

# **POSTMORTEM EXAMINATION PROGRAM**

**Conducted for the California Horse Racing Board  
July 1, 2008–June 30, 2009**

**California Animal Health and Food Safety Laboratory System**

**J.D. Wheat Veterinary Orthopedic Research Laboratory**

School of Veterinary Medicine

University of California, Davis

**February 2010**



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## Postmortem

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## Examination

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## Program

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### California Animal Health and Food Safety Laboratory System

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### J.D. Wheat Veterinary Orthopedic Research Laboratory

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# POSTMORTEM EXAMINATION PROGRAM

## Introduction

The Postmortem Examination Program has been in operation since February 1990 and has performed examinations on 5,088 horses, as of June 30, 2009.

Initiated by the California Horse Racing Board (CHRB), the program is a partnership with the California Animal Health and Food Safety Laboratory System (CAHFS) to meet three primary objectives: 1) to determine the nature of injuries occurring in racehorses, 2) to determine the reasons for these injuries, and 3) to develop injury prevention strategies<sup>1</sup>.

To accomplish this, a broad, cooperative approach was organized involving the development of a contract with the CAHFS to perform a necropsy on every horse that died or was euthanized on racetracks or training facilities under the jurisdiction of the CHRB. This visionary partnership has become a national model for the racing industry in an effort to improve the safety and welfare of racehorses.

Pathologists at the Davis, Tulare and San Bernardino laboratories of the CAHFS conduct postmortem examinations and compile detailed information on each horse, which is then reported to the CHRB. A broad range of specimens are collected and shared with veterinary scientists in the School of Veterinary Medicine (SVM) at the University of California, Davis (UCD).

In-depth analyses of these specimens helps to more precisely determine the causes and risk factors that lead up to catastrophic injuries in racehorses resulting in their death or euthanasia. During the past year, funding for postmortem examinations and ancillary testing was provided by the CHRB. Racing associations provide transportation of the horses to the nearest laboratory facility and additional studies are funded by the Center for Equine Health at UCD

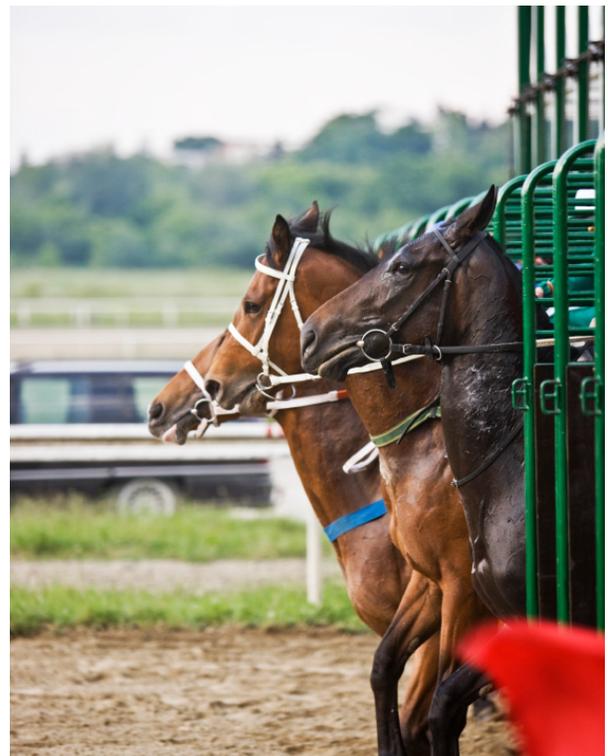
<sup>1</sup> CAHFS provides descriptive pathology reporting only. Due to the lack of descriptive, population and environmental information provided to the laboratory, CAHFS does not make recommendations on interventions or identify risk factors associated with injury or disease.

and private sources.

Information from the tests and data gathered from the postmortem examinations are analyzed in efforts to elucidate the specific cause of catastrophic injuries. An advisory board, composed of horse owners, trainers, veterinarians, track maintenance people and CHRB officials, gives insight into injury investigations as well as sharing program findings and prevention strategies with the horseracing industry.

