POSTMORTEM EXAMINATION PROGRAM

Conducted for the California Horse Racing Board
July 1, 2010–June 30, 2011

California Animal Health and Food Safety Laboratory System

J.D. Wheat Veterinary Orthopedic Research Laboratory

School of Veterinary Medicine
University of California, Davis
March 2012

Postmortem Examination Program

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March 2012

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Introduction

The Postmortem Examination Program has been in operation since February 1990 and has performed examinations on 5,639 horses, as of June 30, 2011. 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. 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 spontaneously or was euthanized on racetracks or at 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 CAHFS' Davis, Tulare and San Bernardino laboratories 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 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 horse racing industry. In depth studies of catastrophic musculoskeletal injuries in Thoroughbred horses have prompted studies by the J.D. Wheat Veterinary Orthopedic Research Laboratory within the SVM to focus on a variety of fractures and failures of the suspensory apparatus of the front limb.

General Submission Information

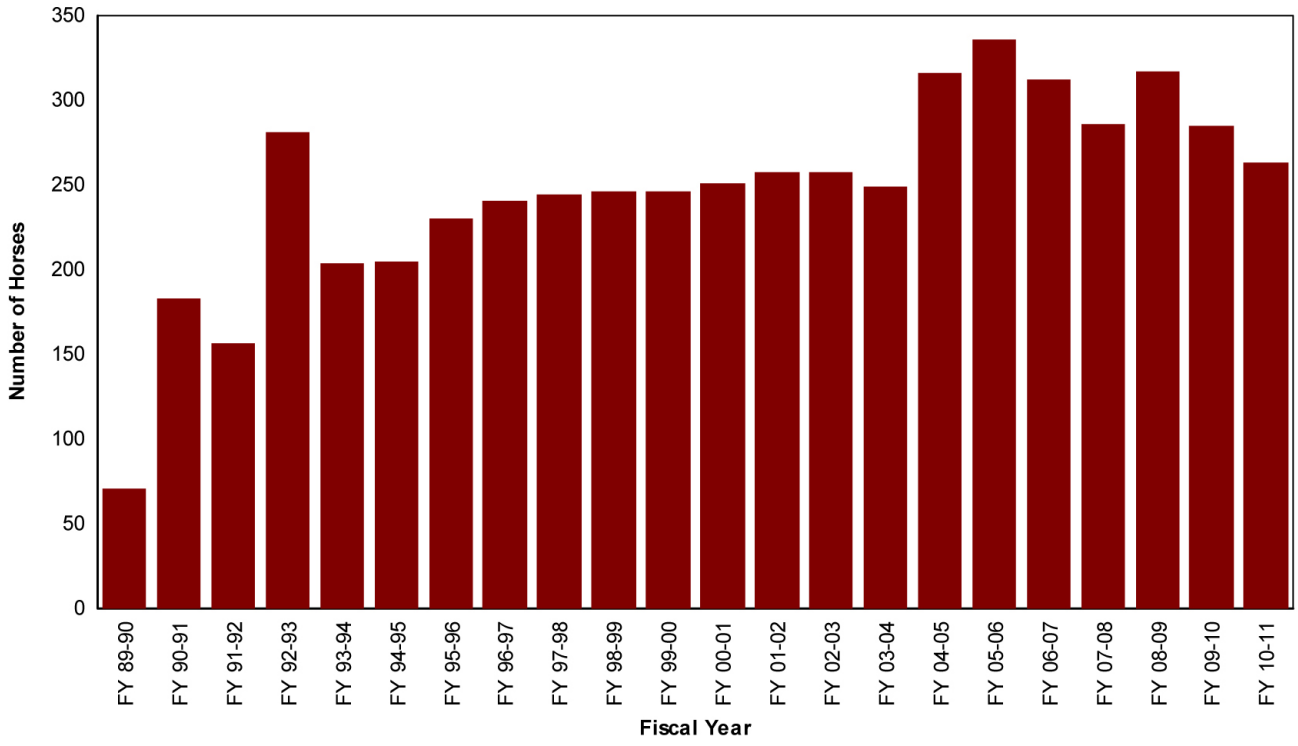
During the 2010-11 fiscal year, 265 horses were submitted to CAHFS as part of the CHRB Postmortem Program. This number is a decrease of 7 percent (21 horses) over the fiscal year 2009-10 count of 286 horses, and of 17 percent (55 horses) over the fiscal year 2008-2009 count of 320 horses. It is, however, still higher than the average number of horses submitted per year since the program began. The graph below (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 slightly almost every year until 2005-06, when a modest decline, interrupted temporarily in 2008-09, started.

