



United States
Department
of Agriculture

Animal and
Plant Health
Inspection
Service

**Veterinary
Services**

Lameness & Laminitis

in U.S. Horses



National Animal Health Monitoring System

April 2000

Study Collaborators

- USDA:Animal and Plant Health Inspection Service (APHIS):Veterinary Services (VS)
 - Centers for Epidemiology and Animal Health (CEAH)
 - Veterinary Medical Officers (VMO's) and Animal Health Technicians (AHT's) in Equine '98 study states
- USDA:National Agricultural Statistics Service (NASS)
- State Veterinary Medical Officers and Animal Health Technicians in Equine '98 study states
- Equine '98 study participating owners/operators

Analytic and Interpretive Contributors

- A.J. Kane and J.L. Traub-Dargatz. Colorado State University, Fort Collins, CO USA
- L.P. Garber, W.C. Losinger, B.A. Wagner, USDA:APHIS:VS, Centers for Epidemiology and Animal Health, Fort Collins, CO USA

Suggested bibliographic citation for this report:

USDA. 2000. Lameness and Laminitis in U.S. Horses. USDA:APHIS:VS, CEAH, National Animal Health Monitoring System. Fort Collins, CO. #N318.0400.

Questions or comments on Equine '98 study methodology or data analysis: Dr. Lindsey Garber
Information on reprints or other NAHMS reports: Ms. Nina Stanton
(970) 490-8000 NAHMSweb@usda.gov

Table of Contents

Abstract	1
Introduction	2
Methodology	3
Terms used in this report	7
Section I: Population Estimates.	9
A. Any Lameness During the Previous 12 Months (including, Specifically, Laminitis)	9
1. Operation description - with lameness and laminitis	9
2. Percent of resident horses with laminitis during the previous 12 months	12
B. Lameness on Day of Equine '98 Interview	14
1. Operations with lameness and laminitis by season	15
2. Horses with lameness and laminitis by season	18
3. Description of lameness cases	23
C. Most Recent Lameness Problem	28
1. Lameness by breed, age, and primary use	28
2. Primary problem of laminitis	29
3. Lameness outcome.	30
References	32
Appendix: Sample Profile	33
A. Responding operations	33

Regional Information

Operations that had any lameness problem (and, specifically, laminitis)	10
Resident horses that had laminitis in the previous 12 months	12
Operations where any resident horses had any lameness problem (and, specifically, laminitis) by season	15
Resident horses that had any lameness problem (and, specifically, laminitis) by season	18

Abstract

Objectives for the lameness portion of the National Animal Health Monitoring System (NAHMS) Equine '98 study: 1) describe the occurrence of owner reported lameness and laminitis in horses and the proportion of operations with one or more affected horses from April 1997 through June 1998 in the U.S.; 2) describe and compare the prevalence of operations and horses with lameness and specifically laminitis during the spring, summer, and winter (1998 - 1999) in the U.S.; and 3) describe the most common causes and outcomes of lameness, including specifically lameness due to laminitis, and other foot or hoof problems in the U.S.

Design: Population based cross-sectional survey

Sample Population: U.S. horse operations in 28 states, excluding racetracks, with at least three horses present on January 1, 1998. This sample represented 83.9 percent of horses on January 1, 1998, in the 28 states.

Procedure: Questionnaire administered by Veterinary Medical Officers (VMO's) and Animal Health Technicians (AHT's) in person to owners/operators during three visits, one in each of three seasons: spring (April 20 through June 12, 1998), summer (June 15 through September 11, 1998), and winter (November 2, 1998, through February 26, 1999).

Results: One-half of U.S. horse operations reported having at least one horse with lameness in the previous year, and 13 percent reported having a horse with laminitis. On the days of the VMO/AHT visits, 3.4 (winter) to 5.4 (spring) percent of horses were affected by lameness and less than 1 percent were affected by laminitis. Boarding and training facilities were more likely to have lameness with racehorses most commonly affected. Generally, more operations and horses were affected by lameness and laminitis in spring and summer compared with winter.

Leg or joint problems were the most commonly perceived cause of lameness in the spring and winter with hoof problems the most common cause in summer. Laminitis, navicular disease, and sole bruises or abscesses were the most common causes of hoof or foot lameness with laminitis accounting for 7.5 to 15.7 percent of all lameness problems. Most affected horses recovered completely and were useable for their intended purposes without treatment following lameness or laminitis (73.8 and 73.7 percent, respectively). Overall, only 2.5 percent of horses with lameness died or were euthanized due to the problem, and 4.7 percent of horses with laminitis died or were euthanized. Together, grazing lush pasture and grain overload were the perceived causes for over 50 percent of the laminitis cases reported.

