 8, 2011, in Ogden, UT. Because of the multistate nature of the outbreak, the American Association of Equine Practitioners (AAEP), the American Horse Council (AHC), and the National Assembly of State Animal Health Officials (NASAHO) requested assistance from the USDA–APHIS–VS in coordinating and communicating the outbreak response. It should be noted that the detailed data related to the case characteristics and case premises were not part of the USDA–APHIS–VS reporting during the outbreak. This multistate outbreak provided VS with

the opportunity to conduct an epidemiologic investigation of EHM cases and of EHV-1 cases that did not exhibit neurologic signs.

This technical report provides a summary of the outbreak investigation with respect to the management of the outbreak. Descriptive characteristics of primary and secondary EHV-1 (with no reported neurologic signs) and EHM cases are included.

Overview of Outbreak Response and Coordination

The first official announcement confirming EHM in a horse that had attended the NCHA event in Ogden, UT, was made through a press release from the State Veterinarian of Colorado on May 13, 2011. On May 14 and 15, 2011, additional cases of disease and several fatalities occurred in horses from multiple States and Western Canada that had attended the event. On Monday, May 16, 2011, the NCHA notified State Animal Health Officials (SAHO) of horses from their States that were entered in the event. SAHOs contacted the owners of these potentially exposed horses.

On May 16, 2011, USDA–APHIS–VS responded to requests from the AAEP, the AHC, and the NASAHO to assist by coordinating and communicating the outbreak response. Standardized recommendations for managing infected and exposed horses were developed by VS and sent on May 17, 2011, to all States with exposed horses; the recommendations were posted on a USDA–APHIS–VS Web site.[4] SAHOs helped implement the recommendations, which included isolating exposed horses, monitoring for clinical signs of disease related to EHV-1 infection, and working with private veterinary practitioners to test and manage affected horses. Enhanced biosecurity procedures were recommended for premises with suspect and confirmed cases, to mitigate further disease spread.[4]

The distinction between the wild type of EHV-1 (also referred to in some literature as the non-neuropathogenic type) and the neuropathogenic type is based on identifying a single nucleotide polymorphism (SNP) within the EHV-1 gene coding for viral DNA polymerase (open reading frame ORF30).[1,3] The EHV-1 strain in this outbreak was the neuropathogenic type.

VS posted weekly situation reports from May 19 through June 23, 2011, based on information contributed by States.[5] The reports included a tally of primary and secondary exposed horses and case numbers for each State using the following standardized case definitions.

Suspect EHV-1 case: An exposed horse that becomes febrile (rectal temperature greater than 101.5°F) during the monitoring period.

Confirmed EHV-1 case: A suspect EHV-1 case in which infection is laboratory confirmed by virus isolation and/or PCR detection, or a fourfold change in titer on the serum neutralization test using paired sera.

Suspect EHM case: An exposed horse exhibiting signs of central nervous system (CNS) dysfunction, including most commonly posterior incoordination, weakness, recumbency with inability to rise, or bladder atony.

Confirmed EHM case: A suspect EHM case testing positive for EHV-1 by virus isolation and/or PCR on nasal swab or blood (buffy coat). In cases of sudden death or when the horse dies as a result of neurological complications, the postmortem lesions are consistent with those of myeloencephalopathy, and EHV-1 has been

isolated, detected by PCR, or demonstrated by immunohistochemical examination of the CNS.

Nonclinical EHV-1 case: An exposed horse with no clinical signs (afebrile, nonneurologic) testing positive for EHV-1 by virus isolation and/or PCR on nasal swab or blood (buffy coat). *Note the number of nonclinical EHV-1 cases was not included in the weekly or final situation reports.*

Primary exposure: A horse that attended the NCHA event in Ogden, UT, from April 29 to May 8, 2011.

Secondary exposure: A horse that did not attend the NCHA event in Ogden, UT, but was subsequently exposed to a horse that attended the event.

As part of the situation reporting during the outbreak, SAHOs did not supply USDA–APHIS–VS with detailed case information, such as signalment, EHV-1 vaccination history, number of case horses per premises, or onset date for clinical signs.

The final situation report from USDA–APHIS–VS, dated June 22, 2011, documented 100 primary suspect or confirmed EHV-1 (no reported neurologic signs) or EHM cases (table 1).[5] The number of nonclinical EHV-1 cases was not included in the situation reports.

Table 1. Number of **primary exposed** horses, suspect, and confirmed EHV-1 and EHM cases, and number of States with primary exposed horses and confirmed or suspect EHV-1 and/or EHM cases:

Number of primary exposed horses at Ogden, UT, NCHA event	Number of EHV-1 suspect cases	Number of EHV-1 confirmed cases	Number of EHM suspect cases	Number of EHM confirmed cases	Number of States with primary exposed horses	Number of States with confirmed or suspect EHV-1 and/or EHM cases
425	40	28	6	26	19	12

Based on the final situation report from USDA–APHIS–VS there were a total of 62 suspect or confirmed secondary exposed EHV-1 or EHM cases (table 2).[5] The number of nonclinical EHV-1 cases were not included in the situation reports.

Table 2. Number of **secondary exposed** horses, suspect, and confirmed EHV-1 and EHM cases, and number of States with secondary exposed horses and confirmed or suspect EHV-1 and/or EHM cases:

Number of secondary exposed horses	Number of EHV-1 suspect cases	Number of EHV-1 confirmed cases	Number of EHM suspect cases	Number of EHM confirmed cases	Number of States with secondary exposed horses	Number of States with confirmed or suspect EHV-1 and/or EHM cases
1,685	22	29	4	7	14	10

Based on the absence of new cases or new premises with cases, disease spread in connection with this outbreak was considered contained on June 23, 2011**.**

A summary of State and Federal resources dedicated to the field response to this outbreak was summarized by USDA–APHIS–VS.[6] This analysis estimated the total reported resource allocations and costs associated with VS Area and SAHO offices responding to the 2011 EHV-1 disease outbreak. The goal of the analysis was to provide information to be used by SAHO offices to estimate resource requirements for a field based response to future outbreaks or emergencies.[6]

Epidemiologic Investigation Methods

The study was granted regulatory compliance approval as an emergency epidemiological investigation by the Federal Office of Management and Budget. Premises- and horse-level questionnaires (see Appendices D–F) were developed by VS veterinary epidemiologists and economists to collect detailed epidemiologic, clinical, and economic information from premises with one or more primary or secondary cases associated with the multistate outbreak. These questionnaires were reviewed by several external subject-matter experts prior to finalization.

The premises-level questionnaire consisted of 26 questions related to the population of horses on the premises, resources allocated to responding to the outbreak, premises biosecurity practices, and monitoring exposed horses. A few questions on the premises-level questionnaire also related specifically to horses: equine inventory and number of horses that attended the NCHA event; activities that each horse participated in; number of horses with fever or neurologic signs; and number of horses with laboratory confirmation of EHV-1 infection.

The horse-level questionnaire contained 56 questions related to signalment, use of the horse, competition level, housing, EHV-1 vaccination history, clinical signs and date of onset, status of the horse (alive, dead, euthanized) and, if alive, status of recovery, treatment history, diagnostic test results, costs associated with the management of the case, which areas of the NCHA event center the horse visited, where the horse was housed at the event, classes in which the horse competed at the event, and travel history before and after the event. In addition, questions were

included about the economic impact incurred by premises and horse owners during the EHV-1 outbreak in both questionnaires (Appendices D–F).

In each State, State or Federal Animal Health Officials had categorized horses as primary or secondary exposed cases and as suspect or confirmed EHV-1 or EHM cases, based on defined criteria. EHV-1 case horses displayed fever or other signs consistent with EHV-1 infection, but had no reported neurologic signs. Some of the horses likely changed status during the outbreak, and their status was updated during weekly situation reports. For example, a suspect case could become a confirmed case if its laboratory results indicated EHV-1 infection, or an EHV-1 case with fever but no initial neurologic signs could become an EHM case if the horse later developed neurologic signs. The number of primary and secondary suspect and confirmed EHV-1 and EHM cases by State based on the VS final situation report are summarized in table 3.[5]

On July 11, 2011, VS epidemiologists and agricultural economists conducted a conference call with SAHOs and Federal Area Veterinarians-in-Charge (AVIC) in the 13 States that had suspect and/or confirmed primary and/or secondary cases.[5] During the call, using questionnaires for the study was discussed, and each State was asked to identify a study coordinator. State study coordinators received all subsequent communications regarding the study from the USDA–APHIS–VS study coordinator. Horses eligible for the study had to meet one of the case definitions in the recommendation document.[4]

The written study plan and electronic versions of the questionnaires were sent to the study coordinators in each State. USDA–APHIS–VS requested that an attempt be made to complete a premises-level questionnaire for each operation with a confirmed or suspect EHV-1 or EHM case, whether from primary or secondary exposure. An attempt to complete a horse-level questionnaire was to be made for all case horses. Study coordinators in each State were familiar with potential study participants (owners and/or trainers) based on case investigations made during the outbreak; thus, they were positioned to determine how best to collect questionnaire data based on existing resources within their State.

State coordinators received a letter from the Director of the VS–Western Region Office and the Director of VS–CEAH urging them to share the study objectives with potential participants while encouraging them to participate in the study. In addition, the NCHA included a notice about the study in its July 13, 2011, newsletter, which was sent to more than 143,000 members. The notice informed NCHA members of the upcoming epidemiologic study and urging them to participate in the study.[7]

The number of contacts and the method of contact with potential participants were delegated to the State coordinators. Responses on the questionnaires were reviewed by the State coordinators for completeness and data accuracy. Completed questionnaires were then mailed to the VS study coordinator for another review. During this review, any corresponding medical records and laboratory test results were attached and, if need be, follow-ups with State coordinators were made to improve the quality and completeness of the data. To maintain the confidentiality of respondents and the identities of the horses, identity-related information was removed from the premises and horse-level questionnaires. Corresponding medical and laboratory records were assigned a code designated by the VS study coordinator.

Questionnaire responses were entered into a SAS database (SAS ver. 9, SAS Institute, Inc., Cary, NC). Data were validated by applying a SAS program specific to the premises-level and case horse-level questionnaires. SAS was used to analyze

the data. For instances in which the mean and median were similar, only the mean was reported. When the mean and median differed, then the median was reported. Data collection for the study began July 18, 2011, and concluded on October 8, 2011.

Epidemiologic Investigation Results

Primary cases

For this epidemiologic study, primary exposed cases were horses that attended the NCHA event at Ogden, UT, and developed a fever, neurologic signs, and/or tested positive for EHV-1 by PCR. A total of 35 primary case horse questionnaires were completed. Not all questions were answered by some respondents, resulting in missing characteristic data for some horses. Of the primary cases, the majority were Quarter horses aged 5 to 15 years (table 4). The distribution of female horses (all of which were not pregnant) and male horses was about equal. Thirty-two primary-case horses were reportedly used for cutting* purposes, and 3 were used for another purpose. The majority of primary cases were exercised at moderate levels, which was described in the questionnaire as exercising 3 to 5 hr/wk: mostly trotting with some walking and some cantering, and possibly some other type of activity.

Of the 35 primary cases, 29 had competed at the Ogden event, 2 served as turnback** horses at the event, and 4 were there for the experience of attending an event and did not compete or serve as turnback horses. Horses that competed at the Ogden event participated in 1 to 12 classes (median of 2 classes). There was no single class in which all primary cases were competitors.

Among the 35 primary cases, 24 horses had a fever and 20 had neurologic signs consistent with EHM. The four primary cases that did not have fever or neurologic signs were positive for EHV-1 via PCR test. Approximately half of the primary cases were females, but more than half (13 of the 20 primary cases) with neurological signs were females. The mean duration of fever among primary cases was 2.9 days (range 1 to 11 days); highest temperatures ranged from 101.5° to 105.8°F. The time from fever detection to onset of neurologic signs in the 13 horses with both of these clinical signs ranged from -1 (neurologic signs preceded detection of fever) to 3 days (figure 1). The earliest date of fever onset among primary cases was May 9, 2011. The greatest number of febrile horses had an onset date of May 13, 2011. The earliest reported onset date for neurologic signs was May 10, 2011. One primary case reportedly had an onset of disease on May 8, 2011, yet did not develop fever until May 11.

The neurologic signs detected in primary cases included: incoordination or wobbly gait (n=20); dogsitting (n=4); down (recumbent) and unable to rise (n=5); exaggerated limb movements, either when walking or while recumbent (n=6); stumbling and falling (n=10); circling (n=2); disorientation (n=5);lethargy (n=20); urine dribbling (n=12); and flaccid tail (n=11). In addition to fever and neurologic signs, other clinical signs detected in these horses included nasal discharge (n=8);

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* An equestrian event in the western riding style in which a horse and rider are judged on their ability to separate a single animal from a cattle herd and keep it away for a short time.

** Horses used to hold cattle from running to the opposite end of the arena. Turnback horses also play a role in how well the working/competing horses do their job.

coughing (n=3); off feed (not eating the feed provided due to anorexia or inappetence, n=5); change in eye color (blue eye turned green coloration (n=1); and limb edema (n=6).

The results of EHV-1 PCR testing performed on nasal swabs and/or blood samples were provided on 27 of the 35 primary exposed cases. Of these 27 horses, 6 tested positive only on the blood sample, 5 tested positive only on the nasal swab sample, 8 tested positive on both blood and nasal swab samples, and 1 tested positive on a sample other than blood or nasal swab. One additional horse tested PCR positive on a sample other than blood or nasal swabs (table 4). EHV-1 PCR testing was performed at seven different laboratories, and test methods used were not uniform across the laboratories.

All four barns at the event center had housed horses that were subsequently identified as primary cases (figure 2). During the event, the most common areas the horses visited other than their housing quarters were riding arena (32 cases) and spike arena (31 cases). Other areas were visited by a smaller number of primary case horses, including the outdoor stadium (3 cases) and the racetrack (11 cases).

As reported in the questionnaire, from May 1, 2010, to April 28, 2011 (12 months before the NCHA event), 26 primary case horses had been vaccinated against EHV-1 and 6 had not been vaccinated during that period; vaccination history was not reported for 3 primary cases. The majority of horses that were reportedly vaccinated against EHV-1 in the 12 months before the NCHA event had received a vaccine that included inactivated EHV-1, with label indication for control of respiratory disease. Only one primary case had reportedly received the modified live EHV-1 vaccine. Ten horses were reportedly vaccinated against EHV-1 from March 25 to April 28, 2011 (within the 5 weeks before the NCHA event); 9 of these became EHM cases. All of these horses reportedly received an inactivated, multivalent type of vaccine containing EHV-1.

Of the 35 primary cases, 29 were treated postexposure with a nonsteroidal anti-inflammatory drug such as flunixin meglumine or phenylbutazone; 21 were treated with dimethyl sulfoxide (DMSO); 14 were treated with corticosteroids; 13 were treated with fluids; 11 were treated with antibiotics; 4 were treated with an immunomodulator; 1 was treated with seizure medication; 2 were placed in a sling; 5 were treated with a drug that reduces clot formation (i.e., aspirin); and 14 were given lysine. There were 25 horses treated with an antiviral drug and, when the drug type was specified, it was valacyclovir. The timing of the initiation of antiviral drug administration in relation to onset of clinical signs was not available from the questionnaire. Besides the treatments listed on the questionnaire, other specified treatments given to one or more of the primary cases included vitamin E, gastric ulcer treatment, acupuncture, sedation, and vitamin B.

The status of 18 of the surviving primary cases was provided at the time of questionnaire completion. The status of the other nonfatal cases was not provided on the questionnaire; 15 recovered fully and 6 had not fully recovered (table 4). The duration from development of clinical signs to full recovery was reported for 12 horses and ranged from 2 to 80 days, with 7 horses recovering within 14 days. Four primary cases were euthanatized, three of which were neurologic cases (EHM), while one was euthanatized due to colic. The horse euthanatized due to colic was a 19-year-old Quarter horse gelding that tested positive for EHV-1 but that had no clinical signs consistent with EHV-1 infection. The three EHM cases that were euthanatized were female Quarter horses that were 5, 7, and 16 years of age (table 4). All three of these horses had become recumbent and unable to rise. The dates of

onset of clinical signs in these three horses were May 11, May 12, and May 14, 2011, and only one horse had a fever. One of the three was treated with an antiviral drug.

Primary case premises

The 35 primary cases were from 25 premises. The number of primary cases per premises ranged from 1 to 4, with the majority of premises (n=19) having only 1 primary case. The median number of equids on premises with primary cases during the isolation and monitoring period was 18 and ranged from 1 to 200. The mean duration of isolation and monitoring for premises with primary cases was 31.5 days. Three premises with primary cases had secondary cases, ranging from one to four secondary cases per premises.

