

Highlights: Demographic Characteristics and Prevalence of Elevated Temperature among Horses Quarantined at the Three Air/Ocean Import Facilities in the United States

A report has recently been made available on the National Animal Health Monitoring System Web site: <http://www.aphis.usda.gov/nahms>. The following are highlights from the report.

Introduction

The objectives of a study conducted by USDA Animal and Plant Health Inspection Service (APHIS) Veterinary Services (VS) were to determine the annual prevalence of elevated temperatures for horses¹ imported by air or ocean to the three USDA animal import centers during a 12-month period², determine risk factors for elevated temperatures, and compare prevalence of elevated temperatures across centers.

The importation of horses into the United States is regulated by USDA–APHIS–VS. Horses arriving by air or ocean, other than those arriving for special events such as the World Equestrian Games, are quarantined at the New York Animal Import Center (NYAIC) in Newburgh, NY; the Miami Animal Import Center (MAIC) in Miami, FL; or the Los Angeles Animal Import Center (LA-AIC)³ in Los Angeles, CA.

Fever is important in the diagnosis of disease in domestic animals; therefore, the body temperature of quarantined horses is monitored in order to facilitate prompt treatment interventions, if appropriate. Horses being imported into the United States, except those from Canada, must remain under USDA quarantine for a minimum of 42 hours, and must have three nonelevated temperatures recorded for the 24-hour period immediately prior to release to complete USDA quarantine. During quarantine, horses are observed for clinical signs of disease and a physical examination is



generally performed every 12 hours. For this study, an elevated temperature was defined as greater than 101.5°F.

Above-normal body temperature can be the result of a true fever (most often due to an infection), inflammation, hyperthermia due to heat stress, drug reactions, allergies, tumors, or other causes. Factors that might be associated with an increased risk for occurrence of elevated body temperature include age, breed, gender, disposition, previous air travel, location in the jet stall, and location of the jet stall in the cargo area of the plane.

Findings

All import centers

The prevalence of elevated temperature varied by import center: 12.0 percent for LA-AIC, 11.4 percent for NYAIC, and 6.6 percent for MAIC. An initial univariable model with center as the only factor showed that the prevalence of elevated temperature was significantly lower for MAIC than for LA-AIC ($p < 0.0001$) or NYAIC ($p < 0.0001$) and was not different between LA-AIC and NYAIC ($p = 0.6$). Some of the difference may be explained by the variation in types of horses imported into each center, duration of transport, and type of transportation.

No Friesian horses were imported through the MAIC during the study period and a lower percentage of horses imported through MAIC were 4 years of age or less. Since young age was determined to be a risk factor for elevated temperature across all three centers and the Friesian breed was more likely to have an elevated

¹ For this report, the term "horse" will be used to refer to horses and other equids.

² Calendar year (CY) 2008 for NYAIC and MAIC, CY 2009 for LA-AIC.

³ LA-AIC import quarantine is a privately operated facility (Jet Pets, Inc.) with oversight by USDA–APHIS–VS.

temperature than the other breed categories, the population characteristics may partially explain the difference. However, the difference in prevalence between centers could not be fully explained by the data available for analysis; likely other factors contributed to the observed differences.

The majority of elevated temperatures occurred within 12 hours of arrival to an import center, typically as

a single occurrence, and usually as a low-grade elevation—greater than 101.5°F but less than 102.5°F. These findings suggest that occurrences of elevated temperature later in the quarantine period, high temperatures (greater than 102.5°F), or repeated elevations in temperature should be considered less common events.

Percentage distribution of horses and prevalence of horses that had elevated temperatures by breed, age, and region of origin, and by center

	Center					
	LA-AIC		MAIC		NYAIC	
	Percent	Elevated Temp Prevalence	Percent	Elevated Temp Prevalence	Percent	Elevated Temp Prevalence
Breed						
Friesian	4.2	40.0	0.0		2.5	19.6
Other breeds	24.2	13.7	26.3	9.0	10.3	13.7
Thoroughbred/ other hot-bloods	24.1	16.9	37.1	7.9	22.5	6.7
Warmblood	47.5	6.2	36.6	3.6	64.7	12.4
Total	100.0		100.0		100.0	
Age (years)						
1 yr or less	6.0	60.9	2.3	25.0	6.3	26.2
2 to 4	25.3	17.6	20.5	11.9	29.8	10.0
5 to 9	47.1	6.4	62.6	5.0	46.1	11.4
10 or more	21.6	4.0	14.6	3.9	17.8	9.0
Total	100.0		100.0		100.0	
Region of Origin						
Australia/NZ	18.7	4.0	0.0		0.7	0.0
Middle East	1.7	11.1	0.0		1.3	11.1
Europe	76.6	13.9	37.5	3.9	95.1	11.8
Americas*	2.2	17.4	62.5	8.4	0.9	0.0
Asia	0.8	0.0	0.0		2.0	4.9
Total	100.0		100.0		100.0	

*Mexico, Central and South America (Argentina, Brazil, Cayman Islands, Chile, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Mexico, Panama, Peru, The Bahamas, Turks and Caicos Islands, Uruguay, and Venezuela).