In-depth studies of catastrophic musculoskeletal injuries in Thoroughbred horses have prompted studies by the Equine Orthopedics Laboratory Group within the SVM to focus on a variety of fractures and failures of the suspensory apparatus of the front limb.

With a detailed database representing more than 11,000 diagnostic findings, a valuable resource is available to help develop preventive strategies on racehorse injuries. Other states have begun their own programs using the CAHFS' CHRB Postmortem Examination Program as their model.



# SUBMISSIONS

## General Submission Information

**D**uring the 2008-09 calendar year 320 horses were submitted to CAHFS as part of the CHRB Postmortem Examination Program. Although the reporting period for this report is different than previous reports, this number is a substantial decrease of 9.0 percent (32 horses) over the calendar year 2008 report; however, it is 8.8 percent higher than the fiscal year 2007-08 count of 294 horses. It is also substantially higher than the average number of horses submitted per year since the program began. Figure 1 shows the number of horses that have been submitted to the program since 1990 by fiscal year. The first year of the program (1990) began in February and does not represent a full fiscal year. The trend line shows that the number of horses submitted for the CHRB program have been increasing an average of seven to eight horses per year.

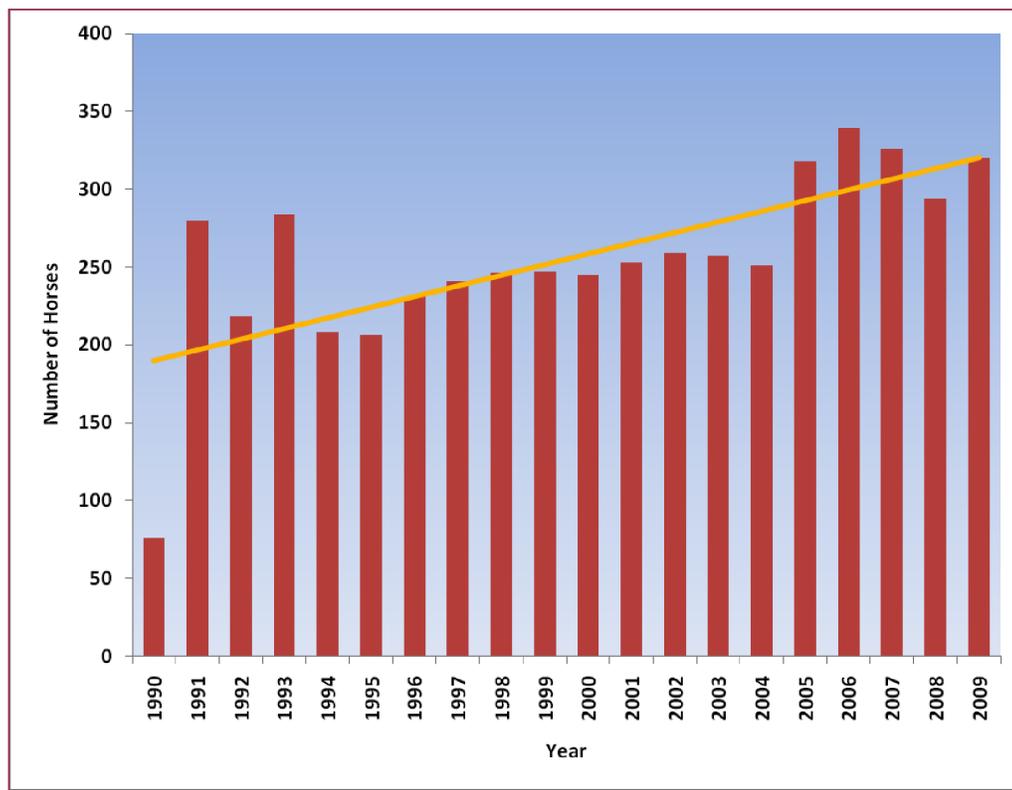
The Davis, Tulare and San Bernardino branches of the CAHFS performed the necropsies, with horses being brought directly to the closest CAHFS

