POSTMORTEM EXAMINATION PROGRAM

Conducted for the California Horse Racing Board
July 1, 2014–June 30, 2015

California Animal Health and Food Safety Laboratory System

J.D. Wheat Veterinary Orthopedic Research Laboratory

School of Veterinary Medicine
University of California, Davis

May 2016

Postmortem Examination Program

California Animal Health and Food Safety Laboratory System

J.D. Wheat Veterinary Orthopedic Research Laboratory

School of Veterinary Medicine
University of California, Davis
Davis, CA 95616
(916) 752-8700

May 2016

Equine Welfare and Racing Injury Prevention Committee

Jeff Blea, DVM
Jim Cassidy
Frosty Franklin, DVM
Gloria Haley
Ellen Jackson
Richard Mandella, Chair
Dino Perez
Tom Robbins
Jeff Salmon
Donald Smith, DVM
Rick Arthur, DVM, ex-officio
Rick Baedeker, ex-officio
Susan Stover, DVM, Ph.D., ex-officio
Francisco Uzal, DVM, Ph.D., ex-officio

TABLE OF CONTENTS

Introduction 2

General Submission Information 3–4

Table 1. Activity at Time of Injury/Fatality
Figure 1. Number of Horses Submitted by Year
Table 2. Submissions by Breed and Month
Figure 2. Number of Horses Examined by Month

Submissions by Breed and Age 5

Table 3. Submissions by Breed and Age
Figure 3. Number of Horses Examined by Age

Submissions by Gender 6

Table 4. Distribution by Gender and Category

Injuries

Categories of Injury 6–7

Table 5. Category of Injury/Fatality by Age
Table 6. Category of Injury by Breed
Figure 4. Number of Quarter Horses Submitted

Organ Systems Affected by Injuries 8–13

Table 7. Organ Systems Affected
Table 8. Musculoskeletal Structures Affected
Table 9. Musculoskeletal Injury Type by Breed

Track Surface Injuries 10

Table 10. Musculoskeletal Injury by Track Type

Human Injuries 10–11

Other Organ Systems Affected 11–12

Cardiovascular System
Hemolymphatic
Integumentary (skin)
Gastrointestinal System
Respiratory System
Nervous System
Whole Body

Research Support 13

POSTMORTEM EXAMINATION PROGRAM

Introduction

The Postmortem Examination Program has been in operation since February 1990, and has performed examinations on 6,512 horses as of June 30, 2015. 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 training facilities under the jurisdiction of the CHRB. This visionary partnership has become a national and international 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 (UC Davis). For instance, specimens from select cases were occasionally shipped to the J.D. Wheat Veterinary Orthopedic Research Laboratory (VORL) at UC Davis. This helped to precisely determine the causes and risk factors that led to catastrophic injuries in racehorses resulting in their death or euthanasia. 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 UC Davis and private sources.

Information from the tests and data gathered from the postmortem examinations are analyzed in an effort to elucidate the specific cause of catastrophic injuries.

CALIFORNIA ANIMAL HEALTH & FOOD SAFETY LABORATORY SYSTEM
U C DAVIS

UCDAVIS
VETERINARY MEDICINE
California Animal Health and Food Safety Laboratory System

SUBMISSIONS

General Submission Information

During the 2014-15 fiscal year, 187 horses were submitted to CAHFS as part of the CHRB Postmortem Program. This number is a decrease of ~6 percent (12 horses) over the fiscal year 2013-14 count of 199, and continues with the downward trend initiated several years ago (Figure 1). The 2014-15 total number of fatalities (187) represents the lowest number of fatalities of the past 20 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 for 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 injury, the activity of the horse is categorized by the CHRB track official into one of three types: non-exercise, racing or training (Table 1).