The CAHFS' Davis, Tulare and San Bernardino laboratories 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: non-exercise, racing or training (Table 1). The majority of catastrophic injuries, 38.5 percent, occurred during a race or immediately following a race. Thirty-four percent of the fatal injuries occurred during or immediately following a training session. The third most frequent category of fatalities, accounting for 27.2 percent of submissions, included horses in the non-exercise group. These were horses suffering primarily from medical conditions, including colic, infectious diseases or other diseases.

Table 1. Activity at Time of Injury

Non-exercise	72
Racing	102
Training	91
Total	265

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



SUBMISSIONS BY BREED AND MONTH

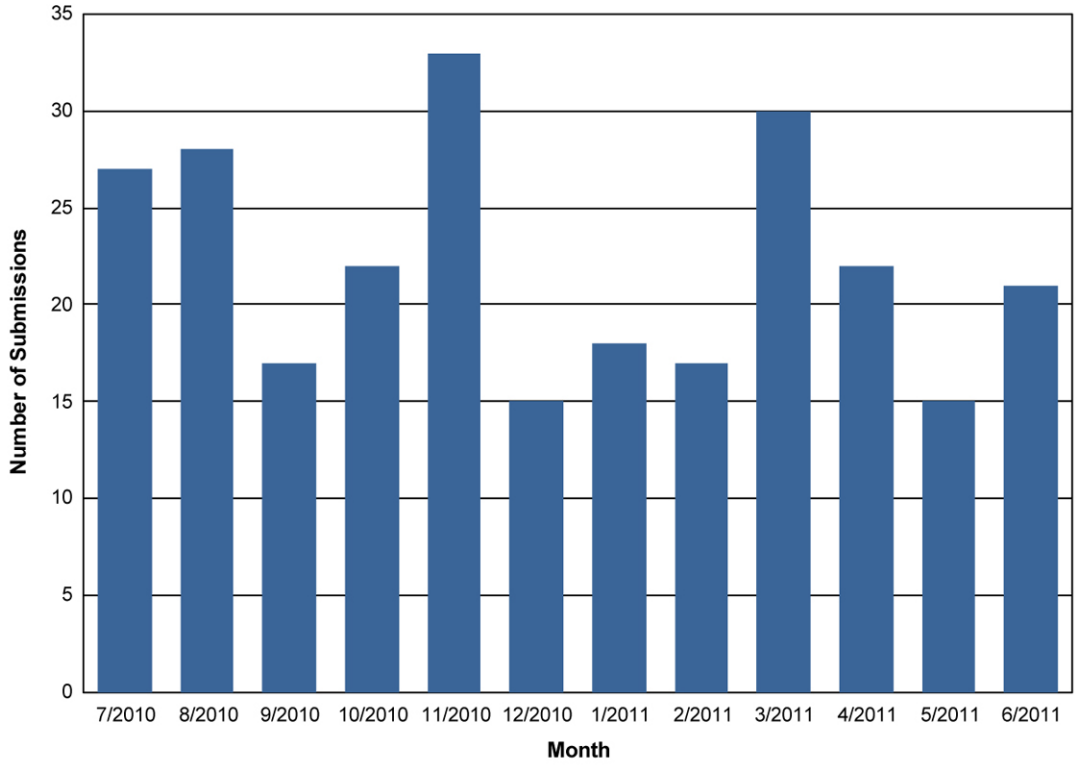
Table 2. Submissions by Breed and Month

Breed	Jul 10	Aug 10	Sep 10	Oct 10	Nov 10	Dec 10	Jan 11	Feb 11	Mar 11	Apr 11	May 11	Jun 11	Total
Paint	0	0	0	1	0	0	0	0	0	0	0	0	1
Quarter Horse	3	7	2	4	9	2	7	3	3	2	3	7	52
Standardbred	0	0	0	0	1	0	0	0	1	2	0	0	4
Thoroughbred	24	21	15	17	23	13	11	14	26	18	12	14	208
Grand Total	**27**	**28**	**17**	**22**	**33**	**15**	**18**	**17**	**30**	**22**	**15**	**21**	**265**