facility. At the time of submission, the CHRB official at the track categorized the activity of the horse at the time of injury into one of three types (Table 1). The majority of catastrophic injuries, 40.3 percent, occurred during a race or immediately following a race. A total of 31.3 percent of the fatal injuries occurred during or immediately following a training session. The third most frequent category of fatalities, accounting for 28.4 percent of submissions, included horses in the non-exercise group. These were horses suffering primarily from colic, infectious diseases or other accidental deaths.

**Table 1. Activity at Time of Injury**

Non-exercise	91
Racing	129
Training	100
<b>Total</b>	<b>320</b>

**Figure 1. Number of Horses Submitted to the Postmortem Program by Fiscal Year**



# SUBMISSIONS BY BREED AND MONTH

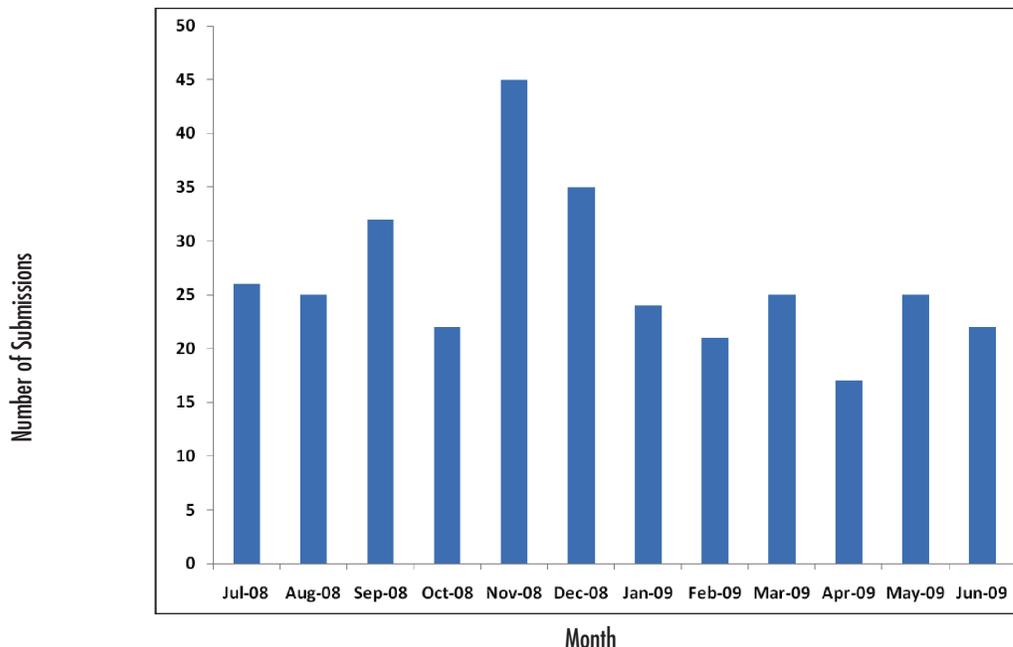
**Table 2. Submissions by Breed and Month**

Breed	Jul 08	Aug 08	Sep 08	Oct 08	Nov 08	Dec 08	Jan 09	Feb 09	Mar 09	Apr 09	May 09	Jun 09	Total
Arabian			1			1							2
Mixed Breed					1	1			1				3
Paint					1								1
Palomino						1							1
Quarter Horse	7	6	4	9	12	10	6	9	2	1	5	7	78
Standardbred	1		1						1	1	1		5
Thoroughbred	18	19	26	13	31	22	18	12	22	15	19	15	230
<b>Grand Total</b>	26	25	32	22	45	35	24	21	25	17	25	22	320