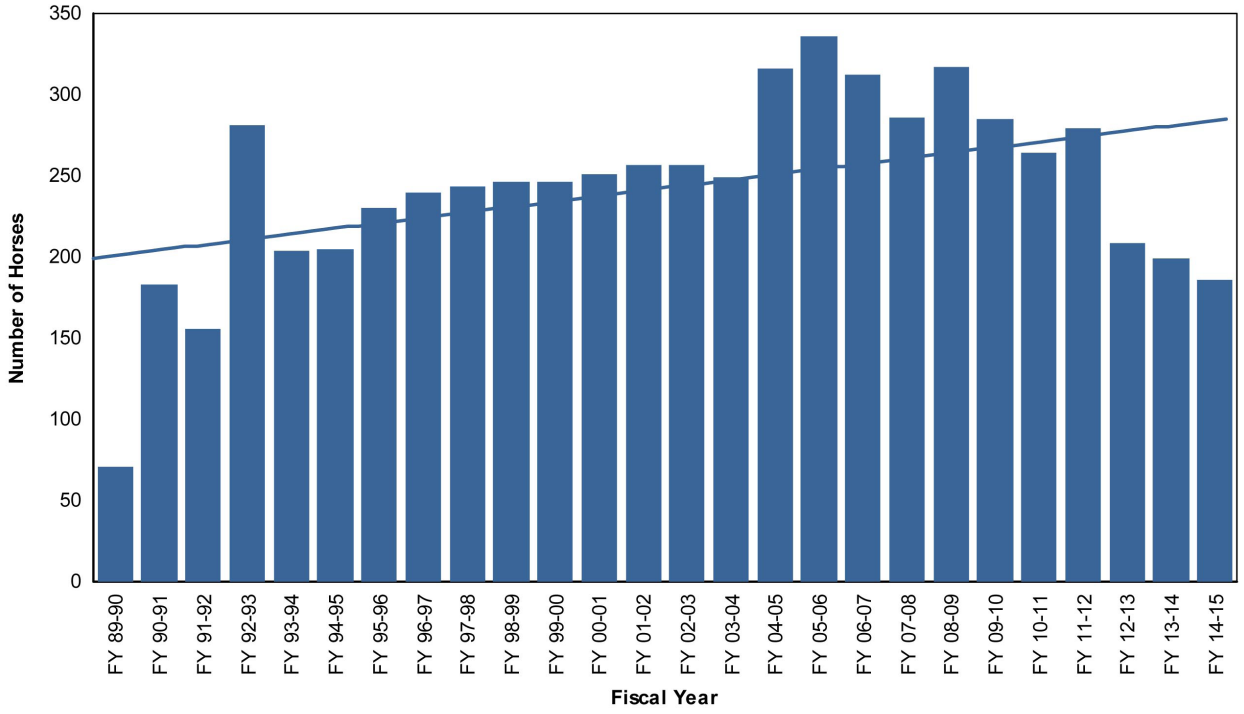
The vast majority of catastrophic injuries, 74 percent, occurred during or immediately following training or racing. Of these, approximately 52 percent occurred during or immediately after racing, and the remaining 48 percent were training-related.

Continued

Table 1. Activity at Time of Injury/Fatality

Non-Exercise	48 (26%)
Racing	72 (38%)
Training	67 (36%)
Total	**187 (100%)**

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 ~26 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.

