

POSTMORTEM EXAMINATION PROGRAM

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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

California Animal Health and Food Safety Laboratory System

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TABLE OF CONTENTS

Introduction	3
Submissions	4-5
Table 1. Submissions by Activity	
Table 2. Submissions by Breed and Month	
Figure 1. Number of Horses Examined by Month	
Submissions by Breed and Age	6
Table 3. Submissions by Breed and Age	
Figure 2. All Breed Submissions by Age	
Figure 3. Quarter Horse Submissions by Age	
Figure 4. Thoroughbred Submissions by Age	
Injuries	
Categories of Injury	7
Table 4. Category of Injury by Age	
Table 5. Category of Injury by Breed	
Category of Injury by Breed	8
Figure 5. Category of Injury: All Breeds	
Figure 6. Category of Injury: Thoroughbreds	
Figure 7. Category of Injury: Quarter Horses	
Organ Systems Affected by Injuries	8-12
Table 6. Organ Systems Affected	
Figure 8. Organ Systems Affected	
Table 7. Musculoskeletal Injuries by Breed	
Figure 9. Musculoskeletal Injuries	
Table 8. Limbs Affected	
Gastrointestinal System	
Respiratory System	
Central Nervous System	
Cardiovascular System	
Whole Body	
Research publications	insert



POSTMORTEM EXAMINATION PROGRAM

Introduction

Since its inception in February 1990, the Postmortem Examination Program has performed nearly 3,200 examinations on horses. 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. A cooperative approach was organized, which included a postmortem examination of every horse that has died or was euthanized on racetracks or at training facilities under the jurisdiction of the CHRB. This visionary partnership between California's horseracing industry, CAHFS and School of Veterinary Medicine (SVM) researchers has become a national model.

Pathologists at CAHFS laboratories in Davis, Tulare and San Bernardino conduct postmortem examinations and compile detailed information on each horse, which is then reported to the CHRB. Specimens from a wide range of sources are collected and shared with veterinary scientists in the SVM at the University of California, Davis (UC Davis). In-depth analyses of these specimens helps to more precisely determine the causes and risk factors that may lead to catastrophic injuries in racehorses. The CHRB funds the

postmortem examinations, and racing associations provide transportation to the nearest laboratory facility. Additional studies are funded by the Center for Equine Health at UC Davis and private sources.

Information from these tests, as well as data gathered from the postmortem examinations, are analyzed in efforts to identify the specific causes of catastrophic injuries. An advisory board, chaired by Richard Mandella, composed of horse owners, trainers, veterinarians, track maintenance personnel and CHRB officials, provides insight into injury investigations and helps disseminate program findings and prevention strategies among the horseracing industry.

Catastrophic musculoskeletal injuries in Thoroughbred racehorses have prompted researchers in the School of Veterinary Medicine's J.D. Wheat Equine Orthopedics Laboratory, led by Dr. Susan Stover, to focus on a variety of fractures and currently failures of the front limb suspensory apparatus. The program's database, representing more than 6,600 diagnostic findings, is instrumental in efforts to develop strategies to prevent racehorse injuries. Other states have begun their own programs using the CAHFS Postmortem Examination Program as their model.



SUBMISSIONS

Under the auspices of the CHRB Postmortem Examination Program during the 2002 calendar year, 256 horses were submitted for necropsies at the nearest of the three—Davis, Tulare and San Bernardino—CAHFS facilities. For each submission, the CHRB official at the track categorized the activity of the horse at the time of injury as one of four types (as shown in Table 1). The majority of catastrophic injuries, 41.4 percent, occurred during a race or immediately following a race. Closely following this, 39.8 percent of the fatal injuries occurred during or immediately following a training session. The third most frequent category of fatalities, accounting

for 18.4 percent of submissions, consisted of horses in the non-exercise group. These were horses suffering primarily from colic or infectious diseases. The last group, accounting for only 0.4 percent of submissions, consisted of horses involved in accidents. These were horses that suffered a fatal injury due to a mishap that was considered a one-of-a-kind event; the figure for 2002 is similar to that of the previous year (0.8 percent in 2001).