The vast majority of submissions (71.9 percent) during FY 2008-09 were Thoroughbreds (Table 2). Nearly a quarter of the horses submitted in 2008 (24.4 percent) were Quarter Horses. This is a 34.5 percent increase over the prior fiscal year and is in line with a continuing increase in Quarter Horse injuries over the last two years. With very small numbers of the other breeds racing, not enough data exist to allow comparison of injury rates among

breeds for any predisposition to any particular type of injury. The number of horses submitted per month was highly variable, with statistically lower than average submissions in October 2008, February 2009 and April 2009. Significantly higher than average submissions were seen in November and December 2008 (Figure 2). This is very similar to submission patterns over the last few years.

**Figure 2. Number of Horses Examined by Month**



## SUBMISSIONS BY BREED AND AGE

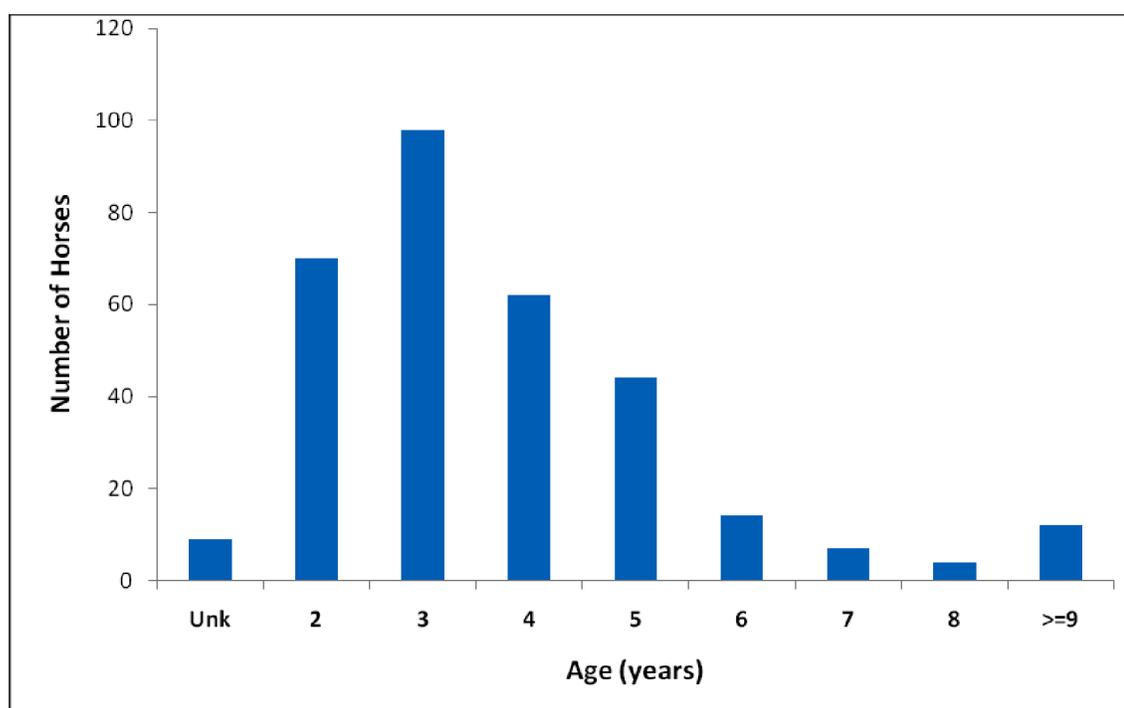
**Table 3. Submissions by Breed and Age**

Breed/Age	Unk	<=2	3	4	5	6	7	8	>=9	Total
Arabian Horse				1		1				2
Mixed Breed						1			2	3
Paint			1							1
Palomino									1	1
Quarter Horse		29	20	12	10	2	1		4	78
Standardbred		1		1		1			2	5
Thoroughbred	9	40	77	48	34	9	6	4	3	230
Grand Total	9	70	98	62	44	14	7	4	12	320
Percentage of Total	2.8	21.9	30.6	19.4	13.8	4.4	2.2	1.3	3.8	100%