Implications: Lameness is a common problem on all types of horse operations and affects all types of horses. Preventive measures for lameness should be focused on hoof, foot, leg, and joint problems and could have the largest effect on boarding and training operations. Proper grazing and feed management could prevent approximately one-half of laminitis cases.

Introduction

Sponsored by the USDA:APHIS:Veterinary Services (VS), the National Animal Health Monitoring System's (NAHMS) Equine '98 study was designed to provide both participants and those affiliated with the equine industry with health and management information on the nation's equine population.

Few health problems have the potential to affect the horse regardless of age, breed, gender, housing, management, or intended use the way lameness can. All types of horses are susceptible to lameness, and sooner or later, most horses are affected by it. Studies of problems that prevent horses from reaching their full potential in racing consistently identify lameness as the most common cause of training failure and lost performance (Jeffcott 1982, Lindner 1993). Among all types of horses monitored over a 2-year period in the Michigan Equine Monitoring System (MEMS), lameness was the most common health problem reported and had the second longest duration and highest number of performance days lost of all disease problems reported (Kaneene 1997).

Clinically, lameness is recognized as an abnormality in the way a horse moves or stands. It is usually associated with a painful musculoskeletal condition or a mechanical abnormality affecting locomotion.

Laminitis (sometimes called founder) is a specific condition of the foot that can produce lameness. Laminitis is characterized by inflammation and destruction of the cellular bond between the sensitive and insensitive laminae of the hoof. These structures normally attach the hoof wall to the coffin bone. In horses with laminitis, the attachment of the hoof wall to the coffin bone is compromised and rotation or sinking of the coffin bone within the hoof capsule can occur. Affected horses are usually reluctant to move and resist attempts to lift their feet. The condition is usually worse in the front feet resulting in a peculiar stance. Horses lean back to transfer weight off the front feet and onto the hind feet. The feet are typically warm and have bounding digital pulses. Severe or chronic cases may have a hopeless prognosis for recovery making euthanasia the most humane alternative.

Preparation for Equine '98 began with a project to identify all of the existing sources of information for monitoring equine health. A Catalog of Opportunities for Equine Health Monitoring was compiled and distributed in June 1995 (USDA 1995). Second, an information needs assessment was undertaken to identify industry informational needs. Focus groups composed of industry representatives, researchers, and State and Federal animal health officials contributed input. In addition, web site and 1-800 telephone call-in surveys were conducted from January 1 through March 15, 1997. This collective feedback formed the basis for the Equine '98 study objectives shown on the inside back cover of this report.

One primary objective of NAHMS Equine '98 was to provide national estimates of the occurrence of specific health problems. During the MEMS study, the Advisory Committee identified lameness as a problem of great importance to the equine industry and determined there was a need for detailed research in this area (Kaneene 1997). The 1997 NAHMS Equine '98 Needs Assessment Survey identified leg problems such as lameness as a high priority concern among horse owners (76.0 percent of respondents), veterinarians, trainers and other respondents (USDA 1997). Lameness was selected as an area of emphasis for these reasons. Laminitis was selected for focused study because little is known about the prevalence of the disease and it can be devastating for both horses and their owners

when it strikes (Hood 1999). Despite recognition of the importance of lameness and laminitis in horses, national estimates of their occurrence have not been previously reported.

Specific objectives for the lameness portion of the National Animal Health Monitoring System Equine '98 study: 1) describe the occurrence of owner reported lameness and laminitis in horses from April 1997 through June 1998 in the U.S.; 2) describe and compare the prevalence of operations and horses with lameness and specifically laminitis during the spring, summer, and winter (1998 - 1999) in the U.S.; and 3) describe the most common causes and outcomes of lameness including specifically lameness due to laminitis and other foot or hoof problems in the U.S.

Methodology

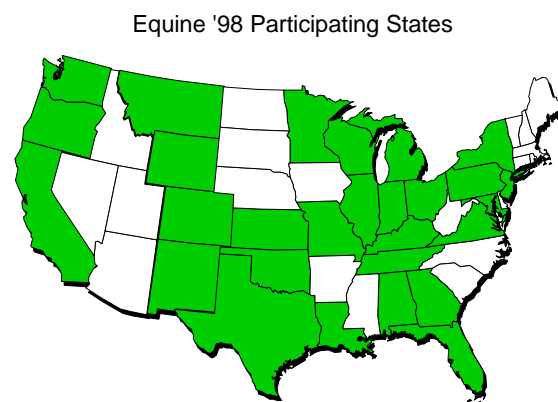
Sample Selection

A goal for all NAHMS national studies is to include states that account for at least 70 percent of the animal and producer/owner populations in the U.S. The most recent data available on which to base the selection of states to be included in Equine '98 Study was the 1992 Census of Agriculture data for horses and ponies.