Information on two categories of biosecurity practices used on premises with primary cases was reported: biosecurity practices normally implemented after returning from any equine event, and biosecurity practices implemented in response to the EHV-1 outbreak (table 5). The most common biosecurity practices normally implemented by respondents for the 19 premises with primary cases that responded to the biosecurity question (6 premises did not respond to this question) were: do not allow unnecessary visitors on the premises (n=7), clean and disinfect hands (n=7), and clean and disinfect trailer between loads (n=6). The most common biosecurity practices implemented in response to the Ogden EHV-1 outbreak by premises with primary cases were: taking horses' bodily temperatures (n=18), cleaning and disinfecting hands (n=18), isolation of returning horses (n=16), disinfecting or changing footwear (n=16), and cleaning and disinfecting the trailer (n=16).

The biosecurity practices normally used by the fewest respondents were: use of disposable personal protection equipment (coveralls and gloves, etc., n=1), use of signage instructing personnel and/or visitors about biosecurity practices (n=1), and having separate workers care for returning horses (n=1). In response to the outbreak, the least frequently used biosecurity practices were: use of signage to instruct personnel or visitors about biosecurity practices (n=3) and dedicating separate personnel to care of returning horses (n=7).

The most common normal biosecurity requirement for visitors (including boarders, veterinarians, farriers, and others) were: hand hygiene (n=6) and separate or disinfected feed equipment (n=4). The least commonly implemented practices normally in place for visitors were: use disposable personal protection equipment (n=1), change of clothing or wearing clean coveralls (n=1), and cleaning and disinfecting footwear (n=1). The most common requirements for visitors in response to the outbreak were: hand hygiene (n=15) and cleaning and disinfecting footwear (n=13).

Secondary cases

Questionnaire data were provided on 15 secondary case horses from 8 premises. Premises could have had a secondary case based on having had a primary exposed horse or horses that returned to the premises, or secondary exposure could have occurred at a location other than home premises. The secondary cases included 12 Quarter horses, 1 American Paint/Quarter horse cross, and 2 Warmbloods (Oldenburg and Trakehner) (table 6). The majority were less than 5 years of age. Ten horses were used for cutting activities. There were 12 horses in moderate exercise level, 1 each in a light and heavy level of exercise. Level of exercise was not reported for one horse.

Among the 15 secondary cases, 14 horses had fevers, with the earliest date of onset being May 15 (range May 15 to May 28, 2011); 4 horses had neurologic signs, with earliest date of onset being May 15 (range May 15 to May 23, 2011). One secondary case did not have reported fever or neurologic signs but tested positive for EHV-1 by PCR. Mean duration of fever among secondary cases was 4 days, and the reported highest temperatures ranged from 101° to 104.7°F.

The neurologic signs among the secondary cases included incoordination/wobbly gait (n=3), down (recumbent) and unable to rise (n=1), exaggerated limb movements either when walking or while recumbent (n=2), stumbling/falling (n=2), disorientation (n=1), lethargy (n=3), urine dribbling (n=2), and flaccid tail (n=2). Symptoms other than fever and neurologic signs included: nasal discharge (n=2), coughing (n=1), off feed (inappetence or anorexia) (n=3), excessive sweating (n=1), and limb edema (n=2).

Five secondary cases were PCR positive on the submitted blood sample only, five were PCR positive on the nasal swab sample only, and three were PCR positive on both the blood and nasal swab samples (table 6).

Two secondary cases were treated with DMSO, 14 with a nonsteroidal anti-inflammatory drug such as flunixin meglumine or phenylbutazone, 2 with corticosteroids, 3 with fluids, 1 with antibiotics, 11 with an antiviral drug, 1 with immunomodulator, 1 was placed in a sling, and 5 were treated with lysine. Two secondary cases had other treatment specified, which included vitamin E, vitamin B, and bladder catheterization.

Eleven of 12 secondary cases for which information was provided had been vaccinated against EHV-1 from May 1, 2010, to April 28, 2011. Four had received EHV-1 vaccination within the 5 weeks before April 28, 2011, and one of these developed EHM.

Three secondary cases were euthanatized. An 8-year-old female Quarter horse that was euthanatized had become recumbent and unable to rise. She had a fever on May 16 that resolved on May 20 and then developed neurologic signs on May 23, 2011. The other two horses were euthanatized due to causes not related to EHV-1 infection. One 16-year-old Quarter horse with a persistent hoof problem and no clinical signs consistent with EHV-1 tested positive for EHV-PCR test on lung tissue from necropsy but not on antemortem nasal swab test. The other horse was a 15-year-old Trakehner that developed colic; it had developed fever on May 18, 2011, had no neurological signs, and tested negative for EHV-1 on blood and nasal swab on the day of fever onset.

Economic aspects of EHV-1 outbreak

Due to the insufficient number of detailed responses to the economic questions from questionnaire respondents, no analyses of the economic costs of the outbreak for horse owners and trainers could be conducted.

Epidemiologic Investigation Discussion

The virologic diagnosis of the initial EHM case in this outbreak was confirmed on May 13, 2011, by the Colorado State Veterinarian. Subsequently, there was detection of disease in other horses that attended the Ogden, UT, event after the horses had left the event center. Consequently, data collection from the outbreak required the cooperation of multiple groups, including the owners and trainers of affected horses,

their private veterinarians, the NCHA, SAHOs, and USDA–APHIS–VS. The veterinarians who managed prior outbreaks in which EHM was a clinical feature indicated a need to learn as much as possible from naturally occurring outbreaks of this disease.[3] The goal of this report was to describe the cases from the outbreak in more detail.

Limitations of this study include the overall response rate; surveys were returned for approximately one-third of the potential primary cases and only about one-fourth of the potential secondary cases. This low response rate could introduce bias into some study results. A calculation of nonresponse bias was not feasible because no comparable information about nonrespondents was available—such as signalment, EHV-1 vaccination history, location while at the NCHA event (primary cases), and number of cases per premises—was available to USDA–APHIS–VS.

Determining how the disease agent was initially introduced to horses that attended the NCHA event remains unknown and was not the goal of this epidemiologic investigation. The investigation did determine that each of four barns used to house horses at the event center had housed horses that were later identified as primary cases (figure 2). This spatial information suggests that exposure could have occurred in the barns or outside the barns' stalling areas.

Although recommendations for testing primary and secondary cases were provided by USDA–APHIS–VS (Appendix A),[4] the decision to test exposed horses was made by the SAHO in each State. In addition, multiple laboratories tested samples during this outbreak. At the time of the outbreak, however, there was lack of uniformity across laboratories in how PCR tests for EHV-1 were conducted. In 2012, the National Assembly of State Animal Health Officials (NASAHO) requested that the USDA–APHIS–VS National Veterinary Services Laboratory conduct a survey of the U.S. veterinary diagnostic laboratories across the country to determine what test methods were used for detecting EHV-1. The results of this survey confirmed NASAHO's assumption that the laboratories were using different methods to diagnose EHV-1.[8] NASAHO indicated a need to standardize EHV-1 laboratory test methods. Per the U.S. Animal Health Association (2012): "The United States Animal Health Association and the American Association of Veterinary Laboratory Diagnosticians request that the USDA–APHIS–VS, National Veterinary Services Laboratory proceed with the neuropathic strains of EHV-1 ring trial and make every effort to standardize testing methodology for EHV-1 PCR testing at diagnostic facilities in the U.S."[8] The lack of uniformity in testing exposed horses and in the laboratory methods used to test samples collected during the outbreak might have led to misclassification when categorizing cases as part of the situation report. Subsequently, this misclassification might have introduced errors occurred into the epidemiologic data related to case characteristics collected as part of this epidemiologic investigation.

The outbreak described in this paper occurred in early May 2011. A previous, in-depth study of EHM suggested that a strong seasonal clustering of outbreaks occurred from fall through spring.[9] However, there have been other EHM outbreaks that have occurred outside of this time period, e.g., in summer months.[10]

Most of the time horses attending cutting competitions would be in the same age range as the primary case horses and the stock-horse breeds. The primary cases described in this report were predominantly Quarter horses, and most were aged from 5 to 15 years.

As mentioned previously, there were an approximate equal number of female and male (gelding or intact) horses among the primary case population; however, a larger

number of females became EHM cases, and all fatalities among the primary and secondary EHM cases were female. Although female horses appeared to be overrepresented in a previous EHM report,[9] there has not been a consistent finding as to the role gender plays in the development of EHM. For example, no gender predisposition for the neurologic form of EHV-1 was reported in a large outbreak at a boarding facility in Ohio, where 46 horses developed neurologic disease.[11] The role of gender in the development of EHM requires further investigation as well as signalment data from future EHM outbreaks.

In this study the prevalence of neurologic disease among the primary cases (table 4, 20/35=57 percent) was more than double that among the secondary cases (table 6, 4/15=27 percent). In another large EHM outbreak, the prevalence of neurologic disease among febrile horses was similar in the initial and second waves of the outbreak, but the severity of neurologic disease was less among horses in the secondary wave.[11]

The majority of the primary or secondary EHV-1 cases (with no reported neurologic signs) and EHM cases had reportedly received an EHV-1 vaccine in the 12 months before the NCHA event. The current USDA-licensed vaccine products containing EHV-1 have been approved based on efficacy studies that support claims for aiding in control of respiratory disease due to EHV-1, prevention of abortion associated with EHV-1, or reduction in shedding of EHV-1. None of these products claims to protect against EHM.

Researchers have suggested that controlling cell-associated virema is critical to preventing naturally occurring EHM.[1] Unfortunately, current inactivated EHV-1 vaccines are ineffective in controlling intracellular virus and cell-associated viremia.[12] There is a general contention that protection against EHV-1 will likely require both neutralizing antibody and cytotoxic T-lymphocyte response.[13] In a 2011 report about a large outbreak of EHV-1 in Belgium, morbidity rates were lower on premises that used an inactivated EHV-1 vaccine compared with premises that did not vaccinate the horses. However, there was no difference in the number of horses that developed neurologic disease on premises that vaccinated.[14] Henninger and others suggested that previous exposure to EHV-1 and individual response to EHV-1 vaccination may influence the immune response and susceptibility to EHM.[11] In summary, EHM has been previously reported among well-vaccinated equine populations[11] and unvaccinated equine populations.[9] The association of EHV-1 vaccination with the development of EHM among primary exposed horses (those that attended the 2011 NCHA event in Ogden, UT) has been further evaluated in a case-control study (Journal of Veterinary Internal Medicine, in press).

Collecting detailed EHV-1 vaccination histories, including the date of administration and the type of vaccine used from cases and controls associated with future EHM outbreaks, could assist in defining the role of EHV-1 vaccination in the development of EHM. Given that inactivated EHV-1 vaccines have produced a different IgG subtype than the modified live vaccine,[15] collecting serum samples for eventual testing of specific immunoglobulin subtype maybe of value in understanding the pathogenesis of the disease.

Multiple treatments have been used for EHM, including empiric supportive care in cases with recumbency, maintaining hydration and an adequate level of nutrition, and evacuation of the urinary bladder and rectal contents. Although their capacity to affect development of the lesions associated with EHM is unknown, nonsteroidal anti-inflammatory drugs are often used as an adjunctive treatment.[1] The majority of primary and secondary cases described in this report had received nonsteroidal anti-inflammatory drugs as a part of their treatment. Corticosteroids were used to treat

some of the cases in this outbreak. Corticosteroids are immunosuppressive drugs. Theoretically, they could aid in the control or prevention of the cellular response of the endothelial cells of the central nervous system and might reduce the vascular damage and thus injury to neuronal tissue. However, there is poor understanding of the efficacy of corticosteroids in the treatment or prevention of EHM.[1]

A small number of the cases described in this outbreak received immunomodulators. The understanding of the role of immunomodulators in the prevention or treatment of EHV infection remains rudimentary.[1] Immunostimulants would have the most potential benefit if given prior to exposure to a pathogen, such as before transport or before exposure to new horses.[1]

Lysine was used to treat several of the cases described in this outbreak. To the authors' knowledge, the efficacy of lysine in the prevention or treatment of EHV-1 infection has not been reported. Lysine has received attention for treatment of human beings latently infected with herpes simplex virus type 1 and for its efficacy in cats latently infected with feline herpesvirus.[16] Information related to lysine and other nutraceutical administration, both prophylactically and therapeutically, should be collected in future naturally occurring EHM outbreaks.

The majority of the primary and secondary cases described in this report were treated with an antiviral drug. The use of antiviral drugs to treat EHM is a relatively recent occurrence. In a 2009 ACVIM consensus statement,[1] it was suggested that antiviral drugs, specifically virustatics, would have theoretical value in the treatment of EHV-1 infection, and that in vitro efficacy had been demonstrated against EHV-1. Pharmacokinetic data suggest that valacyclovir, a prodrug of acyclovir, had greater promise than acyclovir, as it was more bioavailable after oral dosing in horses.[1] The prophylactic efficacy of valacyclovir against clinical disease after EHV-1 challenge in aged mares has been reported.[17] Specifically, aged mares in a prophylactic treatment group given valacyclovir prior to and for 2 weeks after experimental challenge with EHV-1 had a significant reduction in days of fever and clinical score compared with those in a control group.[17] In another study to evaluate the efficacy of oral valacyclovir in ponies challenged with EHV-1, Garré and others reported on differences in clinical signs, viral shedding, and viremia between ponies started on valacyclovir treatment the day of viral challenge and untreated ponies.[18] In both of these reports, antiviral drug treatment was initiated either before or at the time of viral challenge and prior to onset of clinical signs. Primary cases described in this report were presumed to be exposed to EHV-1 while at the NCHA event. However, clinical signs of primary cases were not detected until after the horses had left the event. Consequently, these primary cases presumably did not receive an antiviral drug at the time of exposure. The precise timing of initiation of antiviral drug administration in relation to onset of clinical signs could not be determined from the survey data. This uncertainty complicates the ability to assess the antiviral drug treatment influenced the outcome of the cases in this outbreak. In future epidemiologic studies it would be worthwhile to determine the date of initiation of treatment with antiviral drugs and the date of the onset of clinical signs.

Among the 20 primary EHM cases, 3 were euthanatized (15 percent EHM primary case fatality rate). In a recent description of an EHM outbreak in Canada, 2 of 20 EHM cases had fatal outcomes (EHM case fatality rate of 10 percent).[19] Henninger and others reported a 30 percent neurologic case fatality in a large EHM outbreak.[11] The case fatality rate among horses with EHM likely depends on multiple factors, including the interaction of the virus and host and the choice of treatment modality. In our study the primary cases that had a fatal outcome were either not treated with antivirals or were treated only 1 day prior to euthanasia (write-in information provided on questionnaire), so antiviral drug administration may have influenced the survival

among treated horses. The single fatal EHM secondary case did not receive antiviral treatment. In future epidemiologic studies it would be optimal to determine the date of treatment initiation with antiviral drugs and the onset date of any clinical signs.

Regarding biosecurity practices in use at the premises with primary cases, approximately one-third of premises routinely used hand hygiene and limited unnecessary visits to the premises when returning from events (table 5). One-fourth of these premises also routinely isolated returning horses. It was clear from the responses on the questionnaire that premises heightened their use of biosecurity practices in response to the outbreak, as was recommended by State and Federal animal health officials. It is possible that these measures limited further transmission between horses that had attended the event and horses that had not left the premises. Despite these precautions, exposure could have already occurred if returning horses were not managed in a manner to limit their direct and indirect contact with other resident horses on the premises.