The largest proportions of submissions (50.0 percent) were 3- or 4-year-old horses (Table 3). Only 21.9 percent of all racehorses submitted were 2 years old or less. The number of horses submitted with catastrophic injuries or death drops dramatically after the fourth year of age (Figure 3). This distribution is consistent with the

age distribution that has been seen in prior years of the program. We cannot conclude if horses 5 years of age and greater are much less susceptible to the athletic injuries of racing because the total number of horses in each age group that are racing and training on facilities controlled by CHRB are not known.

**Figure 3. Number of Horses Examined by Age**



## SUBMISSIONS BY GENDER

The gender distribution of the horses submitted during 2008 is shown in Table 4 below. Males represented 60.8 percent of the total group with 32.4 percent of males being intact (stallions) and 67.5 percent geldings. Females comprised 39.2 percent of the group. Geldings and females were injured nearly

twice as often during racing than training. Intact males in this sample of horses were more likely to be injured during training than racing. The sex distribution of the horse population housed, trained and raced on California racetracks is not known.

**Table 4. Distribution of Horses by Gender and Category**

Gender	Non-Exercise	Race	Training	Total
Female	39	50	37	126
Male	13	19	31	63
Neutered Male	39	60	32	131
<b>Total</b>	<b>90</b>	<b>129</b>	<b>100</b>	<b>320</b>



# INJURIES

As mentioned earlier, the categories of injury represent the activity of the horse or circumstances at the time of the fatal or catastrophic injury. The largest cluster of fatal injuries, 40.9 percent, occurred during racing and training in 3- and 4-year-old racehorses (Table 5). The 2-year-

old horse fatalities were evenly distributed among all three categories. Along with an increase in the number of horses submitted for non-exercise related fatalities, the age distribution, unlike previous years, was evenly distributed among horses up to five years of age.