States which met a minimum contribution to the U.S. total for number of horses and ponies and number of farms reporting horses or ponies were included in the study. Iowa and Idaho were excluded from the study due to expected resource conflicts with a then proposed NAHMS cattle on feed study. An additional seven states were included: Georgia, Maryland and New Jersey due to a high level of state equine industry interest; Alabama, Louisiana, New Mexico, and Wyoming to improve geographical representation. The 28 states eventually included in the Equine '98 study accounted for 78.2 percent of the U.S. 1992 Census horses and ponies and 78.0 percent of the farms with horses and ponies (see map).

A combination of Area and List frame data from the USDA's National Agricultural Statistics Service (NASS), which provided estimates for the January 1, 1998, inventory for all states in the U.S., formed the basis for selecting the sample for the Equine '98 study from the 28 target states. The Equine '98 sample selection is a sub-sample of the NASS Fall 1997 Area Survey and January 1998 Equine Survey respondents that reported one or more equids on hand on January 1, 1998. The sub-sampling was done within size groups based on total number of equids for list and area separately. Distribution of the sample to individual states was based primarily on the U.S. 1992 Census size indicator (previously discussed).

NASS, in collaboration with VS, identified 2,904 equine operations from 28 states (see map) willing to participate in the initial phase of the Equine '98 study. This sample was selected so valid inferences in two initial reports, *Parts I and II: Baseline Reference of*



#3760*

*Identification numbers are assigned to each graph in this report for public reference.

1998 Equine Health and Management, could be made to all operations with equids (domestic horses, miniature horses, ponies, donkeys/burros, mules) and to all equids in the 28 states. During this first phase of the study, NASS enumerators administered a questionnaire on participating operations from March 16, 1998, through April 10, 1998.

Operations with three or more horses present on January 1, 1998, in the same 28 states were eligible to participate in the second phase of the study (which included the lameness portion). Racetracks were excluded from the second phase of the study. Horses in this context included adults and foals of all full-size horse breeds that usually stand over 14 hands when full grown and did not include miniature horses, ponies, donkeys/burros, or mules. This sample was estimated (based on NAHMS' projection) to represent: 51.6 percent of operations with horses on January 1, 1998, and 83.9 percent of horses on January 1, 1998, in the 28 states.

Data Collection

After a training period to familiarize themselves with the questionnaire and interview techniques, federal and state Veterinary Medical Officers (VMO's) and Animal Health Technicians (AHT's) collected additional data on site for the second phase using questionnaires administered to the owner or operator. Three 'snapshots' of information were collected regarding lameness that existed on each day of three separate Equine '98 visits to each operation. For this report, the three periods are classified as the seasons of spring, summer, and winter.

- Spring: April 20 - June 12, 1998
- Summer: June 15 - September 11, 1998
- Winter: November 2, 1998, - February 26, 1999.

There were 1,178 operations with 28,026 horses participating in the spring interviews, 1,136 operations with 26,845 horses in the summer, and 1,072 operations with 24,159 horses in the winter.

To assess the occurrence of lameness problems and laminitis, data collectors provided operators with standardized definitions. A lameness problem was defined as an abnormality of gait such that the horse could not be used for its intended purpose OR could only be used if intervention (such as medications, corrective shoeing or rest) was employed. Horses receiving intervention only for the prevention of lameness were not considered as having a lameness problem. Laminitis was defined as an inflammation of the junction between the sensitive and insensitive laminae or layers of the hoof wall, with a severe case also called founder. Information in this report is operator reported and not directly based on assessments made by a VMO or other veterinarian.

After data collection, data quality was assessed by interviewers and study coordinators in each state (Table 1). Additional assessment of data quality, data entry, and editing for this report were done by the NAHMS national staff in Ft. Collins, Colorado. Overall data quality assessment was satisfactory with 98.9 percent of owner data quality scores in the acceptable range (scores 1 - 3) and 99.8 percent of field data quality scores considered acceptable (scores 1 -3).