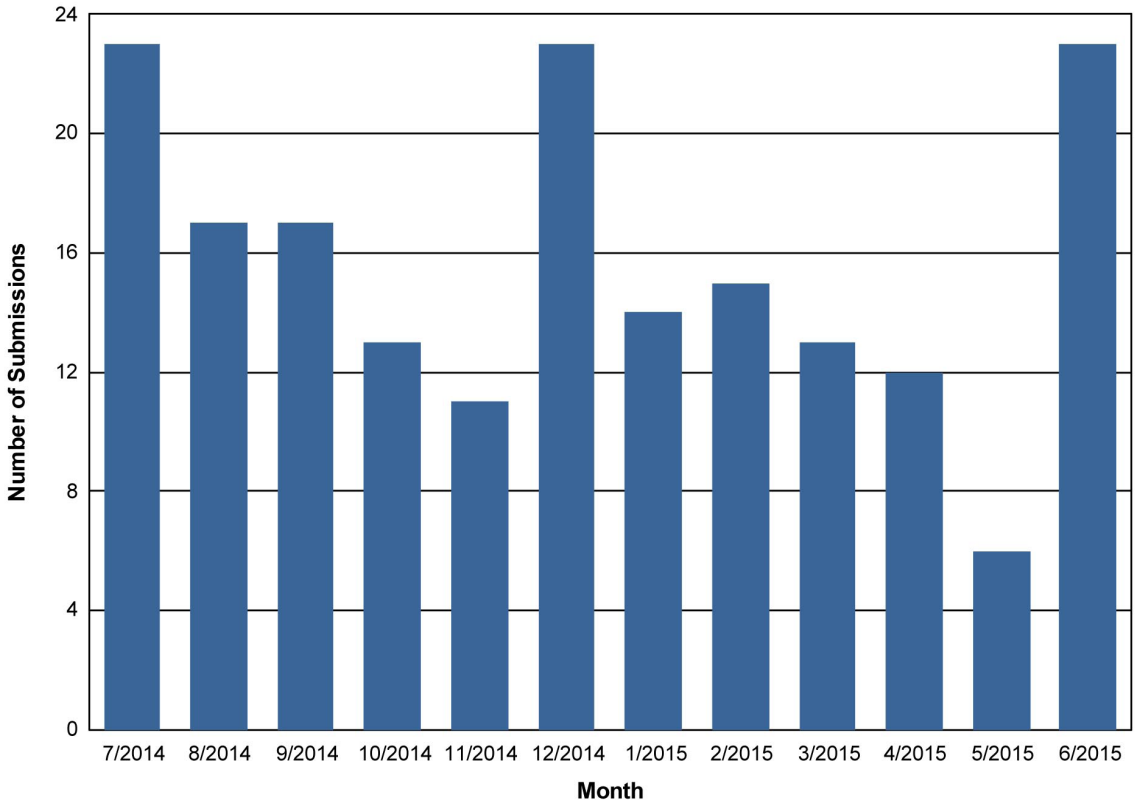
As in the past, the vast majority of submissions, 155 (~83 percent) during FY 2014-15 were Thoroughbreds (Table 2). Twenty eight of the horses submitted in 2014-15 (~15 percent) were Quarter Horses. This is a ~5 percent increase over the prior fiscal year and constitutes the first increase in three years in which a reduction in the number of Quarter Horse submissions was observed. With very small numbers of other breeds racing, not enough data exists to allow comparison of injury rates among

Continued

Table 2. Submissions by Breed and Month

Breed	Jul 14	Aug 14	Sep 14	Oct 14	Nov 14	Dec 14	Jan 15	Feb 15	Mar 15	Apr 15	May 15	Jun 15	Total
Paint Horse	0	0	0	0	0	0	0	1	0	0	0	0	**1**
Quarter Horse	3	1	2	5	1	3	0	2	4	0	0	7	**28**
Standardbred	0	0	0	0	0	2	1	0	0	0	0	0	**3**
Thoroughbred	20	16	15	8	10	18	13	12	9	12	6	16	**155**
Grand Total	**23**	**17**	**17**	**13**	**11**	**23**	**14**	**15**	**13**	**12**	**6**	**23**	**187**

Figure 2. Number of Horses Examined by Month



breeds for any predisposition to any particular type of injury.