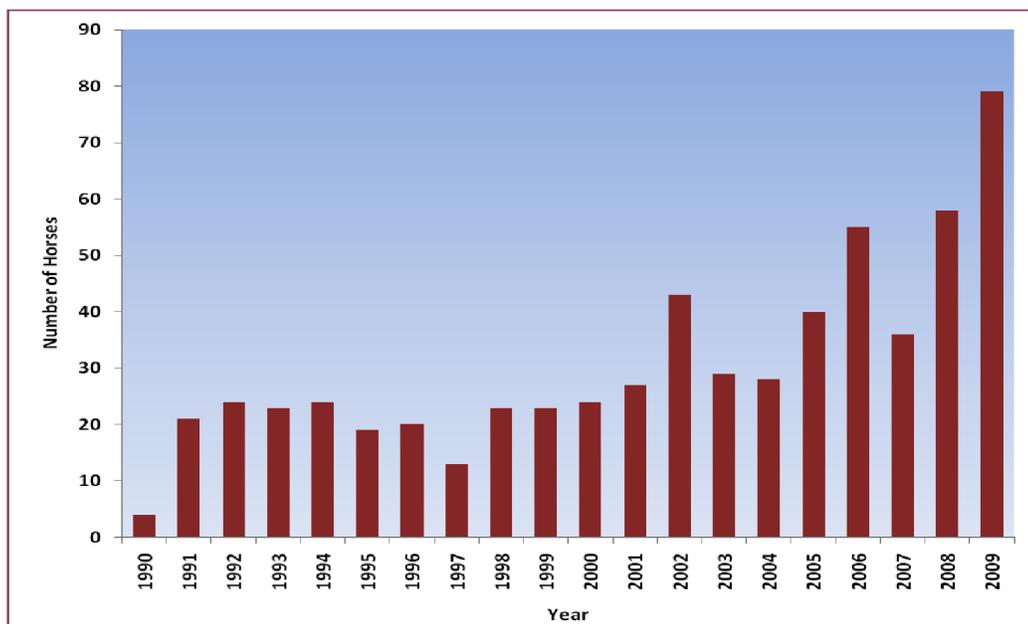
**Table 5. Category of Injury by Age**

Category/Age	Unk	<=2	3	4	5	6	7	8	>=9	Total
Non-Exercise	4	19	24	17	9	4	2	2	10	91
Race		26	44	27	23	4	4		1	129
Training	5	25	30	18	12	6	1	2	1	100
Total	9	70	98	62	44	14	7	4	12	320
Percent of Total	2.8	21.9	30.6	19.4	13.8	4.4	2.2	1.3	3.8	100%

Thoroughbred horses suffered nearly equal proportions of racing (35.7 percent) and training (39.6 percent) catastrophic injuries, although training injuries were more likely in younger horses (Table 6). Typical of previous years, Quarter Horses infrequently suffer a catastrophic injury during

a training session. Quarter Horse submissions during 2008-09 continue to show an increase over prior years for both race-related injuries and non-exercise related fatalities. Figure 4 shows the historical number of Quarter Horses submitted to the program since its inception.

**Figure 4. Number of Quarter Horses Submitted to the CHRB Postmortem Program by Year**



**Table 6. Category of Injury by Breed**

Injury Class by Breed	Non-Exercise	Race	Training	Total
Arabian	1	1		2
Mixed Breed Horse	2		1	3
Paint		1		1
Palomino	1			1
Quarter Horse	27	44	7	78
Standardbred	3	1	1	5
Thoroughbred	57	82	91	230
<b>Total</b>	<b>91</b>	<b>129</b>	<b>100</b>	<b>320</b>

In 2008-09, approximately 74.4 percent of the total primary injuries or conditions were due to musculoskeletal problems (Table 7). Of this group, 91.9 percent of injuries affected the front or rear legs (Table 8). The injuries listed in these tables represent the primary injury to the horse. Unlike previous years, with the advent of the new CAHFS Laboratory Information System, multiple primary findings for each horse submitted may now be recorded. Thus the total number of reported injury types exceeds the total number of horses submitted.

This is especially true in severe injuries involving multiple bones in the fore- or hind-limbs. In these cases, multiple related injuries, such as tendon and ligament ruptures are identified concomitantly, but not necessarily reported as primary injuries.

Musculoskeletal injuries are most likely to occur during racing or training. Because these injuries are by far the most common, most of the investigative efforts at the University of California, Davis, have focused on causes and prevention of limb injuries.

**Table 7. Organ Systems Affected**

Organ System Affected/Breed	CV	GI	Skin	MS	Nerv	Resp	Uro	WB	Total
Arabian Horse		2		1					3
Mixed Breed Horse				1			1	1	3
Paint Horse				1					1
Palomino Horse						1			1
Quarter Horse		8	1	64	1	2		2	78
Standardbred Horse	1	1		3					5
Thoroughbred Horse	2	9	1	168	15	21		14	230
<b>Total</b>	<b>3</b>	<b>19</b>	<b>2</b>	<b>238</b>	<b>16</b>	<b>24</b>	<b>1</b>	<b>17</b>	<b>320</b>

(CV = cardiovascular; MS= musculoskeletal; Skin = Integumentary system; GI= gastrointestinal system; Nerv= nervous system; Resp= respiratory system; Uro = Urogenital/Reproductive; WB= whole body)



**T**able 8 compares limb specific catastrophic injuries. There were significantly more front limb injuries sustained during racing when compared to those injuries sustained during training. There were nearly equal numbers of right and left front limb injuries as well as equal numbers of

right and left rear limb injuries. The number of rear limb injuries, as a proportion of the total number of musculoskeletal injuries was approximately equal to the prior year, but substantially higher than in years prior to 2007-2008.