The vast majority of submissions (78.5 percent) during FY2010-11 were Thoroughbreds (Table 2). Fifty-two of the horses submitted in 2010-11 (19.6 percent) were Quarter Horses. This percentage is almost identical to the prior fiscal year, which represented an interruption of the continuing increase in Quarter Horse submissions observed over the previous two years. With very small numbers of the other breeds racing, not enough data exists 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 variable, although no obvious clusters of submissions are shown at any given month of the year (Table 2 and 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

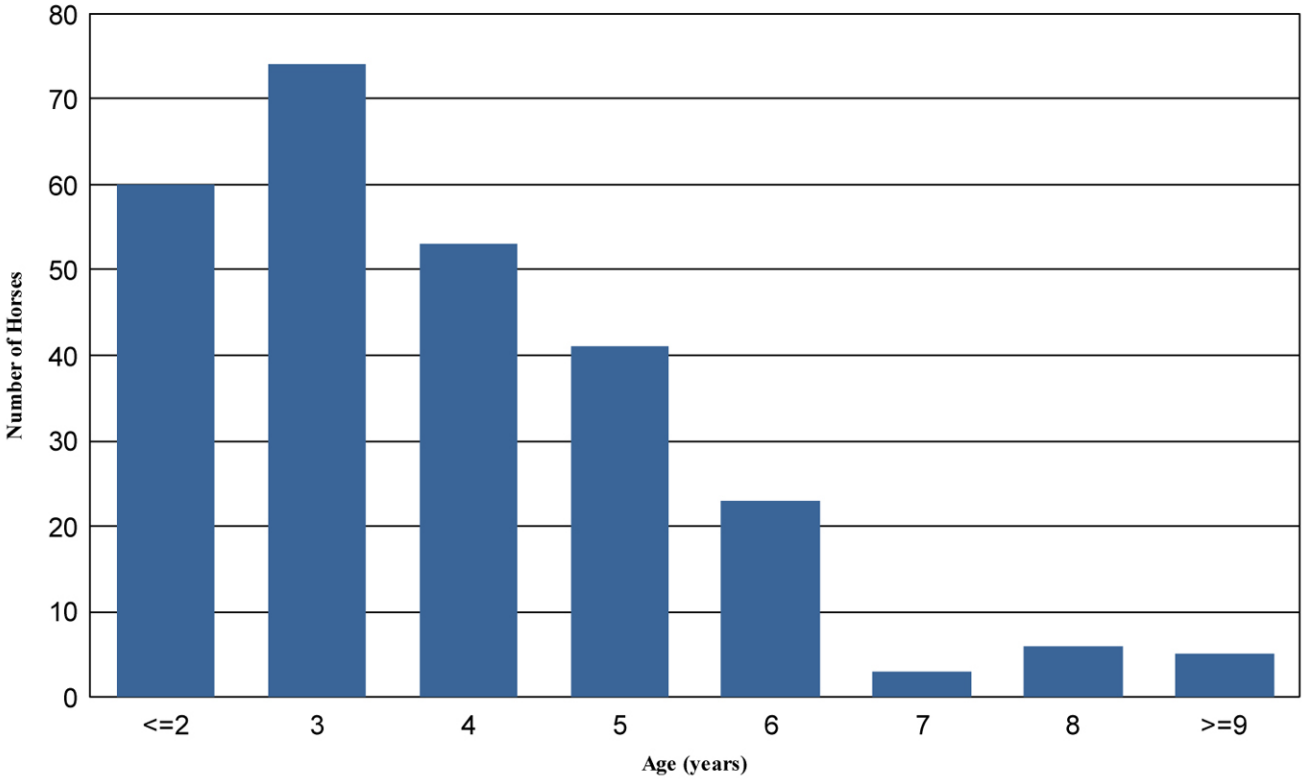
Table 3. Submissions by Breed and Age

Breed/Age	<=2	3	4	5	6	7	8	>=9	Total
Paint	1	0	0	0	0	0	0	0	1
Quarter Horse	23	10	8	2	2	0	0	1	52
Standardbred	1	0	0	1	1	0	0	1	4
Thoroughbred	29	64	45	38	20	3	6	3	208
Total	**60**	**74**	**53**	**41**	**23**	**3**	**6**	**5**	**265**

The largest proportions of submissions, 47.9 percent, were 3- or 4-year-old horses (Table 3). Only 22.6 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 fifth year of age (Table 3 and 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 to us.