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Table 3. Number of primary and secondary confirmed and suspect EHV-1 and EHM cases by State based on the final USDA–APHIS–VS outbreak situation report[5]:

State	Primary confirmed EHV-1/ EHM cases	Primary suspect EHV-1/ EHM cases	Secondary confirmed EHV-1/ EHM cases	Secondary suspect EHV-1/ EHM cases	Total primary cases	Total secondary cases
AZ	3	6	11	4	9	15
CA	16	0	6	0	16	6
CO	15	22	1	0	37	1
ID	3	9	5	16	12	21
MO	0	1	0	0	1	0
NV	1	0	2	0	1	2
NM	3	2	1	2	5	3
OK	1	0	0	0	1	0
OR	3	0	2	0	3	2
TX	0	0	0	1	0	1
UT	5	5	3	3	10	6
WA	4	0	5	0	4	5
WY	0	1	0	0	1	0
13	54	46	36	26	100	62

Table 4. Primary case characteristics based on epidemiologic investigation, by farm code:

Farm code*	**Age** (yr)	**Breed**	**Gender**	**Fever** (onset date)	**Neuro** (onset date)	**Other clinical signs**	**Reported # of EHV-1 vaccinations 5/1/10–4/28/11**	**Reported to be EHV-1 vaccinated 3/25/11–4/28/11**	**Antiviral treatment**	**Horse status**	**Fully recovered at time of data collection**	**Positive PCR test by sample type**
A	19	QH	Gelding	●	●	No	0	No	Yes	Dead	NA	B,N
B	8	QH	Female	05/15/11	05/15/11	No	1	No	Yes	Alive	Unk	
B	8	QH	Gelding	05/17/11	05/17/11	No	0	No	Yes	Alive	Unk	
B	8	QH	Gelding	●	●	No	0	No	Yes	Alive	Unk	B
C	12	QH	Gelding	05/13/11	●	No	2	Yes	Yes	Alive	Unk	
C	7	QH	Female	05/11/11	05/14/11	Yes	1	No	Yes	Alive	Unk	
D	11	QH	Female	●	●	Yes	3	No	No	Alive	Yes	B,N
E	15	Paint	Gelding	05/11/11	05/13/11	Yes	4	No	Yes	Alive	Yes	N
F	7	QH	Gelding	05/13/11	●	No	1	No	Yes	Alive	Yes	N
G	9	QH	Female	05/09/11	●	No	1	No	No	Alive	Unk	
H	7	QH	Female	05/11/11	05/12/11	No	2	Yes	No	Dead	NA	N,O
I	8	QH	Gelding	●	05/12/11	Yes	2	Yes	Yes	Alive	No	B,N
J	6	QH	Female	●	05/16/11	No	0	No	Yes	Alive	Unk	
K	5	QH	Female	05/13/11	●	No	1	No	No	Alive	Yes	N
L	7	QH	Female	05/13/11	05/13/11	Yes	0	No	Yes	Alive	No	N
L	Unk	QH	Gelding	05/12/11	●	Yes	0	No	Yes	Alive	Yes	B

Table 4. Primary case characteristics based on epidemiologic investigation, by farm code (continued):

Farm code*	Age (yr)	Breed	Gender	Fever (onset date)	Neuro (onset date)	Other clinical signs	Reported # of EHV-1 vaccinations 5/1/10–4/28/11	Reported to be EHV-1 vaccinated 3/25/11–4/28/11	Antiviral treatment	Horse status	Fully recovered at time of data collection	Positive PCR test by sample type
M	4	QH	Female	●	05/14/11	Yes	2	Yes	Yes	Alive	No	B
M	3	QH	Female	●	05/14/11	No	2	Yes	Yes	Alive	Yes	
M	Unk	QH	Gelding	●	05/10/11	No	2	Yes	Yes	Alive	Yes	
M	16	QH	Female	●	05/14/11	No	2	Yes	Yes	Dead	NA	B,N
N	3	QH	Female	05/13/11	05/15/11	Yes	3	Yes	Yes	Alive	Yes	B
N	6	QH	Female	05/13/11	●	No	3	No	Yes	Alive	Yes	
N	3	QH	Gelding	05/13/11	●	No	4	No	Yes	Alive	Yes	
O	5	QH	Female	●	05/12/11	No	1	No	No	Dead	NA	O
P	10	QH	Gelding	05/16/11	●	Yes	2	No	No	Alive	Yes	
Q	13	QH	Gelding	05/16/11	●	Yes	1	No	Yes	Alive	Yes	B,N
R	10	QH	Gelding	05/15/11	05/15/11	No	0	No	No	Alive	Yes	B
S	6	QH	Stallion	05/17/11	05/17/11	Yes	1	No	Yes	Alive	No	B,N
T	6	QH	Female	05/13/11	05/12/11	Yes	2	Yes	Yes	Alive	Yes	
U	8	QH	Gelding	05/13/11	●	No	0	No	No	Alive	Unk	
V	12	QH	Female	05/22/11	05/23/11	Yes	1	No	Yes	Alive	No	

Table 4. Primary case characteristics based on epidemiologic investigation, by farm code (continued):

Farm code*	Age (yr)	Breed	Gender	Fever (onset date)	Neuro (onset date)	Other clinical signs	Reported # of EHV-1 vaccinations 5/1/10–4/28/11	Reported to be EHV-1 vaccinated 3/25/11–4/28/11	Antiviral treatment	Horse status	Fully recovered at time of data collection	Positive PCR test by sample type
V	5	QH	Gelding	05/18/11	●	Yes	1	No	Yes	Alive	Yes	
W	6	QH	Gelding	●	●	No	0	No	No	Alive	Unk	B
X	11	QH	Gelding	05/12/11	05/13/11	No	2	No	Yes	Alive	No	B,N
Y	10	QH	Female	05/09/11	05/10/11	Yes	1	Yes	No	Alive	Unk	B,N

*Entries with the same letter indicate cases from the same premises. See also table 6.
QH = Quarter horse; Paint = Paint horse; Neuro = clinical signs of neurologic disease; B = whole blood sample; N = nasal swab sample; O = other sample than blood or nasal swab, e.g., tissue collected at necropsy or sample type not specified; NA = not applicable; Unk = unknown at time of data collection; ● = no onset date as horse did not have this clinical sign. Other clinical signs could include nasal discharge, coughing, off feed, colic, limb edema/stocking up, other.

Table 5. Biosecurity practices (listed in order they appeared on the questionnaire) that are normal procedures implemented by the respondents and their staff on primary case premises when returning from an event and those that were implemented in response to the EHV-1 disease outbreak:

Procedure implemented for respondent and their staff	**Number of primary case premises that normally implemented this practice when returning from event/number of premises responding to question** (% of those responding that used the practice)	**Number of primary case premises that implemented in response to Ogden EHV-1 outbreak/number of premises responding to question** (% of those responding that used the practice)
Returning horses isolated from others on the premises[1]	5/19 (26)	16/21 (76)
Take horse's temperature	3/19 (16)	18/22 (82)
Use separate or disinfect grooming equipment	5/19 (26)	15/21 (71)
Use separate or disinfect feeding equipment	4/19 (21)	14/20 (70)
Use separate or disinfect tack	4/19 (21)	11/20 (55)
Use disposable personal protection equipment[2]	1/19 (5)	13/21 (62)
Changed clothes or wore clean coveralls	4/19 (21)	14/20 (70)
Disinfect or change footwear	2/19 (11)	16/21 (76)
Clean and disinfect hands	7/19 (37)	18/20 (90)
Clean and disinfect trailer between loads	6/19 (32)	16/20 (80)
Have personnel dedicated to caring for returning horses who do not have contact with other horses on premises	1/19 (5)	7/20 (35)
Use signage instructing personnel and/or visitors on biosecurity	1/19 (5)	3/20 (15)
Do not allow unnecessary visitors on the premises	7/19 (37)	14/20 (70)
Required for people visiting the premises (visitors, boarders, veterinarians, farriers, etc.)		
Use separate or disinfected grooming equipment	3/19 (16)	12/18 (67)
Use separate or disinfected feeding equipment	4/19 (21)	12/18 (67)
Use of separate or disinfected tack	3/19 (16)	11/18 (61)
Change of clothes or wearing of clean coveralls	1/19 (5)	12/18 (67)
Disinfect or change footwear	1/19 (5)	13/18 (72)
Park away from the animal areas	3/19 (16)	12/18 (67)
Clean and disinfect hands	6/19 (32)	15/18 (83)
Use disposable personal protection equipment[2]	1/19 (5)	12/18 (67)

[1]Prevented direct contact with other hoses.

[2]PPE for example coveralls, latex/plastic gloves.

Table 6. Secondary case characteristics based on epidemiologic investigation, by farm code:

Farm code*	Age (yr)	Breed	Gender	Fever (onset date)	Neuro (onset date)	Other clinical signs	Reported # of EHV-1 vaccinations 5/1/10–4/28/11	Reported to be EHV-1 vaccinated 3/25/11–4/28/11	Antiviral treatment	Horse status	Fully recovered at time of data collection	Positive PCR test by sample type
B	4	QH	Gelding	05/22/11	●	No	1	No	Yes	Alive	Yes	B
C	3	QH	Gelding	05/18/11	●	No	2	Yes	Yes	Unk	No	B,N
C	4	QH	Female	05/20/11	●	No	2	No	Yes	Unk	No	B
C	3	QH	Gelding	05/15/11	●	Yes	2	No	Yes	Unk	No	B
C	3	QH	Gelding	05/20/11	●	No	1	Yes	Yes	Unk	No	B
J	3	QH	Female	05/28/11	●	No	0	No	Yes	Alive	Yes	B,N
Z	5	QH	Gelding	05/16/11	●	No	2	No	Yes	Alive	Yes	N
AA	4	Paint/QH	Gelding	05/15/11	05/15/11	Yes	1	No	Yes	Alive	Yes	B,N
BB	4	QH	Female	05/16/11	05/23/11	Yes	1	No	Yes	Alive	No	N
BB	8	QH	Female	05/17/11	05/23/11	Yes	1	Yes	Yes	Unk	No	N
CC	8	QH	Female	05/16/11	05/23/11	No	0	No	No	Dead	NA	B
CC	3	QH	Gelding	05/16/11	●	No	0	No	No	Alive	Yes	N
DD	16	QH	Female	●	●	No	1	Yes	No	Dead	NA	O
DD	5	OLDEN	Gelding	05/21/11	●	Yes	0	No	No	Alive	Yes	N
DD	15	TRAK	Gelding	05/18/11	●	Yes	1	No	Yes	Dead	NA	

*Entries with the same letter indicate cases from the same premises. See also table 4.
QH = Quarter horse; Paint/QH = Paint/Quarter horse mix; OLDEN = Oldenburg; TRAK = Trakehner; Neuro = clinical signs of neurologic disease; B = whole blood sample; N = nasal swab sample; O = other sample than blood or nasal swab, e.g., tissue collected at necropsy or sample type not specified; NA = not applicable; Unk = unknown at time of data collection; ● = no onset date as horse did not have this clinical sign. Other clinical signs could include nasal discharge, coughing, off feed, colic, limb edema/stocking up, other.

Figure 1. Primary cases by date of onset of fever and neurologic signs based on epidemiologic investigation.

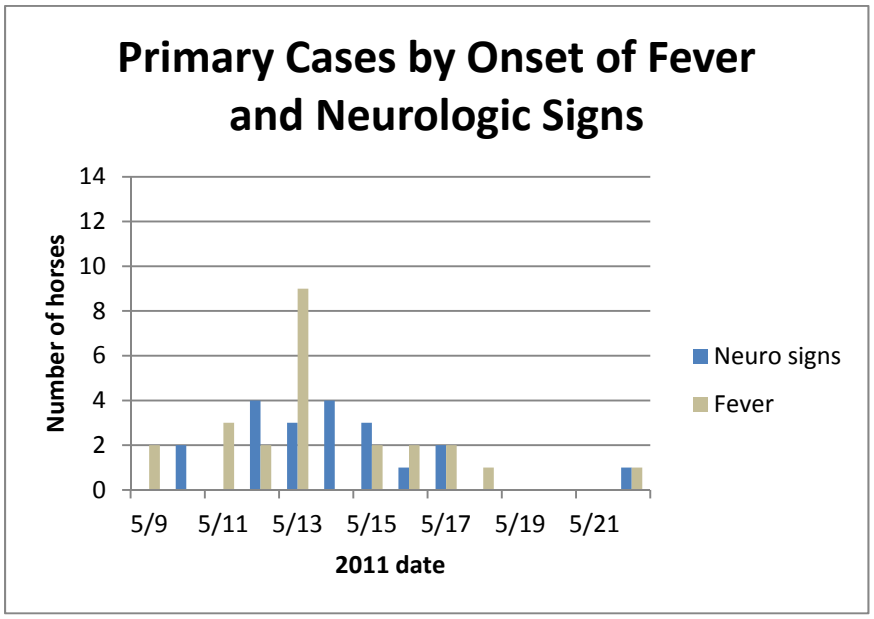
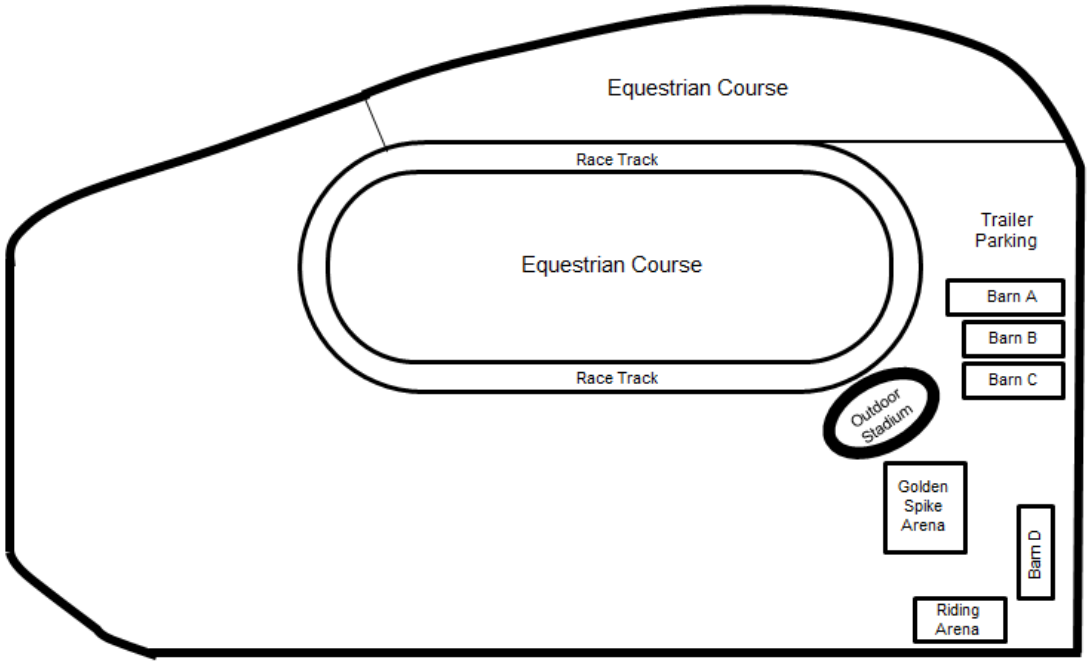


Figure 2. Map of event center.



Appendix A: Recommendations for Horses Exposed to Equine Herpes Virus (EHV-1) or Equine Herpes Virus Myeloencephalopathy (EHM), May 16, 2011

Background

Cases of equine herpes virus (EHV-1) and equine herpes virus myeloencephalopathy (EHM) have been identified in horses that recently attended a cutting-horse event in Ogden, UT, held from April 29 to May 8, 2011. The National Cutting Horse Association has notified State Veterinarians of horses from their States that were entered in the event and may have been exposed to the virus. Horses exposed at the event in Utah have since left the event and may now have exposed horses at their home farm or other equine facilities.

Case Definitions

Suspect EHV-1 case: An exposed horse that becomes febrile (rectal temperature greater than 101.5°F) during the monitoring period.

Confirmed EHV-1 case: A suspect EHV-1 case whose infection is laboratory confirmed by virus isolation and/or PCR detection of the virus, or a fourfold change in titer on the serum neutralization test using paired sera.

Suspect EHM case: An exposed horse exhibiting signs of central nervous system (CNS) dysfunction, including most commonly posterior incoordination, weakness, recumbency with inability to rise, or bladder atony.

Confirmed EHM case: A suspect EHM case testing positive for EHV-1 by virus isolation and/or PCR assay on nasal swab or blood (buffy coat). In cases of sudden death or where the horse dies as a result of neurological complications, the postmortem lesions are consistent with those of myeloencephalopathy and EHV-1 has been isolated, detected by PCR, or demonstrated by immunohistochemical examination of the CNS.

Nonclinical EHV-1 case: (It is not recommended to test exposed nonclinical horses). An exposed horse with no clinical signs (afebrile, nonneurologic) testing positive for EHV-1 by virus isolation and/or PCR assay on nasal swab or blood (buffy coat).

Monitoring of Exposed Horses

Key points:

- *Isolation and monitoring are recommended for all premises with exposed horses.*
- *Exposed horses should be initially be monitored for fever and/or neurologic signs for at least 7 days.*
- *Owners should confirm with their practicing veterinarian or State animal health officials whether any requirements exist for notification to the State Veterinarian.*
- *Once suspect or confirmed cases are identified on a premise, then all horses on the premises should be managed as described in the "Management of Suspect and Confirmed EHV-1 or EHM Cases" section below.*

Horses that attended the event in Ogden, UT, and other horses currently on the same premises as the horse exposed at the event should be isolated and monitored. Horses that left the premises after being exposed to the horse that attended the event should also be located and held for monitoring. Horses that attended the event and horses that have since contacted the horse that attended the event are considered exposed horses.