Table 1. Owner data quality scores (assessed by interviewer) and field data quality scores (assessed by NAHMS study coordinator in each state) for the second phase of data collection including this lameness report.				
Score	Percent Responses			Definition
	Spring	Summer	Winter	
Owner Data Quality Scores (Assessed by VMO or AHT Interviewer)				
1	51.1	52.8	54.8	Owner has a thorough knowledge of the operation and complete information. There is no question about the validity of the overall data this Owner provided.
2	31.1	33.3	33.1	Owner has a good knowledge of the operation and has accurate records when needed. There is little question about the overall data quality this Owner provided.
3	16.7	13.5	11.3	Owner has a fair knowledge of the operation. Data are based on the Owner's best and earnest recollection and knowledge. Records were not consulted.
4	1.1	0.4	0.8	Owner has little understanding of the operation and the industry in general. Information is inconsistent and often fabricated or based on wild guesses.
Total	100.0	100.0	100.0	
Field Data Quality Scores (Assessed by NAHMS Study Coordinator in Each State)				
1	65.5	72.7	77.1	Questionnaire is complete, legible, free of errors, and the totals reconcile. Explanations for missing or questionable responses are written on the form. Data can be edited without difficulty.
2	29.8	24.3	19.9	Questionnaire is complete, legible, contains few errors, and the totals reconcile. Explanations for missing or questionable responses are written but may not be complete. Data can be edited with little difficulty.
3	4.5	2.9	2.7	Questionnaire contains non-legible responses, incomplete sections, or many obvious errors. A few of the totals do not reconcile, and explanations for missing or questionable responses are missing or not legible. Data are difficult to edit.
4	0.2	0.1	0.3	Questionnaire is not complete, not legible, contains obvious errors, and totals do not reconcile. Explanations for missing or questionable responses are missing or not legible. Data are difficult to edit and may be discarded.
Total	100.0	100.0	100.0	

Percentages of operations and horses with lameness problems and, specifically, laminitis were calculated as probability based weighted estimates of the proportions of affected operations or horses in the population. These population estimates were adjusted for non-participation using stratum specific weights that represented the inverse of the sampling fraction for each operation. Analytic methods that account for this complex survey design stratification in the variance estimates were used for the calculation of standard errors¹. Percentage estimates for different levels of each factor were compared by examining the 90 percent confidence interval [point estimate +/- (1.65 x SE)]. Overlapping intervals suggest no significant (p<0.10) difference between the levels of each factor being compared.

Logistic regression techniques accounting for repeated measures were used to identify significant seasonal effects on the percentages of operations and horses, respectively, affected with lameness and, specifically, laminitis¹. Across each row of a table, estimates with superscripts in common are not significantly (p<0.10) different from each other.

The 90 percent confidence interval was chosen for this report as the data and number of observations support that level of confidence to evaluate differences among groups.

1 Sudaan, Version 6.4, 1996. Research Triangle Park, NC.

Other reports generated from the second phase included *Part III: Management and Health of Horses in the U.S., 1998* and *Part IV: Reference of Health Management for Horses and Highlighted Diseases, 1998*. (A list of expected outputs resulting from Equine '98 is included on the back cover of this report.)

Results of the Equine '98 and other NAHMS studies are accessible on the World Wide Web at <http://www.aphis.usda.gov/vs/ceah/cahm> (see Equine).

For questions about this report or additional Equine '98 and NAHMS results, please contact:

Centers for Epidemiology and Animal Health
USDA:APHIS:VS, attn. NAHMS
555 South Howes
Fort Collins, CO 80521
(970) 490-8000
NAHMSweb@usda.gov
www.aphis.usda.gov/vs/ceah/cahm

Terms Used in This Report

Equid: Animal of the family *Equidae*. For this study, included only domestic horses, miniature horses, ponies, mules, and donkeys/burros.

Horse: For this study, a domestic horse that was at least 14 hands tall when full grown. (Also see *resident horse* below.)

Lameness problem: Case definition for this study included horses with an abnormality of gait such that the horse could not be used for its intended purpose OR could only be used if intervention (such as medications, corrective shoeing, or rest) was employed. Laminitis cases were considered a subset of lameness problems.

Laminitis: For this study, a condition characterized by inflammation and damage to the junction between the sensitive and insensitive laminae or layers of the hoof wall, with a severe case also called 'founder'. Laminitis cases were considered a subset of lameness problems.

N/A: Not applicable.

Operation: An area of land managed as a unit by an individual, partnership, or hired manager.

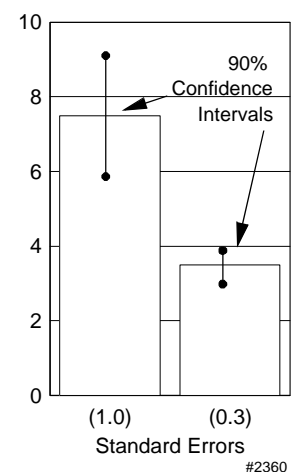
Percent horses: The total number of *horses* with a certain attribute divided by the total number of horses on all operations (or all operations within a certain category such as size or region).

Percent horses on those operations: The total number of horses residing on those *operations* with a given attribute, divided by the total number of horses on all operations (or all operations within a certain category such as size or region).

