POSTMORTEM EXAMINATION PROGRAM

Conducted for the California Horse Racing Board
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California Animal Health and Food Safety Laboratory System

J.D. Wheat Veterinary Orthopedic Research Laboratory

School of Veterinary Medicine
University of California, Davis

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Postmortem Examination Program

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POSTMORTEM EXAMINATION PROGRAM

Introduction

The Postmortem Examination Program has been in operation since February 1990 and has performed examinations on 6,126 horses, as of June 30, 2013. 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 and international model for the horse 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). Additionally, from 2011 until mid-2013, all musculoskeletal specimens from CHRB horses necropsied at CAHFS laboratories were shipped to the Veterinary Orthopedic Laboratory at UC Davis for the Enhanced Examination Program.

In-depth analyses of these specimens helped to more precisely determine the causes and risk factors that led up to catastrophic injuries in racehorses, resulting in their death or euthanasia. During the past years, 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.

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General Submission Information

During the 2012-13 fiscal year, 209 horses were submitted to CAHFS as part of the CHRB Postmortem Examination Program. This number is a decrease of ~ 25 percent (69 horses) over the fiscal year 2011-12 count of 278 horses, and the lowest number of fatalities of the past 18 years. 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 to the CHRB program have been increasing slightly almost every year until 2005-06, after which a decline, interrupted temporarily in 2008-09 and 2011-12, 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 track official categorized the activity of the horse at the time of injury into one of three types: non-exercise, racing or training (Table 1).

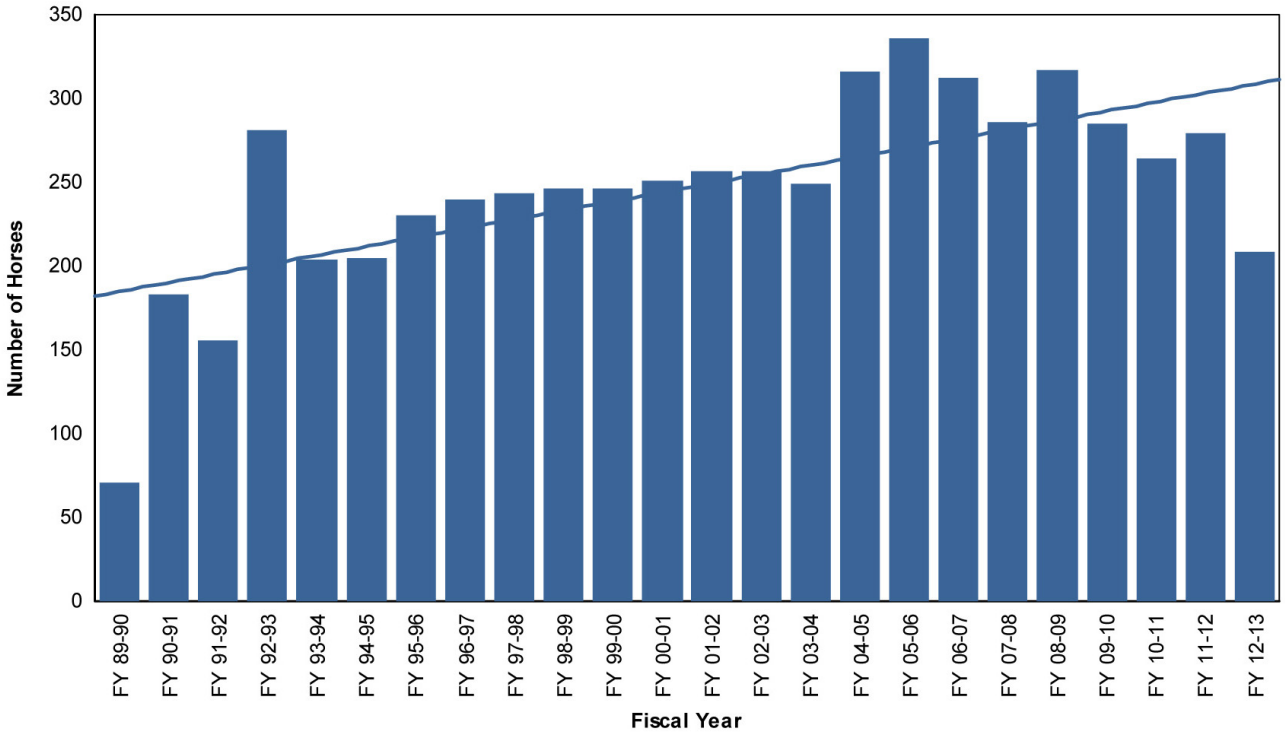
The vast majority of catastrophic injuries, 73 percent, occurred during or immediately following training or racing. Of these, approximately 59 percent occurred during or immediately after racing, and the remaining 41 percent were training-related.