**Table 8. Injury by Primary Limb Affected**

Limb Affected	Non-Exercise	Race	Training	Total
Bilateral Front	14	3	1	18
Left Front	3	61	52	116
Left Rear		6	11	17
Right Front	2	65	37	104
Right Rear	2	9	9	20
<b>Total</b>	<b>21</b>	<b>144</b>	<b>110</b>	<b>275</b>

**Table 9. Musculoskeletal Injuries by Breed**

Finding	Arabian	MixedBreed	Paint Horse	Quarter Horse	Standard-bred	Thoroughbred	Total
Carpal Fracture – Left Front			1	10		5	16
Carpal Fracture – Right Front			1	19		8	28
Cervical Vertebra Luxation						1	1
Femur Fracture Left				1		1	2
Femur Fracture Right						1	1
Fetlock Joint Luxation – Left Front		1		2		9	12
Fetlock Joint Luxation – Right Front				1		6	7
Fetlock Joint Luxation – Right Rear				1		1	2
Humerus Fracture – Left					1	9	10
Humerus Fracture – Right						3	3
Laminitis				11		1	12
Proximal Sesamoid Fracture – Left Front				3		13	16

Table 9 continues on next page



**Table 9. Musculoskeletal Injuries by Breed (continued)**

Finding	Arabian	MixedBreed	Paint Horse	Quarter Horse	Standard-bred	Thoroughbred	Total
Proximal Sesamoid Fracture – Right Rear						3	3
Proximal Sesamoid Fracture – Right Front				1		13	14
Metacarpus Fracture – Left Front			1	3		22	26
Metacarpus Fracture – Right Front			1	1		14	16
Metatarsus Fracture – Right Rear						5	5
Metatarsus Fracture – Left Rear						4	4
Muscle Laceration				2			2
Musculoskeletal Disease				3		1	4
P1 Fracture – Left Front					1	3	4
P1 Fracture – Left Rear						2	2
P1 Fracture – Right Front				1		2	3
P1 Fracture – Right Rear						3	3
P2 Fracture – Right Rear						1	1
Pastern Joint Luxation – Right Front				1			1
Pelvis Fracture						7	7
Radius Fracture – Left				1			1
Scapula Fracture – Left						2	2
Scapula Fracture – Right	1			2		2	5
Sesamoid Fracture, Biaxial – Left Front						27	27
Sesamoid Fracture, Biaxial – Left Rear						2	2
Sesamoid Fracture, Biaxial – Right Front				2		25	27
Skull Fracture						4	4
Suspensory Apparatus Failure – Left Front				1			1
Suspensory Apparatus Failure – Left Rear					1		1
Suspensory Apparatus Failure – Right Rear					1		1
Tarsus Fracture – Left				2		1	3
Tendon Injury						1	1
Tendon Rupture – Left Front						1	1
Tendon Rupture – Right Rear				1			1
Tibia Fracture – Left						3	3
Tibia Fracture – Right				1		2	3
Vertebra Fracture				5		3	8
Vertebral Instability				1			1
<b>Total</b>	<b>1</b>	<b>1</b>	<b>4</b>	<b>76</b>	<b>4</b>	<b>211</b>	<b>297</b>

**Track Surface and Musculoskeletal Injuries in Thoroughbreds**

The distribution of musculoskeletal injuries in Thoroughbreds was evaluated when comparing the three types of track surfaces in which these horses performed. Table 10 shows the limb distribution of injuries. The data show that

for the current fiscal year the absolute number of injuries on synthetic surfaces for horses submitted to CAHFS was only nominally higher. The total number of starts and workouts by track surface is not part of this report.

**Table 10. Musculoskeletal Injury: Affected Limb by Track Type**

<b>Limb</b>	<b>Dirt</b>	<b>Synthetic</b>	<b>Turf</b>	<b>Total</b>
Bilateral	4	1		5
Left Front	48	62	5	115
Left Rear	5	12		17
Right Front	52	47	4	103
Right Rear	6	12		18
<b>Total</b>	<b>115</b>	<b>134</b>	<b>9</b>	<b>258</b>

**Other Organ Systems Affected by Injuries****Cardiovascular:**

There were only a very small number of cases with primary cardiovascular disease identified during 2008. Horses diagnosed with primary cardiovascular causes of death typically did not have a primary cause identified. None of the diagnoses in this category were due to infectious causes.