Monitoring of all exposed horses should initially occur for at least 7 days after the notification of the owner by the State Veterinarian. During the isolation period, it is recommended to discontinue or reduce any strenuous training or exercise for exposed horses. Also, biosecurity practices, such as those recommended on the American Association of Equine Practitioners (AAEP) Web site, should be implemented on the exposed premises.
http://www.aaep.org/pdfs/control_guidelines/Biosecurity_instructions%201.pdf

All exposed horses should have rectal temperatures taken twice daily (8 to 12 hours apart) and recorded in a log for at least 7 days after notification of the owner by the State Veterinarian. Horses whose rectal temperature registers higher than 101.5°F are considered to be febrile. All horses on the premises should also be monitored for neurologic signs (ataxia, posterior incoordination, weakness, recumbency with inability to rise, circling, head pressing, head tilt, bladder atony) during the home quarantine period. Central nervous system signs, such as posterior incoordination, weakness, recumbency with inability to rise, and bladder atony are most common in EHM affected horses. If any horse on the premises becomes febrile or begins to show neurologic signs, all horses on the premises should be managed as described in the "Management of Suspect and Confirmed EHV-1 or EHM Cases" section below. In addition, if required by the State Veterinarian, the owner or practitioner should report the clinical signs to the State Veterinarian's office. If none of the exposed horses becomes febrile or presents with neurologic signs during the isolation monitoring period, then the isolation may be discontinued.

Management of Suspect and Confirmed EHV-1 or EHM Cases

Key points:

- *Suspect and confirmed clinical cases need to be strictly isolated from nonclinical horses.*
- *Suspect clinical cases should be sampled for laboratory confirmation of EHV-1.*
- *Management Option 1: Cases and herd mates isolated for at least 21 days past resolution of clinical signs, then releasing test on all horses on the premises.*
- *Management Option 2: Cases and herd mates isolated for at least 28 days past resolution of clinical signs with no releasing test.*

Suspect EHV-1 or suspect EHM cases should be immediately isolated from other horses on the premises. The most effective method of isolation is removal of the suspect horse from the general horse housing area in which nonclinical horses are located. The isolation facilities of a local veterinary clinic or a separate barn/building on the affected premises are highly recommended. Some farms have used portable event tents and portable stalls to create an isolation unit on the premises. Febrile and neurologic EHV-1 cases shed large amounts of virus via the respiratory route and sharing airspace or fomites (equipment, buckets, human contact) within a barn

may lead to further disease transmission. If physical separation of suspect cases in a different building is not possible, then relocation within the barn to a stall far removed from other horses with strict isolation biosecurity protocols implemented for handling the suspect horse may be an effective method of containment.

Suspect EHV-1 and suspect EHM cases should be sampled by a private practitioner for diagnostic testing as described in the “Diagnostic Testing” section below.

Management Option 1 (best)

Confirmed and suspect EHV-1 and EHM cases should remain isolated with no movement of horses in or out of the affected premises for a period of at least 21 days from the resolution of clinical signs in all horses on the premises. Daily monitoring of rectal temperatures for all horses on the premises should continue through the 21-day period and horses should not be on any nonsteroidal anti-inflammatory drugs (NSAIDs) during this time, as NSAIDs will mask a fever. If no new suspect or confirmed cases are identified during the 21 days, then sample all exposed horses on the premises using real-time or nested PCR testing of nasal swabs. If all negative results are obtained, the quarantine can be discontinued.

Management Option 2 (for premises with many horses where Option 1 may be economically impractical)

Confirmed and suspect EHV-1 and EHM cases should remain isolated with no movement of horses in or out of the affected premises for a period of at least 28 days from the resolution of clinical signs in all horses on the premises. Daily monitoring of rectal temperatures for all horses on the premises should continue through the 28-day period and horses should not be on any NSAIDs during this time. If no new suspect or confirmed cases are identified within this 28-day period, then the quarantine can be discontinued with no additional diagnostic testing.

Treatment and Vaccination

Horses with neurological signs will require intensive supportive care that should be administered by an equine private practitioner. Since vaccination and treatment strategies can be highly variable and depend on the specific farm situation, owners should work directly with the private practitioner to develop the appropriate treatment and/or vaccination strategy for premises with suspect or confirmed EHV-1 or EHM cases.

Diagnostic Testing (Note: Testing of nonclinical, exposed horses is not recommended.)

1) Suspect EHV or EHM case (live horse with clinical disease)
   a. Wear disposable gloves and change gloves between each horse.
   b. Collect whole blood into EDTA and label sample (preferably have an assistant label samples).
   c. If a twitch is used to restrain the horse it must be washed and disinfected between horses.
   d. Nasal swab collected using Dacron tipped swab with plastic shaft. Swab should be in contact with nasal mucosa for at least several seconds.
   e. Place swab in viral transport media or other transport solution recommended by laboratory performing the test and label sample. Use a small volume of transport fluid (less than 2 mL) to avoid over-dilution of the sample.
   f. Perform hand hygiene between horses sampled and put on new pair of examination gloves.
   g. Keep samples cool but not frozen and ship by overnight delivery.
   h. Request real-time or nested PCR test and virus isolation.
   i. If sample reported as PCR positive, request typing of the virus based on DNA polymerase gene testing.

2) Suspect EHV or EHM case (abortion or euthanatized suspect case)
   a. If mare aborts while wearing disposable examination gloves, place fetus and placenta into a large plastic bag and avoid contamination of equipment or horse housing areas with the placental fluids.
      i. Submit both the fetus and placenta to a veterinary diagnostic laboratory for testing.
      ii. Request histopathology and testing of fetal tissues and placenta for EHV.
   b. If horse is euthanatized, necropsy should be performed.
      i. Request histopathology and testing of spinal cord and brain for EHV.

3) Testing for release from quarantine (premises with suspect or confirmed cases)
   a. After resolution of clinical signs in all horses for the specified period
   b. Collect nasal swabs from all clinical cases and exposed cases.
   c. Be certain to avoid any cross contamination by wearing a new pair of exam gloves to collect samples from each horse and perform hand hygiene between horses sampled.
   d. Keep samples cool and ship by overnight delivery.
   e. Request real-time or nested PCR test.

4) PCR test interpretation (Per ACVIM Consensus statement on EHV)
   a. A positive EHV-1 test result on a blood sample indicates viremia most probably resulting from an active infection. It is unlikely that latent viral infection alone will give a positive result in this test.
   b. A negative EHV-1 test result on a blood sample indicates the absence of detectable EHV-1 viremia.
   c. A positive EHV-1 test result on a nasal swab sample should be interpreted as indicative of the shedding of infectious virus. Quantitative PCR (i.e., real-time PCR) could provide more information about the likely level of risk this shedding poses.
   d. A negative EHV-1 test result on a nasal swab indicates the absence of detectable virus shedding.

Serological Testing

Owing to widespread EHV-1 exposure and vaccination in the general equine population, serologic testing on a single sample is uninformative. Serologic testing which demonstrates a four-fold or greater increase in serum antibody titer between acute and convalescent samples collected 7 to 21 days apart provides presumptive evidence of EHV-1 infection, if there is no EHV vaccination in this time period. The serum neutralization (SN) test, also called the virus neutralization (VN) test is most commonly used. The acute sample should be collected as soon as horses are placed under observation, or at the earliest unset of clinical signs. In the midst of an outbreak, detection of rising virus-neutralizing antibodies in paired serum samples can be used to screen for horses that were exposed to the virus. A proportion of both affected and unaffected in-contact horses may seroconvert, providing indirect evidence that EHV-1 is the etiologic agent. Neutralizing antibodies do not distinguish between EHV-1 and EHV-4 infections.

Laboratory Submission*

The following State and university laboratories are currently available to conduct real-time or nested PCR testing for EHV-1:

California Animal Health & Food Safety Laboratory System (real-time PCR)
http://www.cahfs.ucdavis.edu/

Lucy Whittier Molecular and Diagnostic Core Facility(real-time PCR)
http://www.vetmed.ucdavis.edu/vme/taqmanservice/

Cornell University College of Veterinary Medicine Animal Health Diagnostic Center (real-time PCR)
http://ahdc.vet.cornell.edu/

The University of Kentucky Veterinary Diagnostic Laboratory (nested PCR)
http://www.lddc.uky.edu/testofferings.asp

Michigan State University Diagnostic Center for Population and Animal Health (real-time PCR)
http://www.animalhealth.msu.edu/Bin/Catalog.exe?Action=Test&Id=2035

New Jersey Department of Agriculture Division of Animal Health Animal Diagnostic Laboratory (real-time PCR)
http://www.nj.gov/agriculture/divisions/ah/prog/lab.html

Pennsylvania Veterinary Laboratory – Harrisburg (real-time PCR)
http://www.padls.org/

University of Georgia – Athens (real-time PCR)
www.http://vet.uga.edu/dlab

Louisiana Animal Disease Diagnostic Laboratory (real-time PCR)
http://laddl.lsu.edu/

University of Illinois (real-time PCR)
http://vetmed.illinois.edu/vdl/index.html

Washington State University Animal Disease Diagnostic Laboratory - Pullman (real-time PCR)

http://www.vetmed.wsu.edu/depts_waddl/

North Dakota State University Veterinary Diagnostic Laboratory (real-time PCR)
http://www.vdl.ndsu.edu/

Murray State Breathitt Veterinary Center (nested PCR)
http://breathitt.murraystate.edu

Iowa State University Veterinary Diagnostic Laboratory (nested PCR)
http://vetmed.iastate.edu/diagnostic-lab

National Veterinary Services Laboratories – Ames (nested PCR)
http://www.aphis.usda.gov/animal_health/lab_info_services/diagnos_tests.shtml

Mississippi State University Veterinary Research and Diagnostic Laboratory (nested PCR)
http://www.cvm.msstate.edu/diagnostic_labs/index.html

Ohio Animal Disease Diagnostic Laboratory – Reynoldsburg (real-time PCR)
http://www.agri.ohio.gov/addl/

Oregon State University Veterinary Diagnostic Laboratory (real-time PCR)
http://oregonstate.edu/vetmed/diagnostic

Texas Veterinary Medical Diagnostic Laboratory (real-time PCR)
http://tvmdl.tamu.edu/

Animal Health Laboratory, University of Guelph (real-time PCR)
http://www.guelphlabservices.com/AHL/

University of Nebraska Veterinary Diagnostic Laboratory (real-time PCR)
http://vbms.unl.edu/nvdls

Additional laboratories will be added to this list as their real-time or nested PCR capabilities for EHV-1 are determined.

*Laboratory information was current as of May 16, 2011. Testing methods may have subsequently changed and additional laboratories are performing real-time PCR testing.

Reporting of Suspect and Confirmed EHV-1 and EHM Cases

It has been requested by the AAEP, American Horse Council, and some affected States that USDA–APHIS–VS compile and distribute information on suspect and confirmed cases of EHV-1 and EHM associated with this incident. To facilitate this request, State Veterinarians in affected States are asked to report information weekly on the exposed horses and cases being monitored in the State. A standardized weekly reporting worksheet is available to assist the States in reporting of suspect and confirmed cases as soon as they are identified. Weekly reporting worksheets should be sent through the AVIC to the designated Regional Epidemiologist for compilation into a national report. The national report will be made available to the State Veterinarians, AVICs, other pertinent APHIS–VS personnel, and equine industry groups.

Cleaning and Disinfection (C&D) of Confirmed EHV-1 and EHM Case Premises

EHV-1 virus can stay viable in the environment for several weeks or longer. Thorough cleaning and disinfection of all horse trailers and equipment that returned from the event in Ogden, UT, is highly recommended. Cleaning and disinfection of barns, individual stalls, feeders, waterers, buckets, and other equipment should be performed on all confirmed EHV-1 and EHM case premises at the end of the quarantine period and before quarantine is discontinued. See the AAEP biosecurity protocols for detailed guidance on effective C&D procedures:

http://www.aaep.org/pdfs/control_guidelines/Biosecurity_instructions%201.pdf

EHV-1 and EHM Education and Outreach Materials

USDA–APHIS Web site

EHV information sheets, color brochures, historical information, and a review of disease mitigation strategies are available on the USDA–APHIS Web site:

http://www.aphis.usda.gov/vs/nahss/equine/ehv/

AAEP Web site

General EHV resources through the American Association of Equine Practitioners:
http://www.aaep.org/ehv_resources.htm

Neurologic disease guidelines:
http://www.aaep.org/pdfs/control_guidelines/Neurologic%20Disease%20Guidelines.pdf

Equine herpes virus:
http://www.aaep.org/images/files/EquineHerpesvirusGuidelines051711.pdf

Biosecurity guidelines:
http://www.aaep.org/pdfs/control_guidelines/Biosecurity_instructions%201.pdf

Biosecurity instructions for caretakers - English and Spanish:
http://www.aaep.org/pdfs/control_guidelines/Instructions%20to%20grooms.pdf

National Cutting Horse Association (NCHA) Web site

For history of the current outbreak and additional outreach materials:

http://www.nchacutting.com/

ACVIM Consensus Statement on EHV-1

http://onlinelibrary.wiley.com/doi/10.1111/j.1939-1676.2009.0304.x/pdf

Appendix B: Equine Herpesvirus (EHV-1) - FINAL Situation Report, June 23, 2011

There are no new cases and no new premises affected. Disease spread in connection with this incident has been contained and no further situation reports will be generated.

Background

Equine herpesvirus (EHV-1) infection in horses can cause respiratory disease, abortion in mares, neonatal foal death, and/or neurologic disease. The neurologic form of EHV-1 is called equine herpesvirus myeloencephalopathy (EHM). While EHV-1 and EHM are only officially listed as reportable diseases in some States, private veterinary practitioners are encouraged to notify their State Animal Health Officials of any suspected or confirmed cases, regardless of current official State reporting requirements.

Cases of EHV-1 and EHM have been identified recently in horses that attended the National Cutting Horse Association (NCHA) Western National Championship event in Ogden, UT, held from April 29 to May 8, 2011. The NCHA has notified State Animal Health Officials of horses from their States that were entered in the event and may have been exposed to the virus. State Animal Health Officials have contacted the owners of potentially exposed horses. Standardized recommendations were developed by State and federal officials and are being followed to isolate exposed horses, monitor them for clinical signs of EHV-1, and work with private veterinary practitioners to test and treat horses affected with the disease. Biosecurity procedures have been recommended for premises with suspect and confirmed cases to mitigate further disease spread.

Definitions for This Report

Primary exposed horses: Horses that attended the Ogden, UT, event from April 29 to May 8.

Secondary exposed horses: Horses that subsequently came into direct contact with horses that attended the Ogden, UT, event.

Tertiary exposed horses: Horses with three degrees or more separation from direct contact with a horse that attended the Ogden, UT, event.

Exposed premises: Premises with exposed horses.

Suspect EHV-1 case: A horse exposed to EHV-1 that develops fever (rectal temperature above101.5°F), but has no neurologic signs at this time.

Confirmed EHV-1 case: A suspect EHV-1 case with laboratory confirmation of EHV-1 infection, but has no neurologic signs at this time.

Suspect EHM case: A horse exposed to EHV-1 that develops neurologic signs. (Posterior incoordination, weakness, recumbency with inability to rise, and/or bladder atony are most commonly seen in EHM cases.)

Confirmed EHM case: A suspect EHM case with laboratory confirmation of EHV-1 infection.

Summary Information on Current Situation

- Owners of horses known to have been exposed in this incident have been contacted by State Animal Health Officials.
- Suspect and confirmed cases are reported to be under voluntary or State quarantine.
- Known exposed horses are reported to be under either voluntary or State quarantine.
- A total of **90** confirmed EHV-1 or EHM cases were reported in **10** States (AZ, CA, CO, ID, NM, NV, OK, OR, UT, WA)
- Of the **90** confirmed EHV/EHM cases, **54** cases were horses that were at the Ogden, UT, event.
- There are **13** horses associated with this incident that are dead or have been euthanized.
- There are **0** newly identified premises with suspect or confirmed cases identified this reporting period.
- With no new cases and no new affected premises, disease spread in connection with this incident has been contained. No further situation reports will be generated.

Detailed Current Information (as of close of business 6/22/2011)

States not included in the tables below have reported there are no known exposed horses related to this incident currently within their States.

Horse Information

Horses categorized in EHV-1 or EHM suspect categories or as EHV-1 confirmed in previous reports may change categories based on test results or development of additional clinical signs.