Continued

Table 1. Activity at Time of Injury/Fatality

Non-Exercise	56
Racing	90
Training	63
Total	209

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



This is in agreement with previous years, in which most fatalities were exercise-related. The third category of fatalities, accounting for ~ 27 percent of submissions, included horses in the non-exercise group. These were horses suffering primarily from medical conditions such as colic, infectious diseases or other conditions.

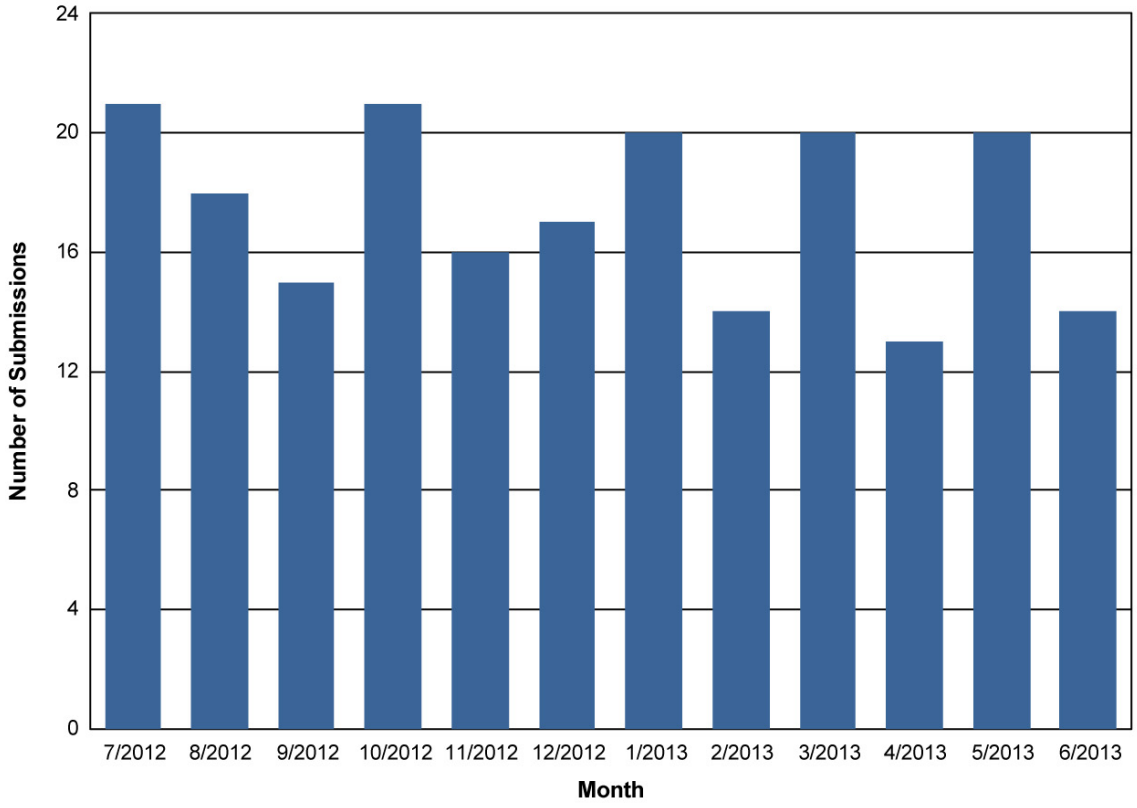
As in the past, the vast majority of submissions (~80 percent) during FY 2012-13 were Thoroughbreds (Table 2). Thirty-seven of the horses submitted in 2012-13 (17.7 percent) were Quarter Horses. This is a 20 percent decrease over the prior fiscal year, and constitutes the second year in which a reduction in the number of Quarter Horse submissions is observed. 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.