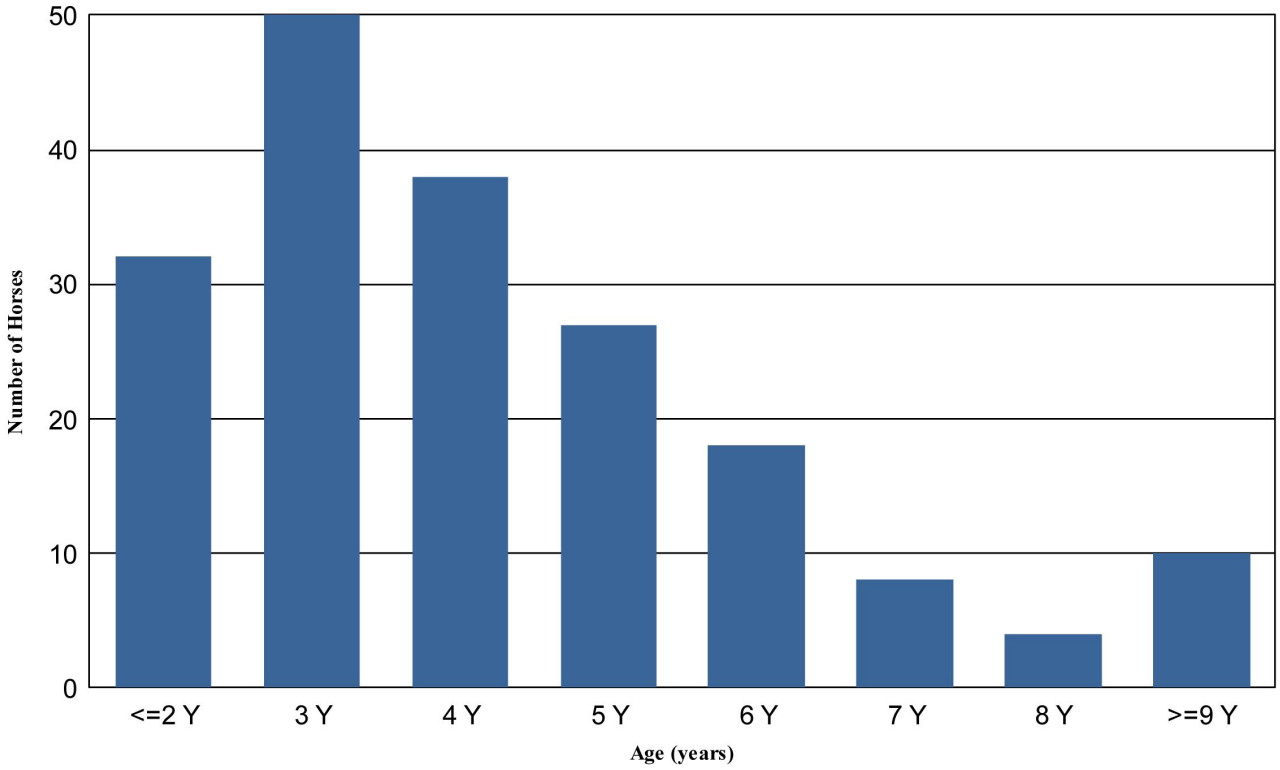
The number of horses submitted per month was variable, although there were not obvious clusters of submissions at any given month of the year (Table 2 and Figure 2). This is very similar to submission patterns over the last few years.

The largest proportion of submissions (~47.0 percent) were 3- or 4-year-old horses (Table 3). Only ~17 percent of all racehorses submitted were 2 years old or younger. The number of horses submitted with catastrophic injuries or death drops dramatically after the fifth year of age (Table 3 and Figure 3). This 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.

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	0	0	1	**1**
Quarter Horse	12	6	4	3	0	1	0	2	**28**
Standardbred	0	0	1	0	0	0	0	2	**3**
Thoroughbred	20	44	33	24	18	7	4	5	**155**
Total	**32**	**50**	**38**	**27**	**18**	**8**	**4**	**10**	**187**

Figure 3. Number of Horses Examined by Age



Submissions By Gender

The gender distribution of the horses submitted during 2014-15 is shown in Table 4 below. Males represented ~56 percent of the total group, with 36 percent of males being intact (stallions) and 64 percent geldings. Females comprised ~44 percent of the group.

Table 4. Distribution of Horses by Gender and Category

Gender	Non-Exercise	Racing	Training	Total
Female	21	36	26	**83 (44%)**
Male	8	10	19	**37 (20%)**
Neutered Males	19	26	22	**67 (36%)**
Total	**48**	**72**	**67**	**187 (100%)**

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, ~79 percent, occurred in 2-, 3-, 4- and 5-year-old racehorses (Table 5). The age of the horses submitted for non-exercise related fatalities was also concentrated between 2 and 5 years of age.

Table 5. Category of Injury/Fatality by Age

Category/Age	<=2	3	4	5	6	7	8	>=9	Total
Non-Exercise	13	9	6	7	5	2	0	6	**48**
Racing	4	17	21	13	10	3	1	3	**72**
Training	15	24	11	7	3	3	3	1	**67**
Total	**32**	**50**	**38**	**27**	**18**	**8**	**4**	**10**	**187**

During this fiscal year, Thoroughbred horses suffered similar numbers of racing (~39 percent) as training (~36 percent) catastrophic injuries (Table 6). This is similar to the year before when the percentage of racing fatalities was identical to that of training catastrophic injuries.