Table 1. Cumulative total of confirmed cases and fatalities as of close of business 6/22/11:

	# EHV-1 confirmed cases	**# EHM confirmed cases**	**# Dead or euthanized suspect or confirmed cases**
Primary exposed horses (at Ogden, UT, event)	28	26	10
Secondary and tertiary exposed horses	29	7	3
Total	57	33	13

Table 2. Status of primary exposed horses (attended Ogden, UT, event) as of close of business 6/22/11:

State	# Primary exposed horses (at Ogden, UT)	# EHV-1 suspect cases	# EHV-1 confirmed cases	# EHM suspect cases	# EHM confirmed cases	# Dead or euthanized suspect or confirmed cases
Arizona	33	4	2	2	1	2
California	59	0	9	0	7	1
Colorado	45	22	9	0	6	2
Idaho	38	7	1	2	2	2
Illinois	1	0	0	0	0	0
Iowa	5	0	0	0	0	0
Minnesota	18	0	0	0	0	0
Missouri	3	1	0	0	0	0
Montana	17	0	0	0	0	0
Nebraska	7	0	0	0	0	0
Nevada	7	0	1	0	0	0
New Mexico	13	1	2	1	1	1
Oklahoma	1	0	0	0	1	0
Oregon	20	0	2	0	1	1
South Dakota	4	0	0	0	0	0
Texas	26	0	0	0	0	0
Utah	51	4	1	1	4	1
Washington	35	0	1	0	3	0
Wyoming	38	1	0	0	0	0
Total	**421**	**40**	**28**	**6**	**26**	**10**

Table 3. Status of secondary and tertiary exposed horses as of close of business 6/22/11:

State	# Secondary and tertiary exposed horses	# EHV-1 suspect cases	# EHV-1 confirmed cases	# EHM suspect cases	# EHM confirmed cases	# Dead or euthanized suspect or confirmed cases
Arizona	60	3	10	1	1	0
California	628	0	5	0	1	1
Colorado	78	0	1	0	0	0
Idaho	129	16	3	0	2	0
Illinois	9	0	0	0	0	0
Iowa	53	0	0	0	0	0
Minnesota	*	0	0	0	0	0
Missouri	*	0	0	0	0	0
Montana	17	0	0	0	0	0
Nebraska	7	0	0	0	0	0
Nevada	7	0	1	0	0	0
New Mexico	13	1	2	1	1	1
Oklahoma	1	0	0	0	1	0
Oregon	20	0	2	0	1	1
South Dakota	4	0	0	0	0	0
Texas	26	0	0	0	0	0
Utah	51	4	1	1	4	1
Washington	35	0	1	0	3	0
Wyoming	38	1	0	0	0	0
Total	**421**	**40**	**28**	**6**	**26**	**10**

*Information not available.

Premises Information

Table 4. Exposed premises information as of close of business 6/22/11:

State	# Exposed premises	# Exposed premises with suspect or confirmed EHV/EHM cases (# new premises this reporting period)	# Exposed premises with no suspect or confirmed cases
Arizona	13	6 (0)	7
California	34	15 (0)	19
Colorado	12	7 (0)	5
Idaho	20	8 (0)	12
Illinois	1	0 (0)	1
Iowa	2	0 (0)	2
Minnesota	6	0 (0)	6
Missouri	1	0 (0)	1
Montana	*	0 (0)	*
Nebraska	3	0 (0)	3
Nevada	7	2 (0)	5
New Mexico	4	3 (0)	1
Oklahoma	1	1 (0)	0
Oregon	16	3 (0)	13
South Dakota	2	0 (0)	2
Texas	16	1 (0)	15
Utah	31	8 (0)	23
Washington	28	7 (0)	21
Wyoming	45	1 (0)	44
Total	**242**	**62** (0)	**180**

Appendix C

State and Federal Resources Allocated in Response to the Ogden, Utah EHV-1 Disease Outbreak

Background

There are several strains of equine herpesvirus (EHV) that cause a variety of disease syndromes in horses, including respiratory disease, abortion, neonatal death, and myeloencephalopathy. Equine herpesvirus-1 (EHV-1) occurs in horses around the world. The neurologic form of EHV-1 is referred to as equine herpesvirus myeloencephalopathy (EHM).[1] Not all horses infected with EHV-1 develop EHM.

From April 29 to May 8, 2011, the National Cutting Horse Association (NCHA) Western National Championship was held in Ogden, Utah. Some horses that attended the event were later diagnosed with EHV-1 infection, and some of these horses developed EHM. According to the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) "Equine Herpesvirus (EHV-1) Final Situation Report," [2] 19 States[3] had primary exposed horses.[4] In addition, 162 EHV-1 or EHM confirmed or suspect cases were reported in 13 States.[5] Due to the scope of the outbreak—and at the request of the American Association of Equine Practitioners, American Horse Council, and National Assembly of State Animal Health Officials— an epidemiologic investigation was initiated by APHIS's Veterinary Services (VS).

The following analysis focuses on the Federal and State resources allocated for the field response to the EHV-1 outbreak. The goal of the analysis is to help Federal and State animal health official (SAHO) offices plan for future disease outbreaks by providing an estimate of the resources used to respond to the EHV-1 outbreak. SAHO Offices and VS Area Offices determined how to respond to the outbreak situation in each State. Roles for SAHO and VS area offices varied by State.

Data

VS Area Offices and SAHO offices in States with exposed horses were surveyed to determine the level of resources allocated in response to the EHV-1 outbreak. Surveys were sent to 37 offices. The analysis uses data from 19 completed surveys from 19 States: 5 from VS Area Offices and 14 from SAHO offices. These data represent resource allocations from 14 States: 7 with cases,[6] and 7 without cases. States with cases that responded represented 88 percent of all cases.

During the outbreak response, most SAHO offices allocated more resources than the VS Area Offices responsible for that State. In just one State with a case(s), the VS Area Office allocated more resources than the SAHO office.

Analysis

Labor accounted for the largest portion of reported resources used to respond to the multistate EHV-1 outbreak. VS Area offices reported allocating 109 hours (regular and overtime[7]) to four activities related to the response

[1] http://www.aaep.org/images/files/FAQforEquine Herpesvirus(final)051911.pdf Accessed February 2, 2012.
[2] http://www.aphis.usda.gov/vs/nahss/equine/ehv/ehv_2011_final_sitrep_062311.pdf Accessed January 20, 2012.
[3] Arizona, California, Colorado, Idaho, Illinois, Iowa, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.
[4] Horses that attended the Ogden, UT, NCHA event from April 29 to May 8, 2011.
[5] Arizona, California, Colorado, Idaho, Missouri, Nevada, New Mexico, Oklahoma, Oregon, Texas, Utah, and Washington, and Wyoming.
[6] For the purposes of this analysis, States are classified as having a case if they reported at least 1 confirmed primary or secondary case (horses that subsequently came into direct contact with horses that attended the Ogden, Utah event) of EHV-1 or EHM. For States with confirmed cases, the total number of cases includes reported suspect cases. States are classified as not having a case if they had no confirmed cases, although they may have reported suspect cases.
[7] Two SAHO offices reported that their employees worked overtime hours. The total overtime worked was 68 hours dedicated to various activities, and none of these hours were paid overtime hours. One VS Area Office reported their employees worked 1.5 hours of paid overtime

(table 1). SAHO offices reported allocating 5,862 hours (table 2), with an average of 419 hours per office. SAHO offices allocated 87 percent of their total reported hours to meetings, conference calls, data entry and analysis, written communications, and public relations (figure 1).

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Table 1. Total reported labor hours (regular and overtime[1]) allocated by VS Area offices (n=5), by activity

Activity	Total Hours
Animal-health official meetings/ conference calls/data entry and analysis	48
Written communication/public relations[2]	23
On-site equine facility visits	0
Public meetings and presentations[3]	38
Total labor hours reported	109

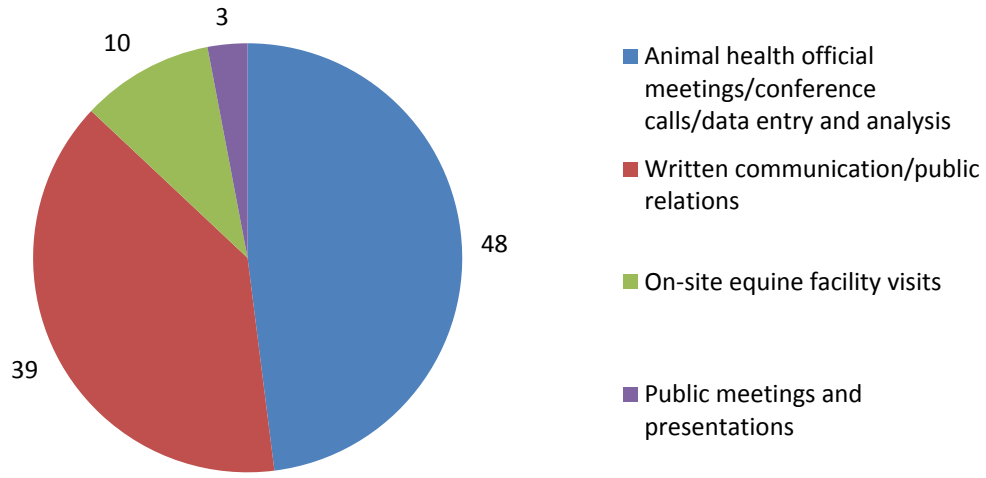
[1]One VS Area Office reported that their employees worked 1.5 hours of paid overtime. Not all employees are required to submit timesheets, so it is likely that a SAHO office reported more than 40 regular hours per week for employees but did not report hours past 40 as overtime.
[2]Preparing situation reports, updating Web sites, preparing and issuing news releases. Some survey respondents reported labor hours utilized on outbreak-related phone calls.
[3]Some survey respondents reported labor hours utilized on outbreak-related phone calls and one-on-one discussions with the public.

Table 2. Total reported labor hours (regular and overtime[1]) allocated by SAHO offices (n=14), by activity

Activity	Total Hours	Range	Average
Animal-health official meetings/ conference calls/data entry and analysis	2,838	15 - 937	203
Written communication/public relations[2]	2,270	2 - 405	162
On-site equine facility visits	559	0 - 330	40
Public meetings and presentations[3]	196	0 - 71	14
Total labor hours reported, range, and average	5,862	17 - 734	419

[1] Two SAHO offices reported that their employees worked overtime. The total overtime worked was 68 hours dedicated to various activities, and none of these were paid overtime hours. Not all employees are required to submit timesheets, so it is likely that a SAHO office reported more than 40 regular hours per week for employees but did not report hours past 40 as overtime.
[2]Preparing situation reports, updating Web sites, preparing and issuing news releases. Some survey respondents reported labor hours utilized on outbreak-related phone calls.
[3]Some survey respondents reported labor hours utilized on outbreak-related phone calls and one-on-one discussions with the public.

Figure 1. Percentage of 5,862 reported labor hours allocated by SAHO offices, by activity



For the seven States with cases, the time allocated by SAHO offices ranged from 1 to 16 hours per exposed horse,[8] with an average of 7 hours per exposed horse (table 3). In one of these States, the SAHO office allocated considerably more labor hours per exposed horse compared with SAHO offices in the other six States, resulting in a wide range of labor hours allocated and a higher average due to this outlier. To more accurately estimate average labor hours allocated per exposed horse, the weighted average was calculated using the proportion of exposed horses in a State to the total number of exposed horses in the outbreak as the weight. The seven States with cases allocated a weighted average of 3 hours per exposed horse (table 3). SAHO offices allocated the same amount of hours per exposed horse, based on the weighted average estimate, whether or not their State had cases.

VS Area and SAHO offices reported allocating hours to eight personnel types (tables 4 and 5). Veterinarians and epidemiologists accounted for the majority (74 percent) of the total number of labor hours allocated to the outbreak response (figure 2).

Response activities[9] for the EHV-1 outbreak spanned an average of 41 days for all participating VS Area Offices and an average of 64 days for all participating SAHO offices.

[8] Primary and secondary exposed horses.

[9] Examples include, animal-health official meetings/ conference calls/data entry and analysis, written communication/public relations, on-site equine facility visits, public meetings and presentations.

The percentage of annual labor hours dedicated to the outbreak may be helpful to plan responses to future outbreaks. For example, a SAHO office with four full-time employees would have 7,520[10] labor hours available over the course of a year. SAHO offices with a case allocated an average of 996[11] hours to the outbreak, which equates to 13.1 percent of the estimated annual labor hours available.

For SAHO offices with a case, response activities related to the outbreak spanned an average of 54 days. A SAHO office with four full-time employees would have 1,236 labor hours available to respond to the outbreak during those 54 days.[12] SAHO offices with cases allocated an average of 996 hours to the outbreak, which equates to 80.0 percent of the hours available during the 54 days.

SAHO offices in States without a case allocated an average of 439.3 hours to the outbreak, which equates to 5.8 percent of the estimated annual labor hours available.

[10] Assumptions: 52 weeks - 2 weeks (10 working days) for holidays - 2 weeks for vacation - 1 week for sick leave = 47 weeks. 47 weeks x 40 hours per week = 1,880 hours. 1,880 hours x 4 full-time employees = 7,520 hours.

[11] Weighted average was calculated using the proportion of hours a State allocated as the weight.

[12] Assumptions: 54 days / 7 days per week = 7.7 weeks. 7.7 weeks x 40 hours per week = 309 hours x 4 full time employees = 1,236 hours. All regular hours, no overtime, no holidays, no leave.

Table 3. Range, average, and weighted average reported hours allocated by SAHO offices in States with and without cases, per exposed horse

		Labor Hours		
SAHO offices. . .		**Range**	**Average**	**Weighted average**
With case	per exposed horse	1–16	7	3
Without case	per exposed horse	2–49	13	3

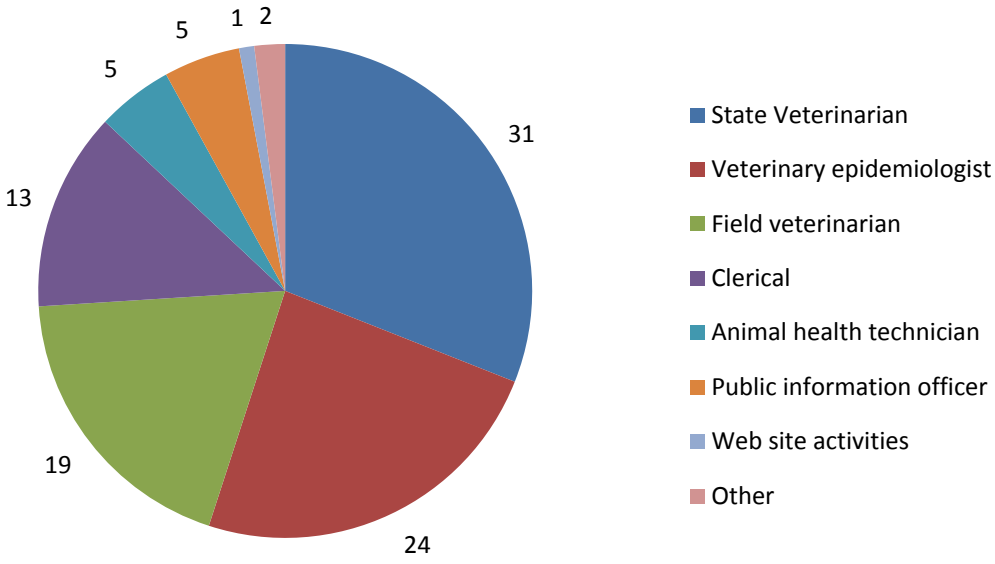
Table 4. Total reported labor hours allocated by VS Area offices (n=5), by personnel type

Personnel type	**Total Hours**
AVIC/State Veterinarian	12
Veterinary epidemiologist	47
Field veterinarian	33
Clerical	1
Animal-health technician	14
Public Information Officer	NA
Web site activities	NA
Other	2
Total labor hours reported	109

Table 5. Total reported labor hours allocated by SAHO offices (n=14), by personnel type

Personnel type	**Total Hours**	**Range**	**Average**
AVIC/State Veterinarian	1,829	2 – 620	131
Veterinary epidemiologist	1,395	0 – 360	100
Field veterinarian	1,111	0 – 420	79
Clerical	741	0 – 200	53
Animal-health technician	306	0 – 80	22
Public Information Officer	293	0 – 94	21
Web site activities	87	0 – 60	6
Other	101	0 – 45	7
Total labor hours reported, range, and average	5,862	18 – 1,622	419

Figure 2. Percentage of 5,862 reported labor hours allocated by SAHO offices, by personnel type



For SAHO offices in States without cases, response activities related to the outbreak spanned an average of 70 days. States without cases evaluated or tested suspect cases, followed-up on exposed horses, and communicated with constituents. A SAHO office with four full-time employees would have 1,600 labor hours[13] available to respond to the outbreak during those 70 days. SAHO offices without cases allocated an average of 439 labor hours responding to the outbreak, which equates to 27.4 percent of the hours available during the 70 days.