The vast majority of submissions (82.8 percent) during 2002 were Thoroughbreds (Table 2). With fewer numbers of the other breeds racing, inadequate data exists to allow comparison of injury rates among breeds for predisposition to any particular type of injury. The number of horses submitted per month was fairly constant throughout the year (as shown in Figure 1 on page 5).

Racehorses 3 to 4 years of age comprised 49.7 percent of the submissions—the largest proportion among all ages of racehorses (Table 3 on page 5). Only 18.4 percent of all racehorses submitted were 2 years old or younger. The number of horses submitted with catastrophic injuries dramatically declines beyond the fifth year of age (Figure 1). It cannot be determined if horses 6 years of age and older are much less susceptible to the athletic injuries of racing, because the numbers of each age group racing and training on facilities controlled by CHRB are not known.

**Table 1.
Activity at Injury**

STATUS AT TIME OF INCIDENT

Accident	1
Non-exercise	47
Racing	106
Training	102
Total	256

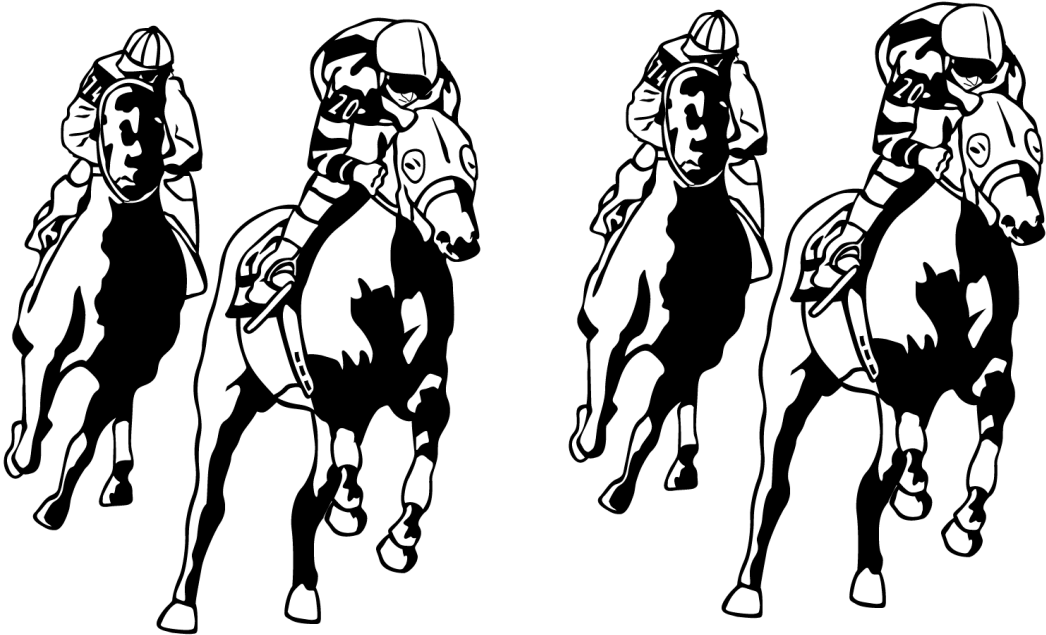
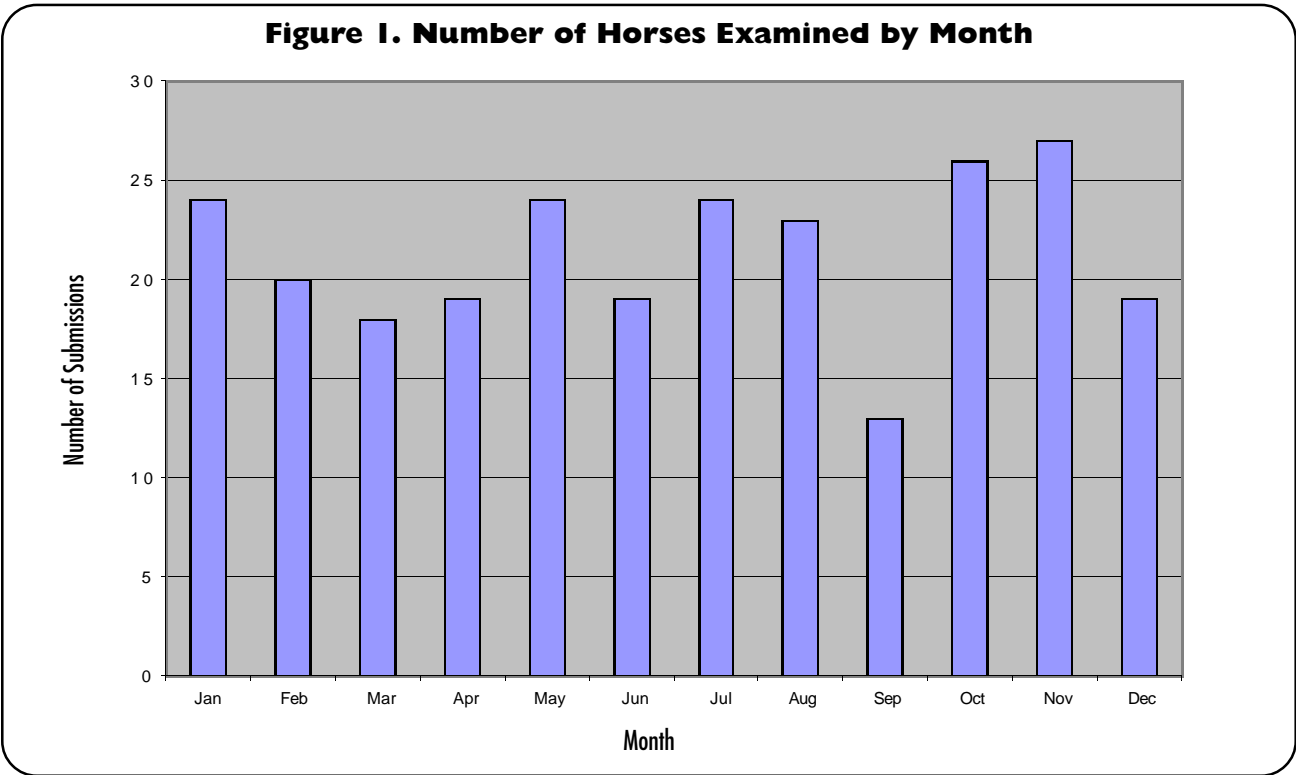
Table 2. Submissions by Breed and Month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Appaloosa	1	0	0	0	0	0	1	0	0	0	0	0	2
Arabian	0	0	0	0	1	1	0	0	0	0	0	1	3
Not Reported	0	1	1	1	0	0	0	0	0	0	0	0	3
Quarter Horse	2	5	5	2	1	1	4	2	1	6	2	2	33
Saddlebred	0	0	0	0	0	0	0	0	0	1	0	0	1
Standardbred	0	0	1	1	0	0	0	0	0	0	0	0	2
Thoroughbred	21	14	11	15	22	17	19	21	12	19	25	16	212
Total	24	20	18	19	24	19	24	23	13	26	27	19	256