Quarter Horses suffered only five (18 percent) catastrophic injuries during training in this period. This is an increase from previous years, when Quarter Horses catastrophic injuries during a training session were infrequent. Quarter Horse submissions during 2014-15 were significantly higher than the previous year (28 in 2014-15 versus 19 in 2013-14), interrupting a steady decline that had started six years ago. Figure 4 shows the historical number of Quarter Horses submitted to the program since its inception.

Continued

In 2014-15, ~76 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, ~68 percent of injuries affected the front or rear legs (Table 8). The injuries listed in these tables represent the primary injury to the horse.

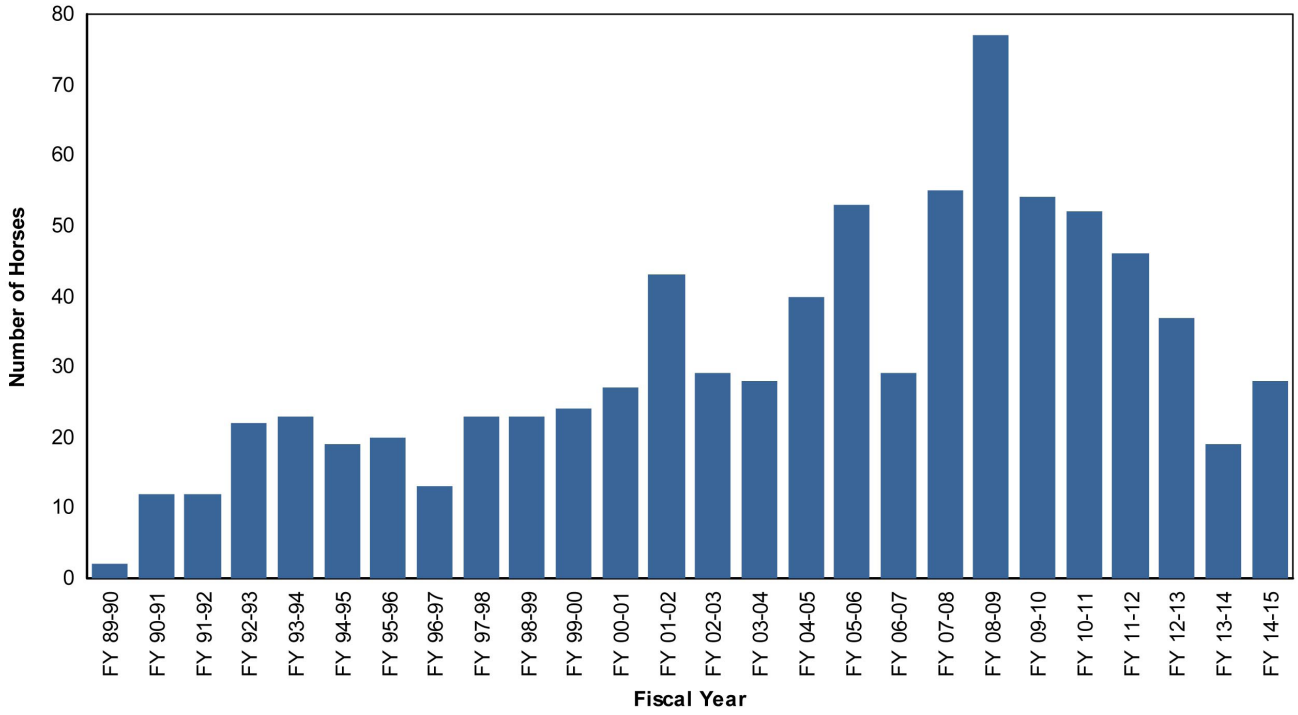
In many cases, several primary findings for each horse submitted were recorded. Thus, the total number of reported injury types exceeds the total number of horses submitted. This is especially true in severe injuries

Continued

Table 6. Category of Injury/Fatality by Breed

Injury Class by Breed	Non-Exercise	Racing	Training	Total
Paint Horse	1	0	0	**1**
Quarter Horse	18	5	5	**28**
Standardbred	2	2	0	**3**
Thoroughbred	28	65	62	**155**
Total	**48**	**72**	**67**	**187**

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



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 8 lists catastrophic injuries by limb and other axial locations. The number of front limb injuries sustained during racing (57) was higher than those injuries sustained during training (43). There were variable numbers of right and left front limb injuries, but similar numbers of right and left rear limb injuries.