In addition to labor allocations, SAHO offices spent money on travel and other activities. SAHO offices spent $5,707.84 for travel expenses related to outbreak response, with the average travel cost for SAHO offices being $1,074.32.[14] The reported amount of money spent on travel does not include money saved or lost due to cancelled trips planned prior to the outbreak. No VS Area Office reported travel costs.

For the seven States with cases, the travel dollars allocated by SAHO offices ranged from $0 to $27.27 per exposed horse, with an average of $5.75 per exposed horse (table 6). In one of these States, the SAHO office spent considerably more on travel per exposed horse compared with SAHO offices in the other six States, resulting in a wide range of dollars spent per exposed horse and a higher average due to this outlier. To estimate a more accurate average amount spent on travel per exposed horse, a weighted average was calculated using the proportion of exposed horses in a State as the weight. SAHO offices in the seven States with cases spent a weighted average of $2.32 per exposed horse on travel. There are several likely reasons that the average amount spent on travel per exposed horse is low. For example, some States may have had several exposed horses on just a few premises; traceouts could have been done through the responsible party via phone; or premises with exposed horses could have been located near the SAHO office.

In States without a case, SAHO offices allocated more travel dollars per exposed horse than SAHO offices in States with cases, based on the weighted average estimate (table 6). This finding was driven primarily by the size of the State and the number of exposed horses in the State. Geographically larger States tended to have more exposed horses and larger travel expenses related to investigating premises with exposed horses.

[13] Assumptions: 70 days / 7 days per week = 10 hours. 10 hours x 40 hours per week = 400 hours. 400 hours x 4 full-time employees = 1,600 hours. All regular hours, no overtime, no holidays, no leave.
[14] Weighted average was calculated using the proportion of dollars a State spent on travel as the weight.

Table 6. Range, average, and weighted average reported travel dollars allocated by SAHO offices in States with and without cases, per exposed horse

		Dollars		
SAHO offices. . .		**Range**	**Average**	**Weighted average**
With case	per exposed horse	0–27.27	5.75	2.32
Without case	per exposed horse	0–31.43	9.58	5.72

The survey included questions about how much VS Area and SAHO offices spent on testing, treatment, euthanasia, disposal, indemnity, hold order/quarantine, biosecurity, and cleaning and disinfection. While there were very few responses to these questions, some interesting and useful information was available. In three States, SAHO offices paid for the testing of 176 horses at an average cost of $59.99 per horse. This price is comparable to the amount horse owners pay a laboratory for EHV testing. The decision to pay for testing was made by each State's responding animal health official office.

The costs associated with hold orders/quarantines included quarantine signage, paperwork, and processing paperwork. VS Area Offices did not pay for any testing or hold orders/quarantines. Eight SAHO offices paid for 55 hold orders/quarantines at an average cost of $3.45 per premises.

Limitations

Limitations to this analysis include the fact that only States with primary exposed horses were asked to participate, and only 51.4 percent of VS Area and SAHO offices queried completed the survey. It is possible that VS Area and SAHO offices did not complete the survey because they did not allocate resources for responding to the EHV-1 outbreak. In addition, other States without exposed horses likely allocated time responding to questions via phone and email, updating Web site information, and participating in meetings/conference calls related to the outbreak. Furthermore, extrapolation of these data for nonrespondents using the information collected from VS Area and SAHO offices that completed the survey is not possible because of the variation in the number of cases, premises, and exposed horses among States. Only resources allocated by VS Area and SAHO offices were reported; the resources allocated by VS national staff, VS Western Region staff, and the staff at the Centers for Epidemiology and Animal Health are not included in this estimate of resource allocation in response to the outbreak. The survey is limited to the field resources allocated to respond to the disease outbreak.

It is clear that many offices shifted resources to respond to this disease outbreak; as a result, regular daily activities were delayed or never completed. The resource estimates in this analysis are conservative and do not include the opportunity cost associated with those postponed or foregone activities. Animal health official offices are aware of the tradeoffs incurred when shifting resources to respond to disease outbreaks. If necessary, they request additional short-term assistance to complete activities or reprioritize their activities.

Conclusions

This analysis estimates the total reported resource allocations and costs associated with VS Area and SAHO offices responding to the 2011 EHV-1 disease outbreak in the United States. The goal of this analysis is to provide information that will help SAHO offices plan for future outbreaks or emergencies. Although the disease outbreak studied here may not resemble all diseases affecting equids, it provides an estimate of the resources allocated to field-based response to a specific outbreak. This information can help estimate the resources needed for similar disease outbreaks.

Appendix D: Premises Questionnaire

Person providing information: *[Check one only.]* E100

- ☐1 Premises owner
- ☐2 Barn manager
- ☐3 Trainer
- ☐4 Other (specify: _____) E100OTH

Date questionnaire administered: _____(mm/dd/yy) E101

Section 1—General

1. When did you become aware of the EHV-1 outbreak?..... E102 _____ date

2. How were you first made aware? *[Check one only.]* E103

   - ☐1 NCHA
   - ☐2 Local association
   - ☐3 State authorities
   - ☐4 Friend
   - ☐5 Other (specify: _____) E103OTH

Section 2—Animals on This Premises

1. What were the starting and ending dates of the isolation (quarantine) and monitoring period for the premises?

   a. Starting ..... E200 _____ date

   b. Ending (if not ended, provide anticipated end date)..... E201 _____ date

2. What was the total number of equids (horses, ponies, donkeys, mules, and other equids) on the premises during the isolation (quarantine) and monitoring period? ..... E202 _____ #

3. Of the total number of equids present on this premises during the start of the isolation (quarantine) and monitoring period, how many were of the following type and how many of each type have been vaccinated for EHV-1 since February 1, 2011:

	Number of animals	Number vaccinated for EHV-1 since Feb. 1, 2011	
a. Horses (excluding miniature horses)	_____	_____	E203/ E210
b. Ponies	_____	_____	E204/ E211
c. Miniature horses	_____	_____	E205/ E212
d. Donkeys or burros	_____	_____	E206/ E213
e. Mules	_____	_____	E207/ E214
f. Other (specify: _____) E208OTH	_____	_____	E208/ E215
g. Total *[Column 1 should equal Question 2.]*	_____	_____	E209/ E216

4. Was a horse or other equid on the premises ever diagnosed with laboratory-confirmed EHV-1(respiratory, abortion, or neurologic form) prior to the Ogden, UT, event? ..... E217 ☐1 Yes ☐3 No

   If YES, when was the most recent case? ..... E218 _____ date

   What form of EHV-1 was diagnosed? ..... E219 _____ form

5. How many camelids (llamas or alpacas) were on the premises during the isolation (quarantine) and monitoring period? ..... E220 _____ #

6. Are all equids and camelids on the premises owned by the same individual? ..... E221 ☐1 Yes ☐3 No

7. How many horses attended the Ogden, UT, NCHA event? ..... E222 _____ #

8. Of those horses that attended the Ogden, UT, NCHA event:

   a. How many competed? ..... E223 _____ #

   b. How many were turnback horses? ..... E224 _____ #

   c. How many attended but did not compete or serve as turnback horses? ..... E225 _____ #

   d. Total number of horses attending the event *[should equal Question 7]* ..... E226 _____ #

[If Question 8b = 0, SKIP to Question 10.]

9. At the Ogden, UT, event, which turnback horses did you use in the competition? E227

   ☐1 Only your own

   ☐2 Other stables' turnback horses

   ☐3 Both types

10. How often did you take the temperatures of your horses while at the Odgen, UT, event? *[Check one only.]* E228

☐1 Twice daily

☐2 Daily

☐3 Less frequently than daily

☐4 Taken only if exhibiting clinical signs

☐5 Never

11. Of those horses from this premises that attended the Ogden, UT, event:

	During event	After event	
a. How many developed a fever (rectal temperature >101.5°F) without evidence of neurological signs?			
[Enter NA if did not monitor temperature.]	_____ #	_____ #	E229/ E235
i. Of these, how many were confirmed EHV-1 positive through laboratory diagnosis?	_____ #	_____ #	E230/ E236
b. How many developed neurologic* signs only (i.e., no fever)?	_____ #	_____ #	E231/ E237
i. Of these, how many were confirmed EHV-1 positive through laboratory diagnosis?	_____ #	_____ #	E232/ E238
c. How many developed both a fever and neurological signs?	_____ #	_____ #	E233/E 239
i. Of these, how many were confirmed EHV-1 positive through laboratory diagnosis?	_____ #	_____ #	E234/ E240

12. Since May 8, 2011, of the horses from this premises that **did not** attend the Ogden, UT, event:

a. How many developed a fever (rectal temperature >101.5°F) without evidence of neurological signs?

[Enter NA if did not monitor temperature.] ..... E241 _____ #

i. Of these, how many were confirmed EHV-1 positive through laboratory diagnosis? ..... E242 _____ #

b. How many developed neurological signs only (i.e., no fever)? ..... E243 _____ #

i. Of these, how many were confirmed EHV-1 positive through laboratory diagnosis? ..... E244 _____ #

c. How many developed both a fever and neurological signs? ..... E245 _____ #

i. Of these, how many were confirmed EHV-1 positive through laboratory diagnosis? ..... E246 _____ #

* Neurologic signs: wobbly gait, dribbling urine, urinary bladder atony, recumbent unable to rise (down), stumbling/falling down, tail flaccid, exaggerated limb movements when walking or while down.

13. Were there any clinical signs of disease in any of the equids or camelids on the premises from April 17 to 29, 2011, prior to the Ogden, UT, event? E247 ☐1 Yes ☐3 No
If YES, list the specific type and name of animal, date of onset, and signs shown:

Animal type	Date of onset	Signs shown
E248	E252	E256
E249	E253	E257
E250	E254	E258
E251	E255	E259

Section 3—Resource Allocation

1. On your premises, how many resources have been allocated in responding to the Ogden, UT, EHV-1disease outbreak?

Category of labor	Total hours	Average hourly rate ($/hour)
Overtime	E301	E305
Additional hire(s)	E302	E306
Salaried staff	E303	E307
Other (specify: _____) E304OTH	E304	E308

2. What was the amount of lost prepaid entry fees or stall fees due to isolation (quarantine) on this premises? ..... E309 $ _____

Section 4—Biosecurity at the Premises Level

1. Identify biosecurity practices that are normal procedures implemented on the premises when returning from an event and those that were implemented in response to the Ogden, UT, EHV-1 disease outbreak. *[Check all that apply and provide costs.]*

Procedure for you and your staff	Normal procedure	Cost*	In response to the Ogden, UT EHV-1 disease outbreak	Additional cost ($)
Returning horses isolated from others on the premises (i.e., prevent direct contact with other horses)	☐1 Yes ☐3 No E401	E415	☐1 Yes ☐3 No E429	E443
Take horses' temperatures	☐1 Yes ☐3 No E402	E416	☐1 Yes ☐3 No E430	E444
Use separate or disinfected grooming equipment	☐1 Yes ☐3 No E403	E417	☐1 Yes ☐3 No E431	E445
Use separate or disinfected feeding equipment	☐1 Yes ☐3 No E404	E418	☐1 Yes ☐3 No E432	E446
Use separate or disinfected tack	☐1 Yes ☐3 No E405	E419	☐1 Yes ☐3 No E433	E447
Use disposable personal protective equipment (coveralls, latex/plastic gloves, etc.)	☐1 Yes ☐3 No E406	E420	☐1 Yes ☐3 No E434	E448
Change clothes or wear clean coveralls	☐1 Yes ☐3 No E407	E421	☐1 Yes ☐3 No E435	E449
Disinfect or change boots	☐1 Yes ☐3 No E408	E422	☐1 Yes ☐3 No E436	E450
Clean and disinfect hands	☐1 Yes ☐3 No E409	E423	☐1 Yes ☐3 No E437	E451
Clean and disinfect trailer between loads	☐1 Yes ☐3 No E410	E424	☐1 Yes ☐3 No E438	E452
Have personnel dedicated to caring for returning horses who do not have contact with other horses on premises	☐1 Yes ☐3 No E411	E425	☐1 Yes ☐3 No E439	E453
Use signage instructing personnel and/or visitors on biosecurity practices	☐1 Yes ☐3 No E412	E426	☐1 Yes ☐3 No E440	E454
Do not allow unnecessary visitors on the premises	☐1 Yes ☐3 No E413	E427	☐1 Yes ☐3 No E441	E455
Other (specify: _____) E414OTH	☐1 Yes ☐3 No E414	E428	☐1 Yes ☐3 No E442	E456
Required for people (visitors, boarders, veterinarians, farriers, etc.) visiting the premises	**Normal procedure**	**Cost***	**In response to the Ogden, UT, EHV-1 disease outbreak**	**Additional cost ($)**
Use separate or disinfected grooming equipment	☐1 Yes ☐3 No E457	E466	☐1 Yes ☐3 No E475	E484
Use separate or disinfected feeding equipment	☐1 Yes ☐3 No E458	E467	☐1 Yes ☐3 No E476	E485
Use separate or disinfected tack	☐1 Yes ☐3 No E459	E468	☐1 Yes ☐3 No E477	E486
Change clothes or wear clean coveralls	☐1 Yes ☐3 No E460	E469	☐1 Yes ☐3 No E478	E487
Disinfect or change boots	☐1 Yes ☐3 No E461	E470	☐1 Yes ☐3 No E479	E488
Park away from the animal area	☐1 Yes ☐3 No E462	E471	☐1 Yes ☐3 No E480	E489
Clean and disinfect hands	☐1 Yes ☐3 No E463	E472	☐1 Yes ☐3 No E481	E490
Use disposable personal protective equipment (coveralls, latex/plastic gloves, etc.)	☐1 Yes ☐3 No E464	E473	☐1 Yes ☐3 No E482	E491
Other (specify: _____) E465OTH	☐1 Yes ☐3 No E465	E474	☐1 Yes ☐3 No E483	E492

*Including supplies, equipment, or rental of stall space.

2. Were horses that were exposed to EHV-1 or horses that were cases of EHV-1 or EHM isolated from horses that had no clinical signs of disease? ..... E493 ☐1 Yes ☐3 No ☐4 NA (no cases)

If YES, check the applicable description and provide cost information:

Isolation description	Case horses	Exposed horses	Cost
Moved to another building or location on the premises	☐1 Yes ☐3 No E494	☐1 Yes ☐3 No E499	E504
Moved within the barn—one to two empty stalls between affected horse and others	☐1 Yes ☐3 No E495	☐1 Yes ☐3 No E500	E505
Moved within the barn—more than two empty stalls between the affected horse and others	☐1 Yes ☐3 No E496	☐1 Yes ☐3 No 1	E506
Removed to a different quarantined premises	☐1 Yes ☐3 No E497	☐1 Yes ☐3 No E502	E507
Other, specify: E499OTH	☐1 Yes ☐3 No E498	☐1 Yes ☐3 No E503	E508

3. When were the exposed horses and cases isolated from other animals?
[Check the applicable description.]

a. Exposed horses: E509

☐1 Upon return from the Ogden, UT, event

☐2 When you became aware of the EHV-1 outbreak associated with the Ogden, UT, event

☐3 Once cases were identified on the premises

b. Cases: E510

☐1 No cases identified

☐2 Upon return from the Ogden, UT, event

☐3 When you became aware of the EHV-1 outbreak associated with the Ogden, UT, event

☐4 When fever was detected in the animal

☐5 When neurological signs were detected in the animal

4. Are there any other observations about horses on this premises or the EHV-1 outbreak that you would like to share with us? E511

Thank you very much for your participation.

Appendix E: Case Horse Questionnaire

Section 1—Horse Information/Signalment

1. Gender: C100
   - ☐1 Gelding
   - ☐2 Stallion
   - ☐3 Nonpregnant mare
   - ☐4 Pregnant mare

2. Breed: .....C101 _____

3. Age (in years) .....C102 _____ yrs

4. What is the **primary** use of this horse? *[Check one only.]* C103
   - ☐1 Recreation/pleasure
   - ☐2 Lessons/school
   - ☐3 Showing/competition in cutting
   - ☐4 Showing/competition other than cutting
   - ☐5 Breeding
   - ☐6 Racing
   - ☐7 Farm or ranch work
   - ☐8 Turnback horse
   - ☐9 Other (specify: _____) C103OTH

6. In how many events did this horse compete from April 1 to 28, 2011?..... C104 _____ #

7. On average, how many days/week was this horse exercised from April 1 to 28, 2011? .....C105 _____ days/wk

8. What was the average level of exercise[1] from April 1 to 28, 2011? *[Check one only.]* C106
   - ☐1 Light
   - ☐2 Moderate
   - ☐3 Heavy
   - ☐4 Very heavy

[1] Light exercise is described as 1 to 3 hours/week of mostly walking and trotting. Many horses kept for recreational riding would be included in the light exercise category. Moderate exercise consists of 3 to 5 hours/week of mostly trotting with some walking, some cantering and possibly some jumping or other type of more difficult activity. Horses used for horse shows, ranch work and frequent recreational riding would fit into the moderate exercise category. Heavy exercise is described as 4 to 5 hours/week of trotting, cantering, galloping and some jumping, cattle work, etc. Horses engaged in three day eventing, polo, endurance racing, cutting, or other competitive events would be in this category. The very heavy exercise category includes racehorses and a few other horses that compete at the elite level of endurance or three day eventing.