SUBMISSIONS BY MONTH

Figure I. Number of Horses Examined by Month



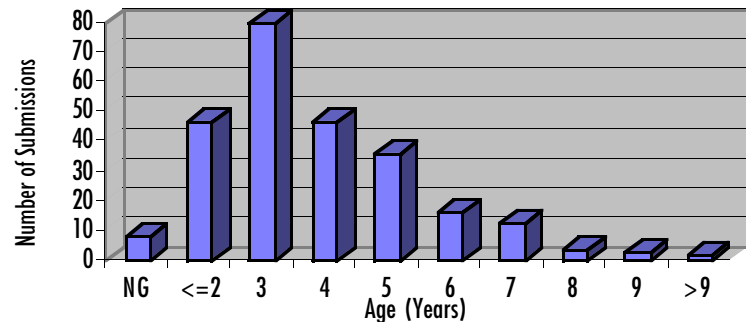
SUBMISSIONS BY BREED AND AGE

Table 3. Submissions by Breed and Age

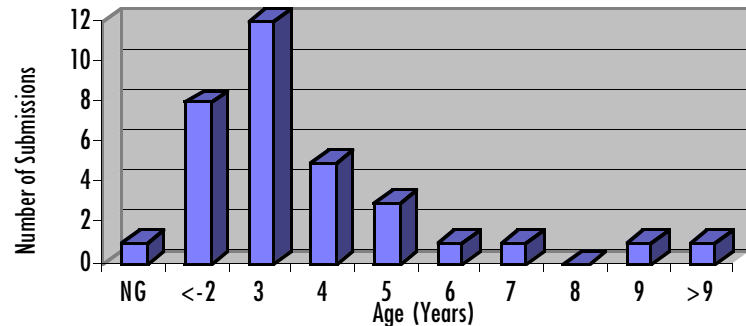
Age (years)	NG*	≤2	3	4	5	6	7	8	9	>9	Total
Appaloosa	0	0	0	2	0	0	0	0	0	0	2
Arabian	0	0	2	0	1	0	0	0	0	0	3
Not Reported	0	0	2	0	1	0	0	0	0	0	3
Quarter Horse	1	8	12	5	3	1	1	0	1	1	33
Saddlebred	0	1	0	0	0	0	0	0	0	0	1
Standardbred	0	0	0	0	0	0	0	1	1	0	2
Thoroughbred	7	38	64	40	31	15	12	3	1	1	212
Total	8	47	80	47	36	16	13	4	3	2	256

*(NG=not given)

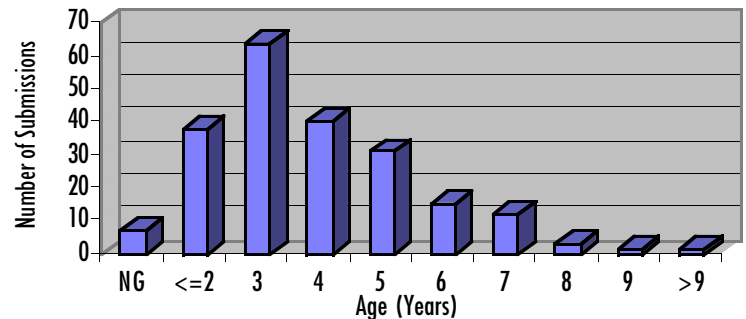
**Figure 2
All Breed
Submissions by Age**



**Figure 3
Quarter Horse
Submissions by Age**



**Figure 4
Thoroughbred
Submissions by Age**



INJURIES

The largest cluster of fatal injuries, 43.0 percent, occurred among 3- and 4-year-old race horses during racing and training (Table 4). The 2-year-old horses sustained a similar number of fatalities in all event categories, except accidents. Horses 4 years old or younger accounted for more than 55 percent of the fatalities due to disease.

As seen in previous years, Thoroughbred horses suffered almost equal numbers of catastrophic injuries while training as in racing (Table 5). Typical of previous years, the Quarter Horses infrequently suffer a catastrophic injury during a training session.

Approximately 81.3 percent of the fatal injuries are due to musculoskeletal problems (Table 6). Of this group, 87.5 percent of injuries involve problems af-

fecting the front or rear legs (Table 7). These injuries are more 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 compares limb-specific catastrophic injuries. In general, slightly more were reported than the previous year, but non-statistically fewer right front injuries were seen in all activity types. Although the numbers were small, more right rear leg injuries occurred than left rear.