Continued

Table 2. Submissions by Breed and Month

Breed	Jul 12	Aug 12	Sep 12	Oct 12	Nov 12	Dec 12	Jan 13	Feb 13	Mar 13	Apr 13	May 13	Jun 13	Total
Paint Horse	0	1	0	0	0	0	1	0	0	0	0	0	**2**
Quarter Horse	5	2	2	3	3	6	1	1	4	3	5	2	**37**
Standardbred	0	1	0	0	0	1	0	1	0	0	0	0	**3**
Thoroughbred	16	14	13	18	13	10	18	12	16	10	15	12	**167**
Grand Total	**21**	**18**	**15**	**21**	**16**	**17**	**20**	**14**	**20**	**13**	**20**	**14**	**209**

Figure 2. Number of Horses Examined by Month

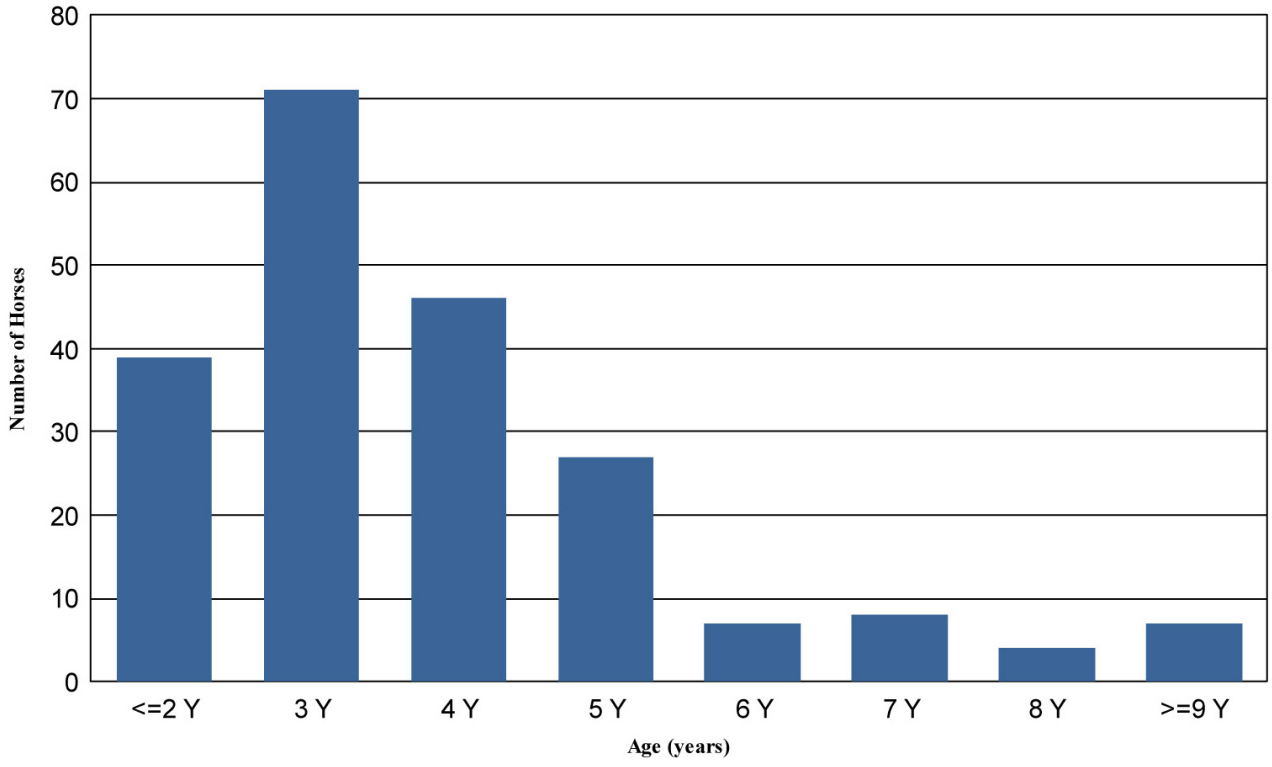


The number of horses submitted per month was catastrophic injuries or death drops dramatically af-
variable, although there were no obvious clusters of ter the fifth year of age (Table 3 and Figure 3). This
submissions at any given month of the year (Table distribution is consistent with the age distribution 2
and Figure 2). This is very similar to submission that has been seen in prior years of the program. We
patterns over the last few years. cannot conclude if horses 5 years of age and greater The largest
proportion of submissions (>50.0 are much less susceptible to the athletic injuries of
percent) were 3- or 4-year-old horses (Table 3). Only racing, because the total number of horses in each
~ 19 percent of all racehorses submitted were 2 years age group that are racing and training on facilities
old, or less. The number of horses submitted with controlled by CHRB are not known to us.