Population estimates: Averages and proportions weighted to represent the population. For this report, the reference population was all operations with three or more horses present on January 1, 1998, in the 28 selected states, excluding racetracks. Most of the estimates in this report are provided with a measure of precision called the *standard error*. If the only error is sampling error, chances are 95 out of 100 that the interval created by the estimate plus or minus two standard errors will contain the true population value. Similarly, the 90 percent confidence interval would be created by multiplying the standard error by 1.65 instead of two. In the example illustrated, an estimate of 7.5 with a standard error of 1.0 results in a 90% confidence interval of 5.9 to 9.2 (1.65 times the standard error above and below the estimate). The second estimate of 3.4 shows a standard error of 0.3 and results in a 90 percent confidence interval of 2.9 to 3.9. **Where significant differences between groups are noted in this report, the 90 percent confidence intervals do not overlap.** In this example the ranges of 5.9 to 9.2 and 2.9 to 3.9 do not overlap, and the two groups would be described as significantly different. Most estimates in this report are rounded to the nearest tenth. If rounded to 0, the standard error was reported as 0.0. If there were no reports of the event, no standard error was reported as (--).

Previous 12 months: The period of time 12 months prior to the Equine '98 interview conducted from April 20 through June 12, 1998.

Examples of a 90% Confidence Interval



Regions:

- **Western:** California, Colorado, Montana, New Mexico, Oregon, Washington, and Wyoming.
- **Northeast:** New Jersey, New York, Ohio, and Pennsylvania.
- **Southern:** Alabama, Florida, Georgia, Kentucky, Louisiana, Maryland, Oklahoma, Tennessee, Texas, and Virginia.
- **Central:** Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, and Wisconsin.

Resident horse: A horse that spent or was expected to spend more time at the operation than at any other operation. The operation was its home base.

Sample profile: Information that describes characteristics of the operations from which Equine '98 data were collected.

Size of operation: Size groupings based on number of resident horses at the *time of the spring VMO interview* (April 20 - June 12, 1998). Size of operation was categorized as 1-5, 6-19, and 20 or more horses at the time of the interview. Although operations were required to have three or more horses or horse foals on January 1, 1998, to qualify for this (second) phase of the study, the horse population on the operation could have decreased to one horse or horse foal at the time of the interview.

Time of interview:

- **Spring:** April 20 through June 12, 1998
- **Summer:** June 15 through September 11, 1998
- **Winter:** November 2, 1998, through February 26, 1999

Section I: Population Estimates

During the Equine '98 spring visit by VMO's and AHT's (April 20 through June 12, 1998) owners or operators of each premise were asked if one or more resident horses had any lameness problem and, specifically, any caused by laminitis on their operation during the previous 12 months. Whether they were new or existing lameness problems, the numbers of lame horses and horses with laminitis specifically were recorded for each operation. A lame horse included any horse with a gait abnormality such that the horse could not be used for its intended purpose or could only be used if interventions (such as medications, corrective shoeing, or rest) were employed. Laminitis is a specific lameness condition of the foot. It is characterized by inflammation and damage to the junction between the sensitive and insensitive laminae which attach the hoof wall to the coffin bone within the hoof. Rotation of the coffin bone within the hoof capsule can occur and a severe or chronic case is often called 'founder.' There were 1,178 operations with 28,026 horses participating in the spring interviews.

A. Any Lameness During the Previous 12 Months (Including, Specifically, Laminitis)

1. Operation description - with lameness and laminitis

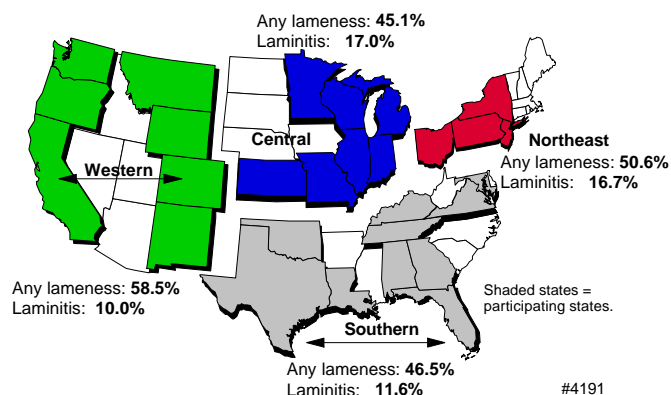
One-half of U.S. horse operations had one or more horses with a lameness problem in the previous 12 months. No significant differences were detected between regions. In the initial phase of Equine '98, sampling included operations with less than three equids of any type (including ponies, miniature horses, donkeys, and mules). Analysis of that sample indicated only 16 percent of operations had one or more equids affected by leg or hoof problems that prevented the intended use of the animal without treatment during 1997 (see *Part I: Baseline Reference of 1998 Equine Health and Management*, USDA, 1998, page 40). When those data were re-examined excluding operations with less than three horses, 49 percent of operations had one or more affected animals. Results reported here are similar to those reported in Part I when that earlier sample is similarly restricted to operations with three or more horses.