9. How was this horse typically housed/maintained from April 1 to 28, 2011?
[Check all that apply.]

- ☐ Stall C107
- ☐ Paddock/corral C108
- ☐ Pasture C109
- ☐ Other (specify: _____) C110OTH C110

10. Is this horse receiving supplements added to the regular feed ration?..... C111 ☐1 Yes ☐3 No

If YES, provide the specific name(s) of the supplements given and amount(s) given/day:

Product	Amount fed per feeding	Frequency of feeding	Length of time on product
Platinum performance®CJ	*1 scoop*	*Twice per day*	*Started 15 months ago*
C112	C117	C122	C127
C113	C118	C123	C128
C114	C119	C124	C129
C115	C120	C125	C130
C116	C121	C126	C131

11. Was a horse or other equid on the premises ever diagnosed with laboratory-confirmed EHV-1(respiratory, abortion, or neurologic form) prior to the Ogden, UT, event? ..... C132 ☐1 Yes ☐3 No

If YES, when was the most recent case? ..... C133 _____ date

What form of EHV-1 was diagnosed?..... C134 _____ form

Section 2—Questions Related to Ogden, UT, Event

1. Did this horse attend the Ogden, UT, April 29–May 8, 2011, NCHA event? ..... C200 ☐1 Yes ☐3 No

[If Question 1 = NO, SKIP to Section 3.]

2. In what capacity was the horse used at the Ogden, UT, event? *[Check one only.]* C201
   - ☐1 Competing
   - ☐2 Turnback horse
   - ☐3 Along for experience
   - ☐4 Other (specify: _____) C201OTH

3. What was the:
   a. Date of arrival at the event? ..... C202 _____ date
   b. Date of departure from the event? ..... C203 _____ date

4. What barn and stall number was the horse housed in while at the Ogden, UT, event?
   [Be specific to stall/pen if possible. See diagram of Golden Spike Event Center and barns with labeled stall numbers.] ..... C204/ C205 _____ **barn** _____ **stall #**

5. How many hours did it take to trailer this horse to the event from its location just prior to arrival at the Ogden event? ..... C206 _____ hrs
   a. How many horses were transported in the same trailer/van with this horse to the event? ..... C207 _____ #

6. How many hours did it take to trailer this horse from the Ogden, UT, event to its next destination after leaving the event? ..... C208 _____ hrs
   a. How many horses were transported in the same trailer/van with this horse when leaving the event? ..... C209 _____ #

7. Use the table below to identify the classes in which this horse competed and to list all of the areas your horse visited each day at the Ogden, UT, event. *[The following is the list of some, but not necessarily all, locations you may use to identify the horse's daily movements. See diagram of Golden Spike Event Center and barns with labeled stall numbers.]* Indicate the class competed and check all locations the horse visited each day.

Codes to be entered in classes competed in below*			
1 = $3000 Novice	4 = Open	7 = $15000 Amateur	10 = $15000 N/Non-Pro
2 = Jr. Youth	5 = $10000 Novice	8 = $33000 Non-Pro	11 = $50000 Amateur
3 = Sr. Youth	6 = $2000 Limited/Rider	9 = $5000 N//Non-Pro	12 = Non-Pro

	April 26	**April 27**	**April 28**	**April 29**	**April 30**	**May 1**	**May 2**
*Classes competed	C210	C220	C230	C240	C250	C260	C270
Riding arena	C211	C221	C231	C241	C251	C261	C271
Golden Spike Arena	C212	C222	C232	C242	C252	C262	C272
Outdoor stadium	C213	C223	C233	C243	C253	C263	C273
Cross country course/racetrack	C214	C224	C234	C244	C254	C264	C274
Barn A	C215	C225	C235	C245	C255	C265	C275
Barn B	C216	C226	C236	C246	C256	C266	C276
Barn C	C217	C227	C237	C247	C257	C267	C277
Barn D	C218	C228	C238	C248	C258	C268	C278
Other, specify: C219OTH	C219	C229	C239	C249	C259	C269	C279
	May 3	**May 4**	**May 5**	**May 6**	**May 7**	**May 8**	**May 9**
*Classes competed	C280	C290	C300	C310	C320	C330	C340
Riding arena	C281	C291	C301	C311	C321	C331	C341
Golden Spike Arena	C282	C292	C302	C312	C322	C332	C342
Outdoor stadium	C283	C293	C303	C313	C323	C333	C343
Cross country course/racetrack	C284	C294	C304	C314	C324	C334	C344
Barn A	C285	C295	C305	C315	C325	C335	C345
Barn B	C286	C296	C306	C316	C326	C336	C346
Barn C	C287	C297	C307	C317	C327	C337	C347
Barn D	C288	C298	C308	C318	C328	C338	C348
Other, specify: C289OTH	C289	C299	C309	C319	C329	C339	C349

8. Which of the following applied to this horse during its stay at the Ogden, UT, event facility? *[Check all that apply.]*

- ☐ Tied in barn outside of stall C350
- ☐ Used a shared water source C351
- ☐ Grazed on facility grounds C352
- ☐ Utilized a wash rack C353
- ☐ Had veterinary treatment or examination C354
- ☐ Was worked on by a farrier C355
- ☐ Other (specify: _____) C356OTH C356

Section 3—Clinical Information

1. Date of onset of first signs of being sick during the isolation (quarantine) and monitoring period ..... H1001 _____ date

2. Did you monitor this horse's temperature? ..... C401 ☐1 Yes ☐3 No

[If Question 2 = NO, SKIP to Question 4.]

3. Did the horse exhibit a fever (rectal temperature of >101.5°F)? ..... C402 ☐1 Yes ☐3 No

   If YES,

   a. What was the date of onset of fever? ..... C403 _____ date

   b. What was the highest temperature documented during the course of disease? ..... C404 _____ temp

   c. What was the date of last fever? ..... C405 _____ date

4. Did the horse exhibit neurologic[2] signs? ..... C406 ☐1 Yes ☐3 No

   If YES, what was the date of onset of neurologic signs? ..... C407 _____ date

5. Was this horse isolated from the other horses and equids on the premises (no direct contact with other horses)? ..... C408 ☐1 Yes ☐3 No

   If YES, on what date was the horse isolated from other equids on the premises? ..... C409 _____ date

[2] Neurologic signs: wobbly gait, dribbling urine, urinary bladder atony, recumbent unable to rise (down), stumbling/falling down, tail flaccid, exaggerated limb movements when walking or while down.

6. Is/was this horse pregnant in 2011? ..... C410 ☐1 Yes ☐3 No

[If Question 6 = NO, SKIP to Question 8.]

If YES, what was the outcome of the pregnancy? C411

☐1 Live birth

☐2 Abortion

☐3 Stillbirth

☐4 Still pregnant

7. If the fetus was aborted or stillborn:

   a. What was the date of pregnancy loss? ..... C412 _____ date

   b. Was EHV-1 the laboratory-confirmed cause of abortion? ..... C413 ☐1 Yes ☐3 No

      If YES, what were the breeding fees, prenatal care costs, and veterinary care costs associated with this mare's pregnancy? ..... C414 $ _____

8. What is the status of the horse? C417

   ☐1 Alive

   ☐2 Euthanized (date: _____) C417DAT

   ☐3 Died (date: _____) C417DAT

[If Question 8 = 2 or 3, SKIP to Question 11.]

9. Has the horse fully recovered? ..... H1002 ☐1 Yes ☐3 No

   If YES, how long after the date of onset of disease until this horse was fully recovered? ..... H1003 _____ days

10. Has this horse returned to its previous performance level? ..... H1004 ☐1 Yes ☐3 No

    If NO, what residual neurologic or other clinical signs does this horse still have?

[If alive, SKIP to Section 4.]

11. If euthanized due to EHV-1, what was the associated cost? ..... H1005 $ _____
    [Include costs for veterinarian farm visit, euthanasia solution and administration, other drugs and supplies, veterinary service fees. Do not include disposal costs.]

12. If this horse died or was euthanized due to EHV-1 and was insured, what was the amount of anticipated insurance payment? ..... H1006 $ _____

    a. If not insured, how much would you estimate this horse would have sold for before disease onset? ..... H1007 $ _____

13. If this horse died or was euthanized due to EHV-1, what was the method of carcass disposal? *[Check one only.]* H1008

- ☐1 Landfill
- ☐2 Renderer
- ☐3 Incinerated
- ☐4 Buried
- ☐5 Composted
- ☐6 Other (specify: _____) H1008OTH

14. What was the associated cost of disposal?..... H1009 $ _____

Section 4—Specific Clinical Signs Observed

Indicate any clinical signs that were observed in this horse during the isolation (quarantine) and monitoring period.

1. Neurologic signs: *[Check all that apply.]*

- ☐ Incoordination/wobbly gait C500
- ☐ Dogsitting C501
- ☐ Down (unable to rise) C502
- ☐ Exaggerated limb movements, either when walking or while down C503
- ☐ Stumbling/falling C504
- ☐ Circling C505
- ☐ Disorientation C506
- ☐ Lethargic C507
- ☐ Urine dribbling C508
- ☐ Flaccid tail C509
- ☐ Other (specify: _____) C510OTH C510

2. Other clinical signs: *[Check all that apply.]*

- ☐ Nasal discharge C511
- ☐ Coughing C512
- ☐ Off feed C513
- ☐ Excessive sweating C514
- ☐ Colic C515
- ☐ Limb edema/stocking up C516
- ☐ Other (specify: _____) C517OTH C517

Section 5—Travel Information

1. What date did this horse arrive on the premises where it was isolated (quarantined) and monitored in response to the Ogden, UT, EHV-1 disease outbreak? ..... C600 _____ date

2. Is the premises on which this horse spent the quarantine and monitoring period the horse's home premises (i.e., it spends more time here in a 12-month period than anywhere else)? ..... C601 ☐1 Yes ☐3 No

3. Besides the Ogden, UT, event, list the locations/events and dates this horse traveled to during April 2011:

Location or event	Dates
C602	C608
C603	C609
C604	C610
C605	C611
C606	C612
C607	C613

4. When traveling by trailer/van, on average, how many hours does the horse travel before resting/unloading? .....C614 _____ hrs

5. In general, which of the following best describes this horse's response to the stress of travel? *[Check the most appropriate description.]* C615

   ☐1 Tends to get more stressed than the average horse

   ☐2 About average for a horse

   ☐3 Very tolerant of travel and does not appear stressed compared to other horses

Section 6—Vaccination Information

1. In the past year **(from May 1, 2010, through April 28, 2011)**, was this horse vaccinated against EHV-1? ..... C700 ☐1 Yes ☐3 No

   If YES, list the dates and products used to vaccinate this horse against EHV-1. It is important to provide the specific product name or category of vaccine because they vary in content and mechanism of action. *[If you cannot remember specific product names, please check with the horse's veterinarian and provide at least the category of vaccine used, i.e., modified live vaccine, killed EHV product labeled for prevention of abortion/respiratory disease, killed product labeled for prevention of respiratory disease.]*

Date (May 1, 2010–April 28, 2011)	**Product name or product category of EHV-1 vaccine**
C701	C707
C702	C708
C703	C709
C704	C710
C705	C711
C706	C712

2. Since **April 29, 2011**, has this horse been vaccinated against EHV-1? ..... C713 ☐1 Yes ☐3 No
   If YES, list the dates and products used to vaccinate this horse against EHV-1.

Date (since April 29, 2011)	**Product name of EHV-1 vaccine**	**Reason for vaccination***	**Who administered the vaccine (owner, veterinarian, trainer, other <specify>)?**	**Cost ($)** (include product and administration cost)
C714	C717	☐1 ☐2 ☐3 C720 (specify: _____) C720OTH	C723	C726
C715	C718	☐1 ☐2 ☐3 C721 (specify: _____) C721OTH	C724	C727
C716	C719	☐1 ☐2 ☐3 C722 (specify: _____) C722OTH	C725	C728

* 1 = because of the disease outbreak
2= regularly scheduled vaccination
3 = other (specify)

Section 7—Treatment

[Please contact the horse's veterinarian for assistance in completing this section.]

1. Date of initial veterinary examination for EHV-1/EHM:..... C800 _____ date

2. Types of treatment: *[Check all that apply.]*

   ☐ DMSO C801

   ☐ Corticosteroids C802

   ☐ Fluids C803

   ☐ Nonsteroidal anti-inflammatories (e.g., flunixin meglumine (Banamine™), phenylbutazone (Bute™),or other (specify: _____) C804OTH C804

   ☐ Antibiotics C805

   ☐ Antiviral drugs (write in product, dose, and duration of treatment) C806/ C807/C808/C809

   ☐ Immunomodulators (write in product, dose, and duration of treatment) C810/ C811/C812/C813

   ☐ Diuretics C814

   ☐ Seizure medications C815

   ☐ Placement in a sling C816

   ☐ Drugs that reduce clot formation/thrombolytics (write in product, dose, and duration of treatment) C817/C818/C819/C820

   ☐ Lysine C821

   ☐ Other (specify: _____) C822OTH C822

3. What was the total cost for treating this horse? *[Include cost of veterinarian farm visit, veterinary service fees; cost of drugs and administration; cost of supplies such as IV sets, syringes, and needles; cost of hospitalization; cost of sling support, etc.; Do not include diagnostic testing costs.]* .....C823 $ _____

Section 8—Diagnostic Testing Information

[Please contact the horse's veterinarian for assistance in completing this section.]

Live horse testing

1. Were samples collected from this horse for diagnostic testing for EHV-1 since the Ogden, UT, event? ..... C900 ☐1 Yes ☐3 No

[If NO, SKIP to Question 5.]

Please fill in the following chart.
[Provide official laboratory reports via fax, scanned document, or hard copy if available.]

Date collected	Sample type[1]	Laboratory	Test performed[2]	Result
C901	C907	C913	C919	C925
C902	C908	C914	C920	C926
C903	C909	C915	C921	C927
C904	C910	C916	C922	C928
C905	C911	C917	C923	C929
C906	C912	C918	C924	C930

[1]Nasal swab, whole blood in EDTA, serum.
[2]Real-time PCR, nested PCR, conventional PCR, virus isolation, SN/VN, etc.

2. Was virus strain typing performed based on DNA polymerase gene testing? ..... C931 ☐1 Yes ☐3 No

   If YES, indicate the virus type: *[Check all that apply.]*

   ☐ Neuropathogenic (DNA_{pol} [ORF30] variants carrying the D_{752} marker) C932

   ☐ Non-neuropathogenic/wild type (DNA_{pol} [ORF30] strains carrying the N_{752} marker) C933

3. Was there quantification of viral load? ..... C934 ☐1 Yes ☐3 No

   If YES, list quantitative results by sample type (nasal swab, blood, or other), and date: C935/C936

4. What was the total cost for the live animal testing? *[include costs of shipping, laboratory testing, testing supplies, veterinarian farm visit (unless already included in treatment costs) veterinarian time, and personal protective equipmentusedto collect sample.]* ..... C937 $ _____

[If Section 3, Question 8 (p 8) = Alive, SKIP to Question 11.]

Postmortem testing

5. Was a necropsy performed? ..... H1010 ☐1 Yes ☐3 No

[If Question 5 = NO, SKIP to Question 10.]

Please include a copy of the necropsy report and any laboratory results.

6. Were the brain and entire spinal cord collected for histopathology?..... H1011 ☐$_1$ Yes ☐$_3$ No

7. Please fill in the following chart for postmortem testing and results.
[Provide official laboratory reports via fax, scanned document, or hard copy if available.]