New York Animal Import Center

Of the 2,062 horses quarantined at the NYAIC in 2008, 236 (11.4 percent) had at least 1 elevated temperature from the time of arrival at NYAIC until release. Of the horses with an elevated temperature, 26.3 percent had more than one elevated temperature and 34.3 percent had a high temperature (i.e., their highest temperature was greater than 102.5°F). An interaction between breed and age was detected, so the possibility of a breed effect within each age category was investigated. In the 2- to 4-year age group, a Friesian was three times more likely to have an elevated temperature than a Warmblood; a Thoroughbred/other hot-blooded horse was less likely to have an elevated temperature than was a Warmblood. In the 5- to 9-year age group, significantly more Warmbloods had elevated temperatures than did horses in the "other breeds" and Thoroughbred/other hot-blooded breed categories. Horses 1 year of age or less had the highest prevalence (26.1 percent) of elevated temperatures. Prevalence of elevated temperatures in other age categories was between 10 and 11 percent.

Miami Animal Import Center

Of the 1,600 horses in quarantine at MAIC in 2008, 106 (6.6 percent) had at least 1 elevated temperature during quarantine. A vast majority of these elevated temperatures occurred on day 1 of quarantine. The risk factors for elevated temperature for horses at MAIC were age and gender. Horses 1 year or less were most likely to have one or more elevated temperatures compared to other age groups. Intact males were more likely than females or castrated males to have an elevated temperature. None of the risk factors was significantly associated with the time at which the first elevation in temperature occurred, because almost all horses (93.4 percent) had their first high temperatures at arrival.

Los Angeles-Animal Import Center

Of the 1,058 horses that arrived at LA-AIC in 2009, 127 horses (12 percent) had at least 1 elevated temperature. Although the majority of the imported horses were between 5 and 9 years old, those younger than 1 year had a higher risk of an elevated temperature. The effect of breed varied by region of origin; a Friesian from Europe was 3.8 times more likely to have an elevated temperature than a Thoroughbred/other hot-blooded horse from Europe. Horses coming from Australia/New Zealand and categorized as "other" breed were least likely to have an elevated temperature compared to the Thoroughbreds/other hot-blooded breed horses. Females were significantly more likely (2.05 times) to have an elevated temperature than a castrated male.

Discussion

Fever is important in the diagnosis of disease in domestic animals. The body temperature of animals at risk of developing disease is monitored in order to detect disease and allow for initiation of prompt treatment interventions. Body temperature is regulated by the hypothalamus, which receives input from internal and external thermoreceptors. Fever is a form of hyperthermia where the hypothalamic temperature point is set higher than normal, but heat loss and heat gain are still maintained.

Transport is stressful to horses. Potential stressors include isolation from herd mates, forced proximity to unfamiliar or aggressive horses, novel or threatening surroundings, exposure to new pathogens, lack of normal activity patterns, forced adoption of an abnormal posture, extremes in temperature and humidity, noise, and water and feed deprivation.

There are references in the literature to a psychological stress-induced rise in core temperature (PSRCT) in humans and animals. Additionally, transport could result in a predisposition to infection due to some or all of these factors. It seems possible that some of the elevated temperatures experienced by imported horses upon arrival at the import center could represent a form of PSRCT. Further investigation to rule out other causes of elevated temperatures would be necessary to prove this hypothesis.

Summary

The prevalence of elevated temperatures varied by center: MAIC had a significantly lower prevalence while LA-AIC and NYAIC had a similar prevalence. The majority of elevated temperatures occurred within 12 hours of arrival to an import center, typically as a single event, and usually as a low-grade elevation, i.e., greater than 101.5°F but less than 102.5°F. Only 34.3 percent of the horses at NYAIC, 13.2 percent at MAIC, and 15 percent at LA-AIC had a temperature greater than 102.5°F.

These findings suggest that occurrences of an elevated temperature later in the quarantine period, high temperatures (greater than 102.5°F), or repeated elevations in temperature should be considered less common events.

The data included in this report summarize records for 4,720 horses. This appears to represent the largest number of records for horses shipped by air to be evaluated for prevalence of an elevated body temperature. Analysis of the existing data identified several factors associated with risk of an elevation in temperature. Additional research is necessary to determine more definitively the causes of and potential interventions for elevated temperatures among imported horses.

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