Table 4. Category of Injury by Age

Age (Years)	NG*	<=2	3	4	5	6	7	8	9	>9	Total
Accident	1	0	0	0	0	0	0	0	0	0	1
Non-exercise	3	14	12	5	5	4	2	0	0	2	47
Racing	2	11	33	23	13	8	10	3	3	0	106
Training	2	22	35	19	18	4	1	1	0	0	102
Total	8	47	80	47	36	16	13	4	3	2	256

*(NG=not given)

Table 5. Category of Injury by Breed

Breed/Injury Class	Accident	Non-exercise	Racing	Training	Total
Appaloosa	0	0	2	0	2
Arabian	0	2	0	1	3
Not Reported	0	0	3	0	3
Quarter Horse	0	9	19	5	33
Saddlebred	0	1	0	0	1
Standardbred	0	0	1	1	2
Thoroughbred	1	35	81	95	212
Total	1	47	106	102	256



Figure 5
Category of Injury:
All Breeds

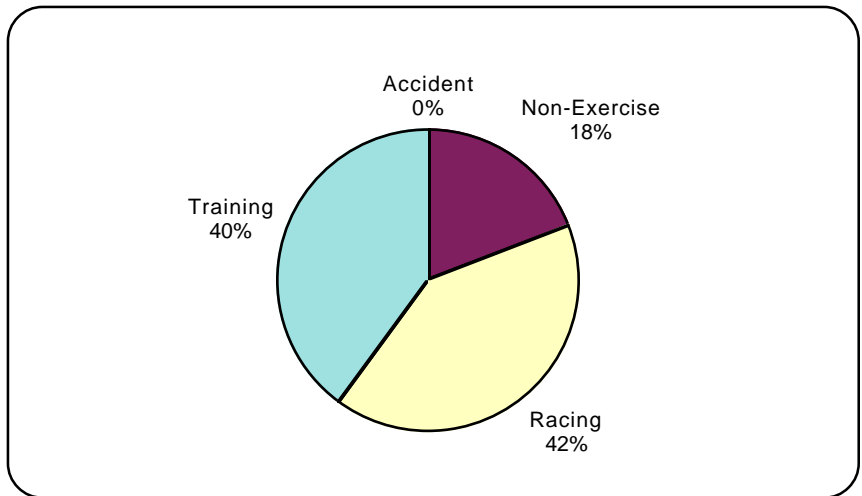


Figure 6
Category of Injury:
Quarter Horses

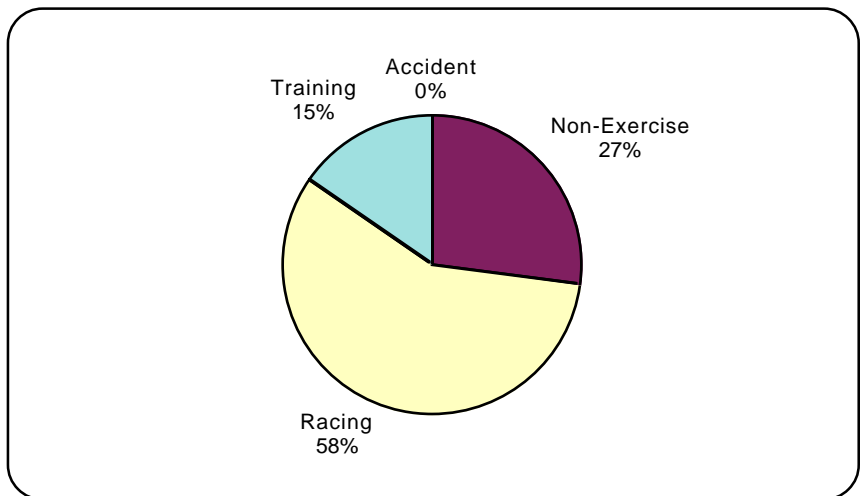
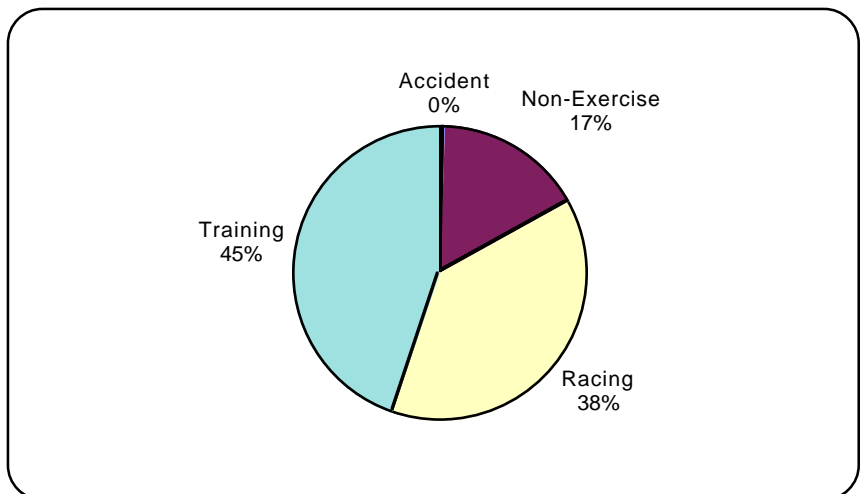