Figure 3. Number of Horses Examined by Age



SUBMISSIONS BY GENDER

The gender distribution of the horses submitted during 2010-11 is shown in Table 4 below. Males represented 59.6 percent of the total group with 26.7 percent of males being intact (stallions) and 74 percent geldings. Females comprised 40.4 percent of the group. As in years before, geldings were injured more frequently during racing than during training, while stallions and mares were injured at similar proportions during these two activities.

Table 4. Distribution of Horses by Gender and Category

Gender	Non-Exercise	Race	Training	Total
Female	23	43	41	107
Male	14	13	14	41
Neutered Males	35	46	36	117
Total	**72**	**102**	**91**	**265**

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, ~60 percent, occurred during racing and training in 2-, 3-, 4- and 5-year-old racehorses (Table 5). The age of the horses submitted for non-exercise-related fatalities was concentrated between 2 and 5 years of age.

Table 5. Category of Injury by Age

Category/Age	<=2	3	4	5	6	7	8	>=9	Total
Non-Exercise	18	12	18	11	6	2	1	4	72
Race	17	26	23	19	12	1	3	1	102
Training	25	36	12	11	5	0	2	0	91
Total	**60**	**74**	**53**	**41**	**23**	**3**	**6**	**5**	**286**

Thoroughbred horses suffered nearly equal proportions of racing (38.9 percent) and training (39.9 percent) catastrophic injuries. However, training injuries were more likely to occur in younger horses (Tables 5 and 6). Typical of previous years, Quarter Horses infrequently suffered a catastrophic injury during a training session. Quarter Horse submissions during 2010-11 were slightly lower than the previous year, but they were still higher than the historical average submission for this breed. 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 Fiscal Year

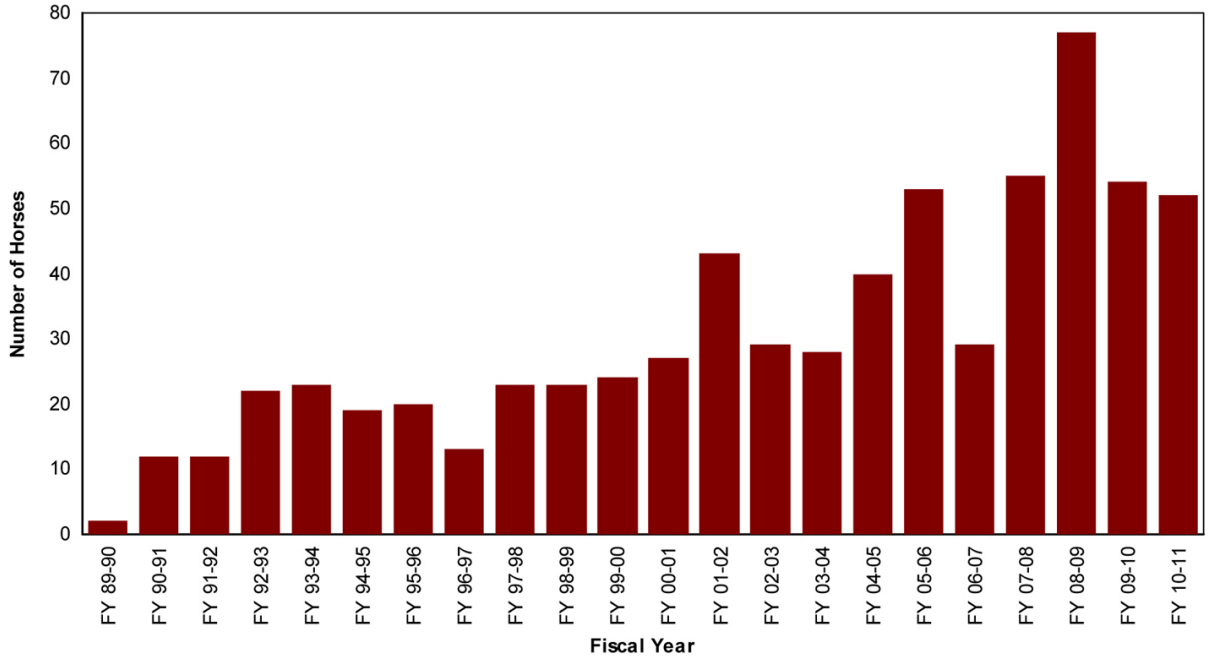


Table 6. Category of Injury by Breed

Injury Class by Breed	Non-Exercise	Race	Training	Total
Paint	1	0	0	1
Quarter Horse	24	21	7	52
Standardbred	3	0	1	4
Thoroughbred	44	81	83	208
Total	**72**	**102**	**91**	**265**

In 2010-11, approximately 70.9 percent of the total primary injuries or conditions in all breeds were due to musculoskeletal problems (Table 7). Of this group, 81.8 percent of injuries affected the front or rear legs (Table 8). The injuries listed in these tables represent the primary injury to the horse.