Operations that had one or more horses with laminitis were less common with only 13.0 percent of all operations reporting a problem in the previous 12 months and little difference between regions. The Central and Northeastern regions had the highest percentages (17.0 and 16.7 percent, respectively), and the Southern and Western regions had the lowest percentages (11.6 and 10.0 percent, respectively) of operations with laminitis.

a. Percent of operations where, in the previous 12 months, one or more resident horses (even if they were no longer part of the operation) had any lameness problem (and, specifically, laminitis) by region:

Region	Percent Operations	Standard Error
Any Lameness Problem		
Southern	46.5	(5.2)
Northeast	50.6	(9.3)
Western	58.5	(6.6)
Central	45.1	(6.6)
All operations	50.0	(3.2)
Laminitis		
Southern	11.6	(3.6)
Northeast	16.7	(7.0)
Western	10.0	(2.6)
Central	17.0	(4.5)
All operations	13.0	(2.0)

Percent Operations Where One or More Resident Horse Had Any Lameness Problem (and, Specifically, Laminitis) by Region

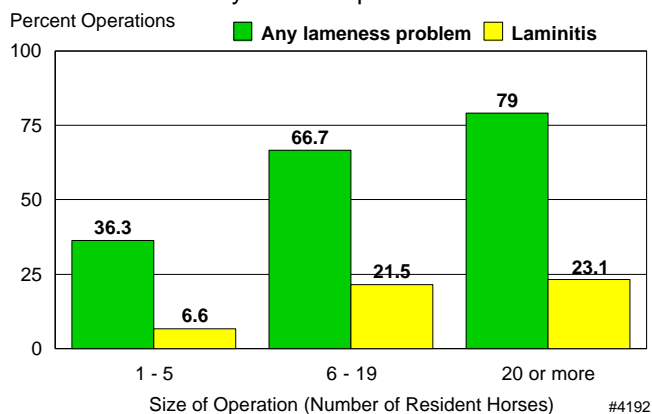


The percentages of operations reporting lameness problems or laminitis in the previous 12 months were higher for operations with more than five horses compared with smaller operations. These results probably reflect a greater combined probability of having at least one lame horse when more horses are present on an operation rather than an increased risk of lameness for individual horses simply because they live on a larger operation.

b. Percent of operations where, in the previous 12 months, one or more resident horses (even if they were no longer part of the operation) had any lameness problem (and, specifically, laminitis) by size of operation:

Size of Operation (Number Resident Horses)	Percent Operations	Standard Error
Any Lameness Problem		
1 - 5	36.3	(4.2)
6 - 19	66.7	(4.1)
20 or more	79.0	(6.8)
Laminitis		
1 - 5	6.6	(2.0)
6 - 19	21.5	(4.5)
20 or more	23.1	(5.5)

Percent Operations Where One or More Resident Horse Had Any Lameness Problem (and, Specifically, Laminitis) by Size of Operation



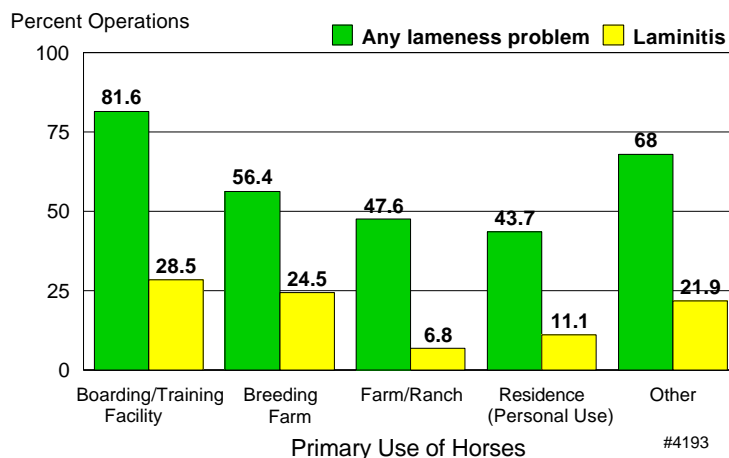
Operations with a primary function of boarding and training were more likely (81.6 percent) to have had at least one lame horse in the previous 12 months compared with those that were primarily farms/ranches (47.6 percent) and residences with horses for personal use (43.7 percent). This difference could be due in part to more rigorous exercise schedules on boarding or training operations compared with farms and ranches and personal residences. Exercise intensity is recognized as a risk factor for lameness and injury in performance horses (Ross 1996, Ross 1999, Estberg 1998). A greater awareness of lameness or a tendency for boarding or training operations to be larger could also explain these findings.