Figure 7
Category of Injury:
Thoroughbreds



ORGAN SYSTEMS AFFECTED IN INJURIES

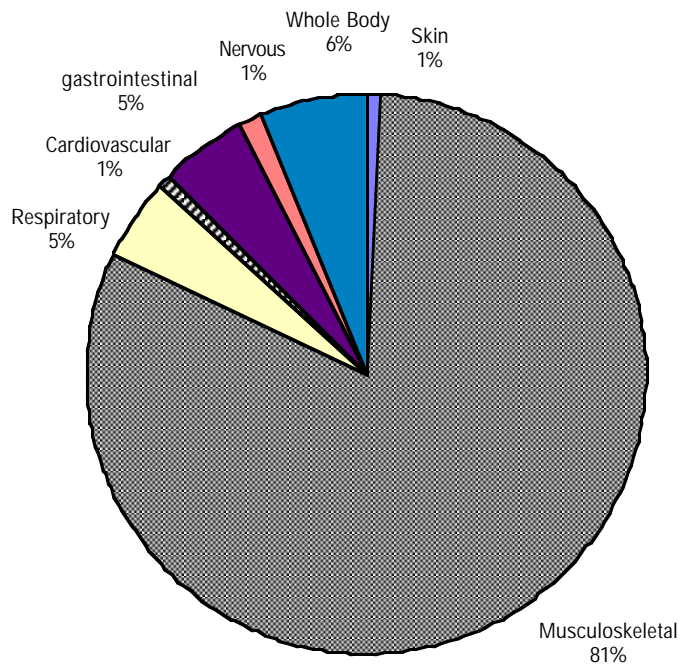
The majority of injuries for all breeds occur to the musculoskeletal system. Most additional investigative studies beyond the Postmortem Examination Program are focused on the musculoskeletal system in an effort to develop prevention strategies.

Table 6. Organ Systems Affected

Organ System Affected	Skin	MS	Resp	CV	GI	Nerv	WB	Total
Appaloosa	0	2	0	0	0	0	0	2
Arabian	0	0	1	0	0	0	2	3
Not Reported	3	0	0	0	0	0	0	3
Quarter Horse	0	23	2	2	5	0	1	33
Saddlebred	0	1	0	0	0	0	0	1
Standardbred	0	2	0	0	0	0	0	2
Thoroughbred	2	177	9	0	8	3	13	212
Total	2	208	12	2	13	3	16	256

(MS=musculoskeletal; Resp=respiratory system; CV=cardiovascular system; GI=gastrointestinal system; Nerv=nervous system; WB=whole body)

**Figure 8
Organ Systems Affected**



MUSCULOSKELETAL INJURIES

Musculoskeletal injuries include those occurring to all muscles, tendons, ligaments and bones. For the sake of continuity, the laminitis or founder cases are listed with the musculoskeletal system rather than the integumentary (skin) system. Several of the horses in Table 7, below, had more than one injury to a part of the musculoskeletal system. In these instances, the injury was categorized according to the damage that most likely occurred first. This premise has been used consistently for every year of the program so the previous year's studies can be compared.