For this report, several primary findings for each horse submitted were 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.

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

Breed	CV	GI	MS	Nerv	Resp	Skin	Uro	WB	Total
Paint	0	0	1	0	0	0	0	0	1
Quarter Horse	3	9	33	0	2	1	0	4	52
Standardbred	0	1	1	1	0	0	0	1	4
Thoroughbred	4	16	153	4	17	1	1	12	208
Total	**7**	**26**	**188**	**5**	**19**	**2**	**1**	**17**	**265**

(CV=Cardiovascular; GI=Gastrointestinal system; MS=Musculoskeletal; Nerv=Nervous system; Resp=Respiratory system; Skin=Integumentary system; Uro=Urogenital/Reproductive; WB=Whole body).

Table 8 compares limb-specific catastrophic injuries. As usual, there were significantly more front limb injuries sustained during racing when compared to those injuries sustained while training. There were similar numbers of right and left front limb injuries but slightly more than twice left rear than right rear limb injuries. Table 9 lists the specific type of musculoskeletal injuries by breed.

Table 8. Musculoskeletal Area Affected

Limb Affected	Non-Exercise	Race	Training	Total
Left Front	0	41	36	77
Left Rear	4	5	12	21
Right Front	1	47	33	81
Right Rear	2	2	6	10
Pelvis	2	2	1	5
Skull	2	1	2	5
Vertebra	3	3	6	12
Other Structures	14	3	3	20
Total	**28**	**104**	**99**	**231**

Table 9. Musculoskeletal Injury type by Breed

Finding	Paint	Quarter Horse	Standard-bred	Thouough-bred	Total
Arthritis	0	0	0	1	1
Carpal Fracture – Left Front	0	5	0	6	11
Carpal Fracture – Right	0	1	0	0	1
Carpal Fracture – Right Front	0	8	0	5	13
Femur Fracture – Left	0	0	0	1	1
Femur Fracture – Right	0	0	0	1	1
Fetlock Joint Luxation – Left Front	0	1	0	1	2
Fetlock Joint Luxation – Right Front	0	0	0	1	1
Foot Disease	0	0	0	4	4
Humerus Fracture – Left	0	0	0	6	6
Humerus Fracture – Right	0	0	0	6	6
Laminitis	0	7	0	2	9
Lateral Proximal Sesamoid Fracture – Right Front	0	0	0	1	1
Medial Proximal Sesamoid Fracture – Left Front	0	0	0	8	8
Medial Proximal Sesamoid Fracture – Left Rear	0	0	0	1	1
Medial Proximal Sesamoid Fracture – Right Front	0	0	0	5	5
Metacarpus III Fracture – Left	0	4	0	14	18
Metacarpus III Fracture – Right	0	1	0	16	17
Metacarpus IV Fracture – Right	0	1	0	0	1

Table 9 continues on next page

Table 9. Musculoskeletal Injuries by Breed (continued)

Finding	Pony	Quarter Horse	Standard-bred	Thouough-bred	Total
Metatarsus Fracture – left Rear	0	0	0	2	2
Metatarsus Fracture – Right Rear	0	0	0	2	2
Muscle Laceration	0	1	0	0	1
P1 Fracture – Left Front	0	0	0	4	4
P1 Fracture – Left Rear	0	0	0	5	5
P1 Fracture – Right Front	0	0	0	3	3
P1 Fracture – Right Rear	0	0	0	2	2
P2 Fracture – Right Rear	0	1	0	0	1
Pelvis Fracture	0	0	0	5	5
Radius Fracture – Left	0	0	0	2	2
Radius Fracture – Right	0	0	0	1	1
Rib Fracture	0	0	0	1	1
Scapula Fracture – Left	0	0	0	2	2
Scapula Fracture – Right	0	1	0	2	3
Sesamoid Fracture, Biaxial – Left Front	0	2	0	22	24
Sesamoid Fracture, Biaxial – Left Rear	0	0	0	1	1
Sesamoid Fracture, Biaxial – Right Front	0	2	0	26	28
Sesamoid Fracture, Biaxial – Right Rear	0	0	0	1	1
Skull Fracture	0	1	0	4	5
Suspensory Apparatus Failure – Left Rear	0	0	0	1	1
Suspensory Apparatus Failure – Right Front	0	0	0	1	1
Suspensory Ligament Rupture	0	0	0	3	3
Tarsus Fracture – Right	0	0	0	1	1
Tendon Rupture	0	0	0	1	1
Tibia Fracture – Left	1	1	0	8	10
Tibia Fracture – Right	0	0	0	2	2
Vertebra Fracture	0	4	1	7	12
Total	**1**	**41**	**1**	**188**	**231**