There was a similar pattern for operations with at least one horse with laminitis. Boarding/training and breeding operations were more likely (28.5 and 24.5 percent, respectively) to have had a horse with laminitis in the previous 12 months compared with farm/ranch operations (6.8 percent).

c. Percent of operations where, in the previous 12 months, one or more resident horses (even if they were no longer part of the operation) had any lameness problem (and, specifically, laminitis) by primary function of operation:

Primary Function of Operation	Percent Operations	Standard Error
Any Lameness Problem		
Boarding/training facility	81.6	(6.6)
Breeding farm	56.4	(8.7)
Farm/ranch	47.6	(5.6)
Residence (personal use)	43.7	(4.6)
Other	68.0	(13.6)
Laminitis		
Boarding/training facility	28.5	(10.2)
Breeding farm	24.5	(7.7)
Farm/ranch	6.8	(2.0)
Residence (personal use)	11.1	(3.1)
Other	21.9	(9.7)

Percent Operations Where One or More Resident Horses Had Any Lameness Problem (and, Specifically, Laminitis) by Primary Function of Operation



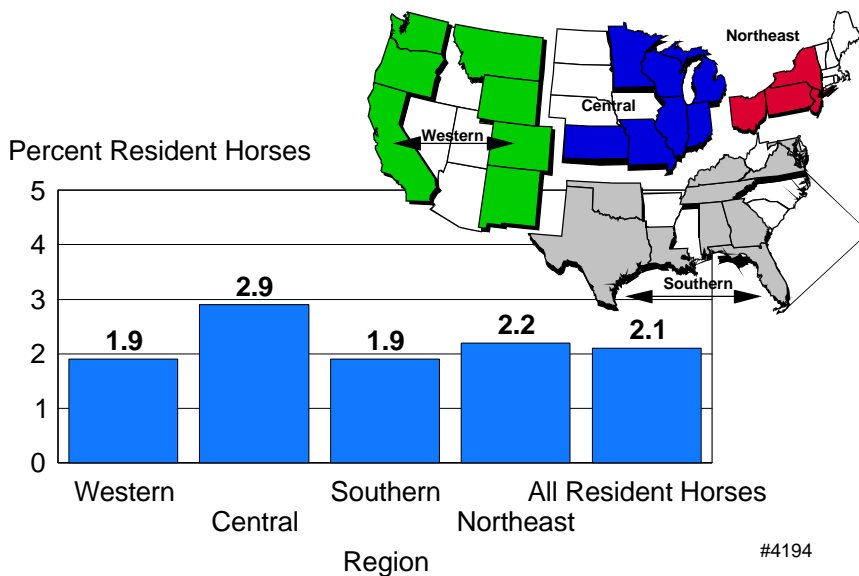
2. Percent of resident horses with laminitis during the previous 12 months

Although it can be a tragic disease, laminitis appears to be rare. Overall, only 2.1 percent of horses were reported to have had laminitis in the previous 12 months, and there were no significant differences in the percentages of horses with laminitis between regions of the country. The incidence of *new* cases could be even lower because new and existing cases of laminitis were recorded in this study.

a. Percent of resident horses that had laminitis in the previous 12 months by region:

Region	Percent Resident Horses	Standard Error
Southern	1.9	(0.6)
Northeast	2.2	(0.9)
Western	1.9	(0.5)
Central	2.9	(0.7)
All resident horses	2.1	(0.3)

Percent Resident Horses With Laminitis* by Region



* During the 12 months previous to Equine '98 interview conducted from April 20 through June 12, 1998.

There was no difference between the percentages of resident horses reported to have had laminitis on small and large operations. Although a larger operation may be more likely to report at least one case of laminitis over the course of a year (Table A.1.b), these results do not indicate that individual horses on large operations are at increased risk of having laminitis.

b. Percent of resident horses that had laminitis in the previous 12 months by size of operation:

Size of Operation (Number Resident Horses)	Percent Resident Horses	Standard Error
1 - 5	2.0	(0.6)
6 - 19	2.8	(0.6)
20 or more	1.5	(0.5)

Operations that primarily used resident horses for pleasure riding had the largest percentage (2.8 percent) of horses with laminitis during the previous 12 months. Differences between categories of use, however, were not significant when standard errors of the estimates were taken into consideration.

c. Percent of resident horses that had laminitis in the previous 12 months by primary use of resident horses:

Primary Use of Resident Horses	Percent Resident Horses	Standard Error
Pleasure	2.8	(0.5)
Showing/competition (not betting)	1.4	(0.5)
Breeding	1.8	(0.6)
Racing	1.1	(1.0)
Farm/ranch	1.8	(0.9)
Other	0.4	(0.3)

B. Lameness on Day of Equine '98 Interview

A 'snapshot' of information was collected regarding lameness problems and, specifically laminitis, that existed on each day of three Equine '98 interviews (within three data collection periods). The first interview was conducted in the period from April 20 through June 12, 1998. Participants scheduled the second interview in the period from June 15 through September 11, 1998, and the last interview from November 2, 1998, through February 26, 1999. For this report, the three periods are classified by season (spring, summer, and winter).