Table 3. Submissions by Breed and Age

Breed/Age	<=2	3	4	5	6	7	8	>=9	Total
Paint Horse	0	0	0	0	0	1	0	1	**2**
Quarter Horse	14	12	6	1	0	1	0	3	**37**
Standardbred	0	0	0	2	1	0	0	0	**3**
Thoroughbred	25	59	40	24	6	6	4	3	**167**
Total	**39**	**71**	**46**	**27**	**7**	**8**	**4**	**7**	**209**

Figure 3. Number of Horses Examined by Age



Submissions By Gender

The gender distribution of the horses submitted during 2012-13 is shown in Table 4 below. Males represented 59.3 percent of the total group with 34.7 percent of males being intact (stallions) and 65.3 percent geldings. Females comprised 40.7 percent of the group.

Table 4. Distribution of Horses by Gender and Category

Gender	Non-Exercise	Racing	Training	Total
Female	27	30	28	**85**
Male	8	17	18	**43**
Gelding	21	43	17	**81**
Total	**56**	**90**	**63**	**209**

Injuries

As previously mentioned, 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, 73.2%, occurred during racing and training in 2-, 3- and 4-year-old racehorses (Table 5). The age of the horses submitted for non-exercise related fatalities was also concentrated between 2 and 4 years of age.

Table 5. Category of Injury/Fatality by Age

Category/Age	<=2	3	4	5	6	7	8	>=9	Total
Non-Exercise	17	20	9	3	1	0	0	6	**56**
Racing	15	25	20	16	4	7	2	1	**90**
Training	7	26	17	8	2	1	2	0	**63**
Total	**39**	**71**	**46**	**27**	**7**	**8**	**4**	**7**	**209**