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 shows that for the current fiscal year the absolute number of injuries on synthetic surfaces was moderately lower than on other surfaces. Because the total number of horses racing on each surface is not known to CAHFS, it cannot be determined from this data whether the injury rates differ by track surface.

Table 10. Musculoskeletal Injury: Affected Limb by Track Type

Limb	Dirt	N/A	Synthetic	Turf	Total
Left Front	45	2	26	4	77
Left Rear	7	4	9	1	21
Right Front	38	2	32	9	81
Right Rear	2	2	4	2	10
Pelvis	1	2	2	0	5
Skull	0	4	1	0	5
Vertebra	5	5	2	0	12
Other Structures	2	14	4	0	20
Total	**100**	**35**	**80**	**16**	**231**

Other Organ Systems Affected by Injuries

Cardiovascular:

During this period six cases of sudden death occurred for which a final cause was not established, but they were attributed to acute heart failure. This represents the same number of horses with this diagnosis during 2009-10. Other cardiovascular system-related deaths include rupture of large arteries and myocarditis.

Gastrointestinal:

Of the digestive system diagnoses, gastrointestinal displacement/rupture and enterocolitis (inflammation of the small and large intestines) were the most frequently observed findings. Most cases of enterocolitis were due to infection with *Clostridium difficile* or *Clostridium perfringens*.

Diagnosis	Total
Enterocolitis	10
Gastrointestinal displacement/rupture	10
Other	6
Total	**26**

Integumentary (Skin):

Only two diagnoses of skin diseases were made on horses submitted to CAHFS during 2010-11. This is consistent with the reduced number of horses with diseases of the skin submitted regularly to CAHFS as part of the CHRB necropsy program. These two cases were euthanized due to non-responsive skin conditions that reduced the quality of life of the animals.

Respiratory:

Similar numbers of cases of respiratory diseases were identified in FY 2010-11 to those that were seen in previous years. Similar to previous years, by far the main cause for pneumonia was bacterial and within this, *Streptococcus zooepidemicus* was the most prevalent etiology. Other less represented etiologies included *Actinobacillus equuli and Actinomyces pyogenes*.

Diagnosis	Total
Exercise-Induced Pulmonary Hemorrhage	9
Pneumonia	8
Other respiratory disease	2
Total	**19**

Nervous System:

Horses with neurological disorders were identified infrequently during 2010-11. There were two cases of Equine Protozoal Myelitis, caused by the protozoal parasite *Sarcocystis neurona*; this represents the same number from the previous year, when there were also two diagnoses of this disease. There were also three cases of miscellaneous neurological disease (encephalopathy, spinal cord injury and peripheral neuropathy).

Urogenital System:

A testicular carcinoma with distant metastasis was diagnosed in a stallion.

Whole Body:

A variety of conditions affecting multiple body systems (classified as "whole body") were identified. These included anaphylaxis, septicemia, sudden death and others.

Diagnosis	Total
Sudden Dealth	9
Anaphylaxis	1
Septicemia	3
Others	4
Total	**17**

MILESTONES

Publications

Lyle CH, Uzal FA, Mc Gorum BC, Aida H, Blissit KJ, Case JT, Charles JT, Gardner I, Horadagoda N, Kusano K, Lam K, Pack JD, Parkin TD, Slocombe RF, Stewart B and Boden LA. Sudden death in racing Thoroughbred horses: An international multicentric study of post-mortem findings. *Equine Veterinary Journal* 43(3): 324-331, 2011.

RESEARCH SUPPORT

Sponsors

- Center for Equine Health, with funds provided by:
  - State of California Satellite Wagering Fund
  - Southern California Equine Foundation
  - Private donors
- Dolly Green Foundation
- Grayson-Jockey Club Research Foundation, Inc.
- Pacific Coast Quarter Horse Racing Association

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