Table 9 (on next page) lists the specific type of musculoskeletal injuries by breed.

Table 7. Organ Systems Affected

Breed	CV	GI	HL	MS	Nerv	Resp	Skin	WB	Total
Paint Horse	0	0	0	0	0	0	0	1	**1**
Quarter Horse	0	4	2	15	1	1	0	5	**28**
Standardbred	0	1	0	1	0	0	0	1	**3**
Thoroughbred	1	8	0	127	4	2	3	10	**155**
Total	**1**	**13**	**2**	**143**	**5**	**3**	**3**	**17**	**187**

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

Table 8. Musculoskeletal Structures Affected

Structure Affected	Non-Exercise	Racing	Training	Total
Left Front	1	23	20	**44**
Left Rear	2	1	3	**6**
Right Front	1	34	23	**58**
Right Rear	1	2	10	**13**
Pelvis	0	3	3	**6**
Skull	1	0	0	**1**
Vertebra	2	4	5	**11**
Various Structures*	7	0	2	**9**
Total	**15**	**67**	**66**	**148**

* Includes laminitis and/or tendinitis of one or more legs

Table 9. Musculoskeletal Injury Type by Breed

Finding	Quarter Horse	Standard bred	Thorough-bred	Total
Arthritis	0	0	2	**2**
Carpal Fracture – Left	0	0	3	**3**
Carpal Fracture – Right	2	0	7	**9**
Femur Fracture – Left	0	0	1	**1**
Fedlock Failure – Left Front	0	0	30	**30**
Fedlock Failure – Left Rear	0	0	2	**2**
Fetlock Failure – Right Front	1	0	34	**35**
Fetlock Failure – Right Rear	0	1	4	**5**
Humerus Fracture – Left	0	1	2	**3**
Humerus Fracture – Right	0	0	5	**5**
Laminitis	3	0	0	**3**
Metacarpus III Fracture – Left	0	0	3	**3**
Metacarpus III Fracture – Right	1	0	0	**1**
Metatarsus III Fracture – Left	0	0	2	**2**
Osteopathy/Neoplasia	0	0	2	**2**
Patella Fracture	0	0	3	**3**
P1 Fracture – Right Front	0	0	1	**1**
P1 Fracture – Right Rear	1	0	2	**3**
Pelvis Fracture	1	0	5	**6**
Radius Fracture – Left	0	0	2	**2**
Scapula Fracture – Left	0	0	2	**2**
Scapula Fracture – Right	0	0	3	**3**
Skull Fracture	2	0	0	**2**
Suspensory Apparatus Failure – Left Front	0	0	1	**1**
Suspensory Apparatus Failure – Right Front	0	0	3	**3**
Tendinitis or Tenosynovitis	1	0	2	**3**
Tibia Fracture – Left	1	0	0	**1**
Tibia Fracture – Right	0	0	1	**1**
Vertebra Fracture	4	0	7	**11**
Total	**17**	**2**	**129**	**148**

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. As before, this 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

Structure Affected	N/A*	Dirt	Synthetic	Turf	Total
Left Front	1	28	9	6	**44**
Left Rear	3	2	1	0	**6**
Right Front	1	39	9	10	**59**
Right Rear	1	8	4	0	**13**
Pelvis	0	2	3	1	**6**
Skull	2	0	0	0	**2**
Vertebra	2	8	1	0	**11**
Various Structures**	8	1	1	0	**10**
Total	**18**	**88**	**28**	**17**	**151**

*Inuries that did not occur on a racing/training surface. **Includes laminitis and/or tendinitis of one or more legs.