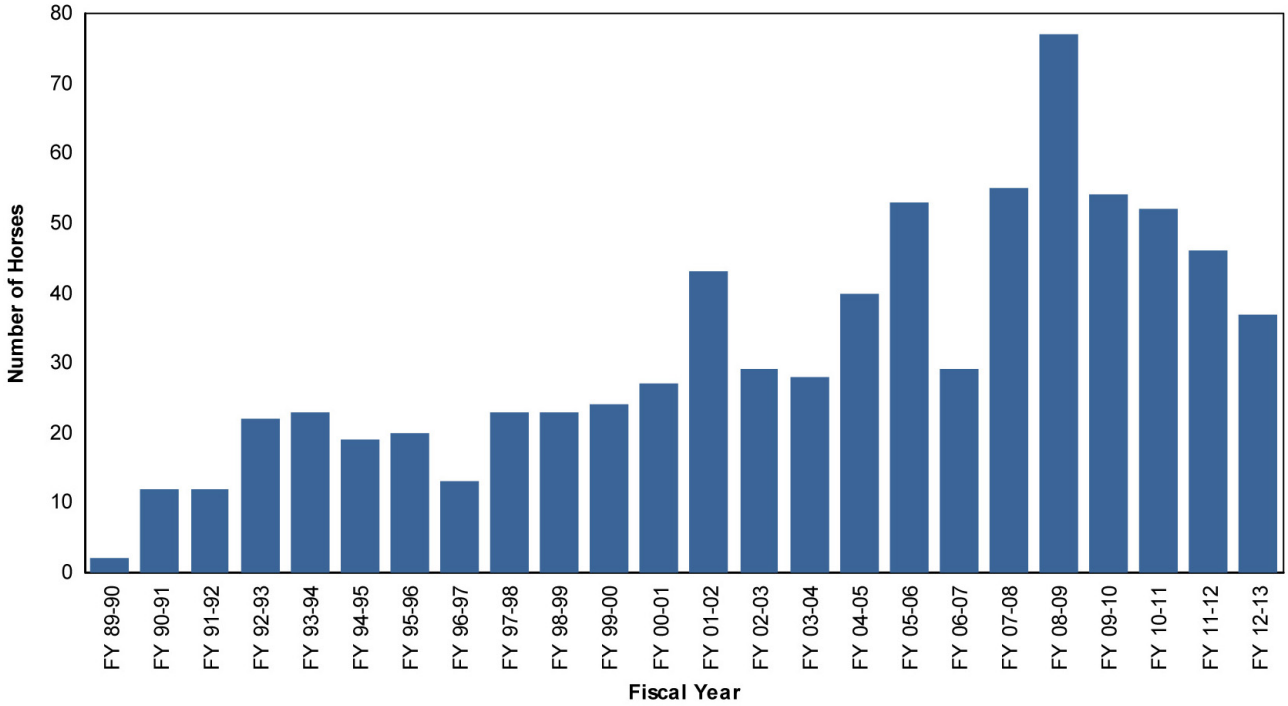
INJURIES

During this fiscal year Thoroughbred horses suffered more racing (41.9 percent) than training (35.9 percent) catastrophic injuries (Table 6). This is a variation from the year before in which catastrophic injuries at training fatalities were more numerous than during racing. Quarter Horses did not suffer catastrophic injuries during training in this period. This is consistent with previous years, when Quarter Horses infrequently suffered a catastrophic injury during a training session. Quarter Horse submissions during 2012-13 were lower than the previous year, continuing the steady decline which started four years ago. Figure 4 shows the historical number of Quarter Horses submitted to the program since its inception.

Table 6. Category of Injury/Fatality by Breed

Injury Class by Breed	Non-Exercise	Racing	Training	Total
Paint Horse	1	0	1	**2**
Quarter Horse	17	20	2	**37**
Standardbred	1	0	2	**3**
Thoroughbred	37	70	60	**167**
Total	**56**	**90**	**630**	**209**

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



In 2012-13, 72.7 percent of the total primary injuries or conditions in all breeds were due to musculoskeletal problems (Table 7), which is consistent with what has been observed in previous years. Of this group, 72.8 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	Hemo	MS	Nerv	Resp	Skin	WB	Total
Paint Horse	0	0	0	0	0	2	0	0	**2**
Quarter Horse	0	2	2	27	1	2	0	3	**37**
Standardbred	0	0	1	0	0	0	0	2	**3**
Thoroughbred	2	7	4	125	2	12	4	11	**167**
Total	**2**	**9**	**7**	**152**	**3**	**16**	**4**	**16**	**209**

(CV=Cardiovascular; GI=Gastrointestinal system; Hemo=Hemopoietic; MS=Musculoskeletal; Nerv=Nervous system; Resp=Respiratory system; Skin=Integumentary system; WB=Whole body).

Table 8 lists catastrophic injuries by limb and other axial locations. The number of front limb injuries sustained during racing was higher than those injuries sustained during training. There were nearly equal numbers of right and left front limb injuries, as well as similar numbers of right and left rear limb injuries.

Table 8. Musculoskeletal Area Affected

Limb Affected	Non-Exercise	Racing	Training	Total
Left Front	0	36	19	**55**
Left Rear	2	3	0	**5**
Right Front	1	37	14	**52**
Right Rear	2	1	3	**6**
Pelvis	2	4	9	**15**
Skull	5	1	1	**7**
Vertebra	0	5	1	**6**
Various Structures	15	0	1	**16**
Total	**27**	**87**	**48**	**162**

Table 9. Musculoskeletal Injury type by Breed

Finding	Quarter Horse	Thoutough-bred	Total
Carpal Fracture – Left	2	2	**4**
Carpal Fracture – Right	4	4	**8**
Cervical Vertebra Fracture	0	2	**2**
Degenerative Joint Disease	1	1	**2**
Fedlock Failure – Left Front	2	27	**29**
Fetlock Failure – Left Rear	0	3	**3**
Fetlock Failure – Right Front	2	26	**28**
Fetlock Failure – Right Rear	0	4	**4**
Humerus Fracture – Left	0	4	**4**
Humerus Fracture – Right	0	4	**4**
Joint Disarticulation	2	0	**2**
Laminitis	7	2	**9**
Lateral Proximal Sesamoid Fracture – Left Front	1	0	**1**
Metacarpus III Fracture – Left	1	5	**6**
Metacarpus III Fracture – Right	0	3	**3**
Metatarsus III Fracture – left	0	1	**1**
Muscle Laceration	0	1	**1**
P1 Fracture – Left Front	0	3	**3**
P1 Fracture – Right Front	0	1	**1**
P1 Fracture – Right Rear	0	1	**1**
P2 Fracture – Right Rear	0	1	**1**
Pelvis Fracture	0	15	**15**
Radius Fracture – Left	0	1	**1**
Radius Fracture – Right	0	1	**1**
Scapula Fracture – Left	0	3	**3**
Scapula Fracture – Right	1	0	**1**
Skull Fracture	0	7	**7**
Suspensory Apparatus Failure – Left Front	1	2	**3**
Suspensory Apparatus Failure – Right Front	0	5	**5**
Tendon Rupture – Right Front	1	1	**2**
Tenosynovitis	2	0	**2**
Tibia Fracture – Left	0	1	**1**
Vertebra Fracture	4	0	**4**
Total	**31**	**131**	**162**