Sample type	Laboratory	Test performed	Result
H1012	H1018	H1024	H1030
H1013	H1019	H1025	H1031
H1014	H1020	H1026	H1032
H1015	H1021	H1027	H1033
H1016	H1022	H1028	H1034
H1017	H1023	H1029	H1035

8. Summarize the gross and histopathologic findings of the case or attach necropsy report. H1036

9. What were the total costs of the postmortem testing? *[Include the cost of necropsy, shipping the samples, laboratory testing, testing supplies, veterinarian farm visit to collect samples, and supplies used in biosecurity, such as examination gloves or PPE used to collect postmortem samples.]* .....H1037 $ _____

Other associated costs

10. Are there other additional expenditures you have incurred as a result of the Ogden, UT, EHV-1 disease outbreak that were not reported previously? .. C938 ☐$_1$ Yes ☐$_3$ No

If YES, please describe what those were and specify an amount: C939/C940

11. Please share any other observations on this horse in relation to the Ogden, UT, EHV-1 disease outbreak: C941

Thank you very much for your participation.

Appendix F: Control Horse Questionnaire

Section 1—Horse Information/Signalment

1. Gender: C100
   - ☐1 Gelding
   - ☐2 Stallion
   - ☐3 Nonpregnant mare
   - ☐4 Pregnant mare
2. Breed: .....C101 _____
3. Age (in years) .....C102 _____ yrs
4. What is the **primary** use of this horse? *[Check one only.]* C103
   - ☐1 Recreation/pleasure
   - ☐2 Lessons/school
   - ☐3 Showing/competition in cutting
   - ☐4 Showing/competition other than cutting (specify: _____) C103CUT
   - ☐5 Breeding
   - ☐6 Racing
   - ☐7 Farm or ranch work
   - ☐8 Turnback horse
   - ☐9 Other (specify: _____) C103OTH
6. In how many events did this horse compete from April 1 to 28, 2011?.....C104 _____ #
7. On average, how many days/week was the horse exercised from April 1 to 28, 2011? ..... C105 _____ days/wk
8. What was the average level of exercise[3] from April 1 to 28, 2011? *[Check one only.]* C106
   - ☐1 Light
   - ☐2 Moderate
   - ☐3 Heavy
   - ☐4 Very heavy

[3] Light exercise is described as 1 to 3 hours/week of mostly walking and trotting. Many horses kept for recreational riding would be included in the light exercise category. Moderate exercise consists of 3 to 5 hours/week of mostly trotting with some walking, some cantering and possibly some jumping or other type of more difficult activity. Horses used for horse shows, ranch work and frequent recreational riding would fit into the moderate exercise category. Heavy exercise is described as 4 to 5 hours/week of trotting, cantering, galloping and some jumping, cattle work, etc. Horses engaged in three day eventing, polo, endurance racing, cutting, or other competitive events would be in this category. The very heavy exercise category includes racehorses and a few other horses that compete at the elite level of endurance or three day eventing.

9. How was the horse typically housed/maintained from April 1 to 28, 2011?
[Check all that apply.]

☐ Stall C107

☐ Paddock/corral C108

☐ Pasture C109

☐ Other (specify: _____) C110OTH C110

10. Is this horse receiving supplements added to the regular feed ration?..... C111 ☐$_1$ Yes ☐$_3$ No

If YES, provide the specific name(s) of the supplements given and amount(s) given/day:

Product	Amount fed per feeding	Frequency of feeding	Length of time on product
Platinum performance®CJ	*1 scoop*	*Twice per day*	*Started 15 months ago*
C112	C117	C122	C127
C113	C118	C123	C128
C114	C119	C124	C129
C115	C120	C125	C130
C116	C121	C126	C131

11. Was a horse or other equid on the premises ever diagnosed with laboratory-confirmed EHV-1(respiratory, abortion, or neurologic form) prior to the Ogden, UT, event? ..... C132 ☐$_1$ Yes ☐$_3$ No

If YES, when was the most recent case? ..... C133 _____ date

What form of EHV-1 was diagnosed?..... C134 _____ form

Section 2—Questions Related to Ogden, UT, Event

1. Did this horse attend the Ogden, UT, April 29–May 8, 2011, NCHA event? ..... C200 ☐1 Yes ☐3 No

[If Question 1 = NO, SKIP to Section 3.]

2. In what capacity was the horse used at the Ogden, UT, event? *[Check one only.]* C201

   ☐1 Competing

   ☐2 Turnback horse

   ☐3 Along for experience

   ☐4 Other (specify: _____) C201OTH

3. What was the:

   a. Date of arrival at the event? ..... C202 _____ date

   b. Date of departure from the event? ..... C203 _____ date

4. What barn and stall number was this horse housed in while at the Ogden, UT, event?
   [Be specific to stall/pen if possible. See diagram of Golden Spike Event Center and barns with labeled stall numbers.] ..... C204/ C205 _____ **barn** _____ **stall #**

5. How many hours did it take to trailer this horse to the event from its location just prior to arrival at the Ogden event? ..... C206 _____ hrs

   a. How many horses were transported in the same trailer/van with this horse to the event? ..... C207 _____ #

6. How many hours did it take to trailer this horse from the Ogden event to its next destination after leaving the event? ..... C208 _____ hrs

   a. How many horses were transported in the same trailer/van with this horse when leaving the event? ..... C209 _____ #

7. Use the table below to identify the classes in which this horse competed and to list all of the areas your horse visited each day at the Ogden, UT, event. *[The following is the list of some, but not necessarily all, locations you may use to identify the horse's daily movements. See diagram of Golden Spike Event Center and barns with labeled stall numbers.]* Indicate the class competed and check all locations the horse visited each day.

Codes to be entered in classes competed below*			
1 = $3000 Novice	4 = Open	7 = $15000 Amateur	10 = $15000 N/Non-Pro
2 = Jr. Youth	5 = $10000 Novice	8 = $33000 Non-Pro	11 = $50000 Amateur
3 = Sr. Youth	6 = $2000 Limited/Rider	9 = $5000 N//Non-Pro	12 = Non-Pro

	April 26	April 27	April 28	April 29	April 30	May 1	May 2
*Classes competed	C210	C220	C230	C240	C250	C260	C270
Riding arena	C211	C221	C231	C241	C251	C261	C271
Golden Spike Arena	C212	C222	C232	C242	C252	C262	C272
Outdoor stadium	C213	C223	C233	C243	C253	C263	C273
Cross country course/racetrack	C214	C224	C234	C244	C254	C264	C274
Barn A	C215	C225	C235	C245	C255	C265	C275
Barn B	C216	C226	C236	C246	C256	C266	C276
Barn C	C217	C227	C237	C247	C257	C267	C277
Barn D	C218	C228	C238	C248	C258	C268	C278
Other, specify: C219OTH	C219	C229	C239	C249	C259	C269	C279

	May 3	May 4	May 5	May 6	May 7	May 8	May 9
*Classes competed	C280	C290	C300	C310	C320	C330	C340
Riding arena	C281	C291	C301	C311	C321	C331	C341
Golden Spike Arena	C282	C292	C302	C312	C322	C332	C342
Outdoor stadium	C283	C293	C303	C313	C323	C333	C343
Cross country course/racetrack	C284	C294	C304	C314	C324	C334	C344
Barn A	C285	C295	C305	C315	C325	C335	C345
Barn B	C286	C296	C306	C316	C326	C336	C346
Barn C	C287	C297	C307	C317	C327	C337	C347
Barn D	C288	C298	C308	C318	C328	C338	C348
Other, specify: C289OTH	C289	C299	C309	C319	C329	C339	C349

8. Which of the following applied to this horse during its stay at the Ogden, UT, event facility: *[Check all that apply.]*

- ☐ Tied in barn outside of stall C350
- ☐ Used a shared water source C351
- ☐ Grazed on facility grounds C352
- ☐ Utilized a wash rack C353
- ☐ Had veterinary treatment or examination C354
- ☐ Was worked on by a farrier C355
- ☐ Other (specify: _____) C356OTH C356

Section 3—Clinical Information

1. Did the horse exhibit any signs of being sick during the isolation (quarantine) and monitoring period? ..... C400 ☐1 Yes ☐3 No

[If Question 1 = NO, SKIP to Section 5.]

2. Did you monitor this horse's temperature? ..... C401 ☐1 Yes ☐3 No

[If Question 2 = NO, SKIP to Question 4.]

3. Did this horse exhibit a fever (rectal temperature of >101.5°F)? ..... C402 ☐1 Yes ☐3 No

   If YES,

   a. What was the date of onset of fever? ..... C403 _____ date

   b. What was the highest temperature documented during the course of disease? ..... C404 _____temp

   c. What was the date of last fever? ..... C405 _____ date

4. Did the horse exhibit neurologic[4] signs? ..... C406 ☐1 Yes ☐3 No

   If YES, what was the date of onset of neurologic signs? ..... C407 _____ date

5. Was this horse isolated from the other equids on the premises (no direct contact with other horses)? ..... C408 ☐1 Yes ☐3 No

   If YES, on what date was the horse isolated from other equids on the premises? ..... C409 _____ date

[4] Neurologic signs: wobbly gait, dribbling urine, urinary bladder atony, recumbent unable to rise (down), stumbling/falling down, tail flaccid, exaggerated limb movements when walking or while down.

6. Is/was this horse pregnant in 2011? ..... C410 ☐1 Yes ☐3 No

[If Question 6 = NO, SKIP to Question 8.]

If YES, what was the outcome of the pregnancy? C411

☐1 Live birth

☐2 Abortion

☐3 Stillbirth

☐4 Still pregnant

7. If the fetus was aborted or stillborn:

   a. What was the date of pregnancy loss? ..... C412 _____ date

   b. Was EHV-1 the laboratory-confirmed cause of abortion? ..... C413 ☐1 Yes ☐3 No

      If YES, what were the breeding fees, prenatal care costs, and veterinary care costs associated with this mare's pregnancy? ..... C414 $ _____

8. Was the cause of disease diagnosed? ..... C415 ☐1 Yes ☐3 No

   If YES, what was the diagnosis? ..... C416 _____

10. What is the status of the horse? C417

☐1 Alive

☐2 Euthanized (date: _____) C417DAT

☐3 Died (date: _____) C417DAT

Section 4—Specific Clinical Signs Observed

Indicate any clinical signs that were observed in this horse during the isolation (quarantine) and monitoring period.

1. Neurologic signs: *[Check all that apply.]*

☐ Incoordination/wobbly gait C500

☐ Dogsitting C501

☐ Down (unable to rise) C502

☐ Exaggerated limb movements, either when walking or while down C503

☐ Stumbling/falling C504

☐ Circling C505

☐ Disorientation C506

☐ Lethargic C507

☐ Urine dribbling C508

☐ Flaccid tail C509

☐ Other (specify: _____) C510OTH C510

2. Other clinical signs: *[Check all that apply.]*

- ☐ Nasal discharge C511
- ☐ Coughing C512
- ☐ Off feed C513
- ☐ Excessive sweating C514
- ☐ Colic C515
- ☐ Limb edema/stocking up C516
- ☐ Other (specify: _____) C517OTH C517

Section 5—Travel Information

1. What date did this horse arrive on the premises where it was isolated (quarantined) and monitored in response to the Ogden, UT, EHV-1 disease outbreak? ..... C600 _____ date

2. Is the premises on which this horse spent the quarantine and monitoring period the horse's home premises (i.e., it spends more time here in a 12-month period than anywhere else)? ..... C601 ☐$_1$ Yes ☐$_3$ No

3. Besides the Ogden, UT, event, list the locations/events and dates this horse traveled to during April 2011:

Location or event	Dates
C602	C608
C603	C609
C604	C610
C605	C611
C606	C612
C607	C613

4. When traveling by trailer/van, on average, how many hours does the horse travel before resting/unloading? ..... C614 _____ hrs

5. In general, which of the following best describes this horse's response to the stress of travel? *[Check the most appropriate description.]* C615

- ☐$_1$ Tends to get more stressed than the average horse
- ☐$_2$ About average for a horse
- ☐$_3$ Very tolerant of travel and does not appear stressed compared to other horses

Section 6—Vaccination Information

1. In the past year **(from May 1, 2010, through April 28, 2011)**, was this horse vaccinated against EHV-1? ..... C700 ☐1 Yes ☐3 No

   If YES, list the dates and products used to vaccinate this horse against EHV-1. It is important to provide the specific product name or category of vaccine because they vary in content and mechanism of action. *[If you cannot remember specific product names, please check with the horse's veterinarian and provide at least the category of vaccine used, i.e., modified live vaccine, killed EHV product labeled for prevention of abortion/respiratory disease, killed product labeled for prevention of respiratory disease.]*

Date (May 1, 2010–April 28, 2011)	**Product name or product category of EHV-1 vaccine**
C701	C707
C702	C708
C703	C709
C704	C710
C705	C711
C706	C712

2. Since **April 29, 2011**, has this horse been vaccinated against EHV-1? ..... C713 ☐1 Yes ☐3 No

   If YES, list the dates and products used to vaccinate this horse against EHV-1.

Date (since April 29, 2011)	**Product name of EHV-1 vaccine**	**Reason for vaccination***	**Who administered the vaccine (owner, veterinarian, trainer, other <specify>)?**	**Cost ($)** (include product and administration cost)
C714	C717	☐1 ☐2 ☐3 C720 (specify: _____) C720OTH	C723	C726
C715	C718	☐1 ☐2 ☐3 C721 (specify: _____) C721OTH	C724	C727
C716	C719	☐1 ☐2 ☐3 C722 (specify: _____) C722OTH	C725	C728

* 1 = because of the disease outbreak
2= regularly scheduled vaccination
3 = other (specify)

Although this horse was not diagnosed as an EHV-1/EHM case, we are interested in any treatment and/or diagnostics performed since the Ogden, UT, event.

Section 7—Treatment Since Ogden, UT, Event

[Pease contact the horse's veterinarian for assistance in completing this section.]

1. Date of initial veterinary examination: ..... C800 _____ date

2. Types of treatment: *[Check all that apply.]*

   ☐ DMSO C801

   ☐ Corticosteroids C802

   ☐ Fluids C803

   ☐ Nonsteroidal anti-inflammatories [e.g., flunixin meglumine (Banamine™), phenylbutazone (Bute™), or other (specify: _____) C804OTH C804

   ☐ Antibiotics C805

   ☐ Antiviral drugs (write in product, dose, and duration of treatment) C806/ C807/C808/C809

   ☐ Immunomodulators (write in product, dose, and duration of treatment) C810/ C811/C812/C813

   ☐ Diuretics C814

   ☐ Seizure medications C815

   ☐ Placement in a sling C816

   ☐ Drugs that reduce clot formation/thrombolytics (write in product, dose, and duration of treatment) C817/ C818/C819/C820

   ☐ Lysine C821

   ☐ Other (specify: _____) C822OTH C822

3. What was the total cost for treating this horse? *[Include cost of veterinarian farm visit, veterinary service fees; cost of drugs and administration; cost of supplies such as IV sets, syringes, and needles; cost of hospitalization; cost of sling support, etc.; Do not include diagnostic testing costs.]*..... C823 $ _____

Section 8—Diagnostic Testing Information

[Please contact the horse's veterinarian for assistance in completing this section.]

Live horse testing

1. Were samples collected from this horse for diagnostic testing for EHV-1 since the Ogden, UT, event? ..... C900 ☐1 Yes ☐3 No

[If NO, SKIP to Question 5.]

Please fill in the following chart.
[Provide official laboratory reports via fax, scanned document, or hard copy if available.]

Date collected	Sample type[1]	Laboratory	Test performed[2]	Result
C901	C907	C913	C919	C925
C902	C908	C914	C920	C926
C903	C909	C915	C921	C927
C904	C910	C916	C922	C928
C905	C911	C917	C923	C929
C906	C912	C918	C924	C930

[1]Nasal swab, whole blood in EDTA, serum.
[2]Real-time PCR, nested PCR, conventional PCR, virus isolation, SN/VN, etc.

2. Was virus strain typing performed based on DNA polymerase gene testing?.....C931 ☐1 Yes ☐3 No

   If YES, indicate the virus type: *[Check all that apply.]*

   ☐ Neuropathogenic (DNA_{pol} [ORF30] variants carrying the D_{752} marker) C932

   ☐ Non-neuropathogenic/wild type (DNA_{pol} [ORF30] strains carrying the N_{752} marker) C933

3. Was there quantification of viral load? .....C934 ☐1 Yes ☐3 No

   If YES, list quantitative results by sample type (nasal swab, blood, or other), and date: C935/C936

4. What was the total cost for the live animal testing? *[Include costs of shipping, laboratory testing, testing supplies, veterinarian farm visit (unless already included in treatment costs), veterinarian time, and personal protective equipment used to collect sample.]*.....C937 $ _____

Other associated costs

5. Are there other additional expenditures you have incurred as a result of the Ogden, UT, EHV-1 disease outbreak that were not reported previously? .. C938 ☐1 Yes ☐3 No

   If YES, please describe what those were and specify an amount: C939/C940

6. Please share any other observations on this horse in relation to the Ogden, UT, EHV-1 disease outbreak: C941

Thank you very much for your participation.