Human Injuries

During the fiscal year 2014-2015, there were 22 human injuries related to catastrophic horse breakdowns. This represents ~12 percent of the 187 horses submitted to the CAHFS lab during this year and it is the same percentage of human injuries reported in the previous year. The distribution of human injuries by breed of horse is presented in Table 11.

Table 11. Human Injury by Horse Breed

Horse Breed	Number of Submissions
Paint Horse	1
Quarter Horse	3
Thoroughbred	18
Total	**22**

Of the 22 human injuries, 14 occurred during running of the race, seven during training and one was non-exercise-related (Table 12). This is similar to the previous year, when most human injuries occurred during running of the race.

Table 12. Human Injury by Activity

Horse Breed	Number of Submissions
Non-Exercise	1
Racing	14
Training	7
Total	**22**

Human Injuries continued

Eighty-six percent of human injuries occurred in horses 5 years old or younger, while only 14 percent of the injuries occurred in horses older than 5 years, which is likely a reflection of the age of horses submitted for the necropsy program (Table 13).

Table 13. Human Injury by Horse Age

Age	Number of Submissions
2	3
3	9
4	4
5	3
6	1
7	1
10	1
Total	**22**

Other Organ Systems Affected by Injuries

Cardiovascular:

During this period there was one case with a confirmed diagnosis of Cardiac Failure.

Diagnosis	Total
Cardiac failure	1

Hemolymphatic:

During this period there were four cases with a confirmed diagnosis of Equine Infectious Anemia.

Diagnosis	Total
Equine Infectious Anemia	4

Integumentary (Skin):

Only three diagnoses of skin disease was made on horses submitted to CAHFS during 2014-2015. This is consistent with the reduced number of horses with skin disease submitted regularly to CAHFS as part of the CHRB necropsy program.

Diagnosis	Total
Cellulitis	3

Gastrointestinal:

Of the digestive system diagnoses, enteritis, colitis and typhlitis or combinations of these syndromes, and gastrointestinal displacements and/or ruptures were the most frequently observed. Causes of these syndromes during this period were due to infections with *Clostridium difficile*, *Listeria* spp., enteroliths or undetermined.

Diagnosis	Total
Enteritis/colitis/ typhlitis	8
Gastrointestinal displacement/rupture	6
Total	**14**

Other Organ Systems Affected by Injuries continued

Respiratory:

There were fewer cases of respiratory diseases identified in 2014-2015 (six) than had been seen the two previous years (22 and 9, respectively). By far the main cause for pneumonia and pleuritis was bacterial and within this, *Streptococcus equi,* subspecies zooepidemicus was the most prevalent etiology.

Diagnosis	Total
Pneumonia	2
Pleuritis	4
Total	**6**

Nervous System:

A total of nine horses were identified with neurological disorders during 2014-2015.

Diagnosis	Total
Equine Protozoal Myelitis	1
Encephalitis/ encephalopathy of undetermined etiology	5
Myelopathy	3
Total	**9**

Whole Body:

The number of unexplained sudden deaths in horses was significantly lower during this reporting period (5) than the previous year (16).

Diagnosis	Total
Hemorrhages	2
Asphyxiation	1
Anaphylaxis	1
Cachexia	2
Metastatic neoplasia	1
periotonitis	1
Unexplained sudden death	5
Unexplained cause of disease (euthanasia)*	5
Total	**18**

* Refers to horses that were euthanized but the cause of disease was not found on postmortem examination.

RESEARCH SUPPORT

Research 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

Researchers

Mark Anderson (retired in 2013)
Patricia Blanchard
Vanessa Dahl
David Fyhrie
Patricia Fyhrie
Tanya Garcia
Federico Giannitti
Dave Hawkins
Mont Hubbard (retired in 2014)
Panaiotis Loukopoulos
Janet Moore
Akinyi Nyaoke
Sarah Puchalski
Guillermo Rimoldi
Sara Sammons
Tiffany Sarrafian
Jacob Setterbo
Susan Stover
Jennifer Symons
Francisco Uzal
Leslie Woods

OAK TREE
RACING ASSOCIATION

California Animal Health and Food Safety Laboratory System

J.D. Wheat Veterinary Orthopedic Research Laboratory

School of Veterinary Medicine
University of California, Davis
West Health Sciences Drive
Davis, California 95616