Table 7. Musculoskeletal Injuries by Breed

Injury by Breed	Appaloosa	Arabian	Reported Not	Quarter Horse	Saddlebred	Standardbred	Thoroughbred	Total
Arthritis	0	0	0	2	0	0	1	3
Fracture, Carpal	0	0	1	5	0	0	12	18
Fracture, Femur	0	0	0	0	0	0	1	1
Fracture, Humerus	0	0	0	0	0	0	18	18
Fracture, Metacarpal	0	0	0	1	0	0	28	29
Fracture, Metatarsal	0	0	0	0	0	0	4	4
Fracture, P1	0	0	0	0	0	1	12	13
Fracture, P2	0	0	0	0	0	0	1	1
Fracture, Pelvis	0	0	0	1	0	0	9	10
Fracture, Radius	0	0	0	0	0	0	2	2
Fracture, Scapula	0	0	0	1	0	0	4	5
Fracture, Sesamoid	1	0	0	3	0	0	22	26
Fracture, Sesamoid – Biaxial	0	0	1	5	0	0	38	44
Fracture, Skull	0	0	0	0	0	0	3	3
Fracture, Tibia	0	0	0	0	0	0	4	4
Fracture, Vertebrae	0	0	0	3	1	0	3	7
Joint Luxation	1	0	0	0	0	0	0	1
Laminitis	0	0	0	0	0	0	2	2
Ligament Rupture	0	0	1	0	0	0	10	11
Muscle Laceration	0	0	0	0	0	0	1	1
Myopathy	0	0	0	0	0	0	1	1
Myositis	0	0	0	1	0	0	0	1
Tendon Rupture	0	0	0	0	0	1	0	1
Tenosynovitis	0	0	0	1	0	0	1	2
Total	2	0	3	23	1	2	177	208