<b>Diagnosis</b>	<b>Total</b>
Aortic Aneurysn	1
Cardiovascular Disease	1
Heart Failure	2
Vascular Disease	1
<b>Total</b>	<b>5</b>



**Integumentary (Skin):**

It is unusual for diseases of the skin to result in the death or euthanasia of an animal; however, in the cases listed above, horses were euthanized due to non-responsive integumentary conditions that reduced the quality of life of the animal.

<b>Diagnosis</b>	<b>Total</b>
Subcutaneous hemorrhage	2
Skin Ulcer	1
Hoof Abscess	1
<b>Total</b>	<b>2</b>

**Gastrointestinal:**

Of the digestive system diagnoses, digestive system obstruction leading to dilation, stasis and/or rupture were the most frequently observed findings. Severe enteritis or colitis (inflammation of the small and large intestines) were also frequently identified. Three out of the eight cases of colitis were due to infection with *Clostridium difficile*.

<b>Diagnosis</b>	<b>Total</b>
Cecal Rupture	1
Choke	1
Colitis	8
Colon Rupture	1
Enteritis	2
Gastric Dilation	1
Gastric Rupture	1
Gastrointestinal Neoplasm	1
Intestinal Obstruction	3
Intestinal Torsion	4
<b>Total</b>	<b>23</b>

**Respiratory:**

There were more cases of respiratory diseases identified in FY 2008-09 than had been seen in previous years. The primary cause in the majority of cases was *Streptococcus zooepidemicus*. One case was due to *Actinobacillus equuli* ssp *haemolyticus*, one case due to *Pseudomonas aeruginosa* and three cases did not have an identified cause. Three horses demonstrated severe exercise-induced pulmonary hemorrhage. One horse succumbed to bacterial pulmonary abscess.

<b>Diagnosis</b>	<b>Total</b>
Chronic Respiratory Disease	1
Exercise Induced Pulmonary Hemorrhage	3
Pneumonia/Pleuro-pneumonia	23
Pulmonary Abscess	2
Pulmonary Infarction	1
<b>Total</b>	<b>30</b>

**Central Nervous System:**

Horses with neurological disorders were identified infrequently during 2008-09. Five cases of neurological disease were of unknown etiology. There was an increase in the number of cases of Equine Protozoal Myelitis, caused by the protozoal parasite *Sarcocystis neurona*. One case of traumatic spinal cord injury was also seen.

<b>Diagnosis</b>	<b>Total</b>
Encephalitis	1
Equine Degenerative Myelopathy	1
Equine Protozoal Myelitis	8
Undiagnosed Neurological Disease	4
<b>Total</b>	<b>14</b>

**Whole Body:**

The number of unexplained sudden deaths in horses was substantially smaller during this reporting period than the previous year. In all but one of these cases (severe trauma) a definite cause of death could not be determined. One horse appeared to bleed out into the abdominal cavity; however the source of the hemorrhage could not be found. Two horses succumbed to systemic bacterial infections of *Actinobacillus equuli* and *Staphylococcus aureus*.

<b>Diagnosis</b>	<b>Total</b>
Abdominal Hemorrhage	1
Septicemia	2
Unexplained Death	4
<b>Total</b>	<b>7</b>

## MILESTONES

**Publications** Entwistle, R.C., Sammons, S.C., Bigley, R.F., Hazelwood, S.J., Fyhrie, D.P., Gibeling, J.C., Stover, S.M. Material properties are related to stress fracture callus and porosity of cortical bone tissue at affected and unaffected sites. *J Orthop Res.* 2009 Oct, 27(10): 1272-9.

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