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 dirt surfaces was higher 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	32	0	16	7	**55**
Left Rear	0	2	0	3	**5**
Right Front	29	1	19	3	**52**
Right Rear	2	2	2	0	**6**
Pelvis	7	2	5	1	**15**
Skull	1	5	1	0	**7**
Vertebra	5	1	0	0	**6**
Various Structures	1	15	0	0	**16**
Total	**77**	**28**	**43**	**14**	**162**

Human Injury

During the fiscal year 2012-2013, there were 20 human injuries related to catastrophic horse breakdowns. This represents 9.6 percent of the 209 horses submitted to the CAHFS lab during this year, an increase over the 7.6 percent human injuries reported in the previous year. The distribution of human injuries by breed of horse is presented in Table 11.

All 20 human injuries occurred during running of the race. Thirty-five percent of human injuries occurred in horses 2 years of age or younger, while the rest of the injuries were evenly distributed in horses between 3 and 5 years of age. One injury (5 percent) occurred in a 7-year-old horse.

Table 11. Human Injury by Horse Breed

Horse Breed	Number of Submissions
Quarter Horse	**5**
Thoroughbred	**15**
Total	**20**

Other Organ Systems Affected by Injuries

Cardiovascular:

During this period there were two cases with a confirmed diagnosis of cardiovascular disease; both with major vessel rupture.

Diagnosis	Total
Major vessel rupture	2
Total	**2**

Integumentary (Skin):

Only seven diagnoses of diseases of the skin were made on horses submitted to CAHFS during 2012-2013. 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.

Diagnosis	Total
Cellulitis	5
Epidermal laceration	2
Total	**7**

Gastrointestinal:

Of the digestive system diagnoses, enteritis/colitis/enterocolitis and intestinal displacements were the most frequently observed findings. Causes of enterocolitis during this period were due to infections with *Actinobacillus equuli* and *Clostridium sordellii*, or undetermined.

Diagnosis	Total
Enteritis/colitis/ enterocolitis	5
Gastrointestinal displacement/rupture	4
Total	**9**

Respiratory:

Approximately the same number of cases of respiratory diseases were identified in 2012-2013 as had been seen the year before (21). By far the main cause for pleuropneumonia, pleuritis and/or pneumonia was bacterial and, within this, *Streptococcus equi* was the most prevalent etiology. Other less-represented etiologies included *Actinobacillus equuli*.

Diagnosis	Total
Pleuropneumonia	10
Pleuritis	3
Pneumonia	2
Pulmonary hemorrhage	6
Pulmonary edema	1
Total	**22**

Nervous System:

Horses with neurological disorders were identified infrequently during 2012-2013.

Diagnosis	Total
Equine Protozoal Myelitis	1
Equine herpesvirus encephalomyelitis	1
Head trauma	1
Total	**3**

Whole Body:

Diagnosis	Total
Peritonitis	4
Septicemia	5
Unexplained death	10
Total	**19**

Hemolymphatic:

Of the seven horses with hemolymphatic disease, five suffered massive hemorrhages. On three of these, trace amounts of rodenticide anticoagulants were detected in the liver. Although the role of these anticoagulants in the bleeding disorder could not be confirmed or ruled out, it is suspected that the anticoagulants were responsible for the bleeding.

The number of unexplained exercise-related sudden deaths (27) in horses was higher during this reporting period than the previous year. The cause of sudden death remainded undetermined in 14 of those horses.

Diagnosis	Total
Bleeding disorder	5
Equine infectious anemia	1
Lymphoma	1
Total	**7**

RESEARCH SUPPORT

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