Figure 9
Musculoskeletal Injuries

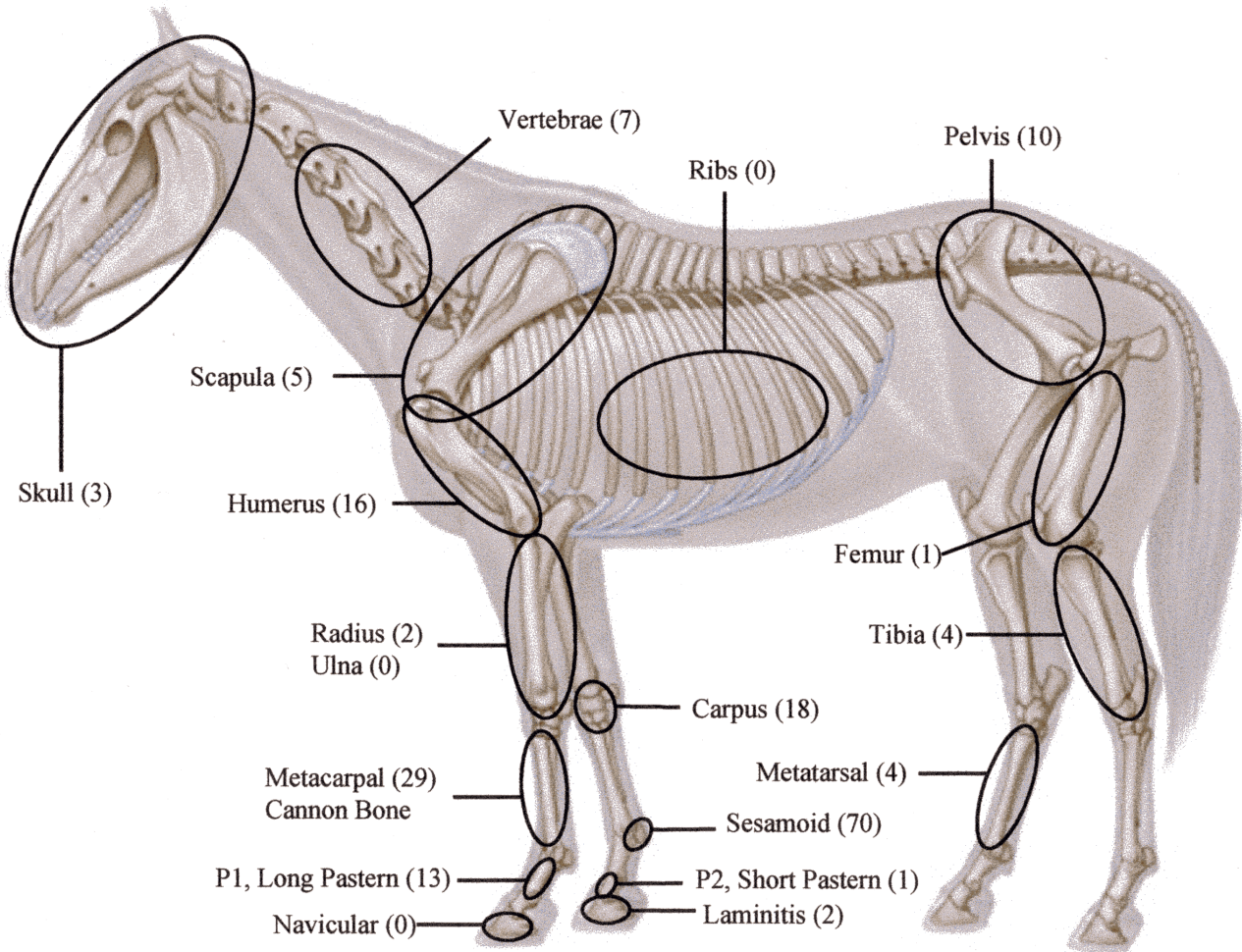


Table 8. Injury by Primary Limb Affected

Limb Affected	Accident	Non-exercise	Racing	Training	Total
Bilateral	0	0	0	2	2
Left Front	1	5	44	35	85
Left Rear	0	0	1	6	7
Right Front	0	3	38	35	76
Right Rear	0	2	3	7	12
Total	1	10	86	85	182



ORGAN SYSTEMS AFFECTED BY INJURIES

Gastrointestinal

Of the digestive system diagnoses, colitis (including typhlocolitis) was by far the most common finding. Five cases of colitis were due to undetermined causes, and only one resulted from *Clostridium difficile*. The remaining three cases were caused by other unidentified bacteria. Other diagnoses included colic due to an undetermined gastric obstruction, and a single case of intestinal torsion.

Colic	1
Colitis	9
Other	3

Respiratory

Several cases of pneumonia, often with a severe pleuritis occurred in 2002. Typical of previous years, *Streptococcus zooepidemicus* was the primary cause, responsible for 50 percent of the cases. A mixture of bacterial species was responsible for the remaining cases. The horses dying from pulmonary hemorrhage were diagnosed as severe “bleeders,” while the remaining cases involved severe laryngeal hemorrhage, and a terminal squamous cell carcinoma.

Pneumonia	8
Pulmonary hemorrhage	2
Other	2

Central Nervous System

The neurological disorders each resulted from different causes. Submissions included one case of peripheral neuropathy of unknown cause, one case of cerebral hemorrhage due to accidental trauma, and one case of neurological disease in which the protozoan *Sarcocystis neurona* was identified.

Cerebral hemorrhage	1
Peripheral Neuropathy	1
Equine Protozoal Myelitis ..	1

Cardiovascular

Cardiovascular diseases were the primary cause of cardiovascular-related death in horses during 2002. One horse was found to have ruptured major thoracic vessels resulting in massive blood loss and death. The other horse had signs of cardiac disease, which may have lead to acute heart failure.

Vessel rupture	1
Myocarditis	1

Whole body

One of the sudden death cases was presumptively related to trauma and one to presumptive heart failure, while the remaining deaths had no identifiable cause. One horse died from a systemic bacterial infection leading to endotoxemia and shock, presumably from severe enteritis. A single horse died from an aggressive tumor that metastasized to the entire abdominal cavity and associated organs.

Sudden/unexplained death ..	13
Septicemia	1
Other	2



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