During the interviews, VMO's or AHT's recorded the number of horses with lameness problems and, specifically, laminitis on that day, including new problems *and* those that may have been reported during previous interviews if those horses were still affected. Horses requiring treatment (such as medication, corrective shoeing, or rest) for temporary relief of lameness on the days of the interviews were classified as having a lameness problem. However, those horses receiving treatment for the *prevention* of lameness only were not counted as having a lameness problem. For example, horses only receiving corrective shoeing for a conformation problem were not classified as having a lameness problem.

In addition to describing the operations and horses with a lameness problem and, specifically laminitis, across the U.S., an objective of this part of the study was to compare the percentages of operations and horses with lameness and, specifically, laminitis between seasons. Across each table row, percentages with superscripts in common are not significantly ($p < 0.10$) different from each other.

There were 1,178 operations with 28,026 horses participating in the spring interviews, 1,136 operations with 26,845 horses in the summer, and 1,072 operations with 24,159 horses in the winter. Data from these operations and horses were weighted to represent the reference population, operations with three or more horses in the 28 participating states.

1. Operations with lameness and laminitis by season

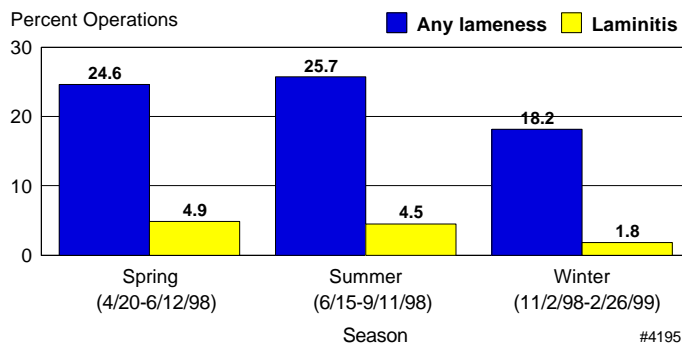
Overall, more operations had at least one horse with lameness and, specifically, laminitis on the days of the spring and summer interviews compared with the winter. Over 30 percent of operations in the Western region had a lameness problem during each time period, while less than 20 percent of operations in the Southern region reported lameness problems each season. The Southern and Northeast regions reported the lowest percentage of operations with lameness in the winter (8.3 and 13.7 percent, respectively).

Laminitis was most commonly reported by operations in the Central region during the spring (7.5 percent) with the Northeast reporting laminitis least often during the winter (0.1 percent). The largest seasonal difference in the percentage of operations with laminitis was between spring (7.5 percent) and summer (2.6 percent) in the Central region, and summer (6.0 percent) and winter (1.1 percent) in the Southern region.

a. Percent of operations where one or more resident horses had any lameness problem (and, specifically, laminitis) on the day of the interview by season and by region:

Region	Percent Operations by Season ¹					
	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Any Lameness Problem						
Southern	15.2 ^a	(2.5)	18.8 ^a	(3.4)	8.3 ^b	(2.4)
Northeast	27.1 ^a	(7.5)	28.4 ^a	(7.9)	13.7 ^b	(6.4)
Western	35.1 ^a	(5.5)	36.2 ^a	(5.8)	33.7 ^a	(5.5)
Central	26.3 ^a	(5.4)	22.2 ^a	(5.3)	19.3 ^a	(4.7)
All operations	24.6 ^a	(2.3)	25.7 ^a	(2.6)	18.2 ^b	(2.2)
Laminitis						
Southern	2.6 ^{a,b}	(1.0)	6.0 ^a	(2.7)	1.1 ^b	(0.8)
Northeast	4.4 ^a	(2.8)	2.7 ^a	(2.2)	0.1 ^b	(0.0)
Western	6.2 ^a	(2.2)	4.8 ^{a,b}	(2.1)	2.7 ^b	(1.2)
Central	7.5 ^a	(3.7)	2.6 ^a	(1.8)	3.3 ^a	(2.0)
All operations	4.9 ^a	(1.1)	4.5 ^a	(1.3)	1.8 ^b	(0.6)

Percent Operations Where One or More Resident Horses Had Any Lameness Problem (and, Specifically, Laminitis) on the Day of the Equine '98 Interview by Season



¹ ^{a,b} Percentages with superscripts in common across each row are not significantly (p>0.10) different from each other by season.

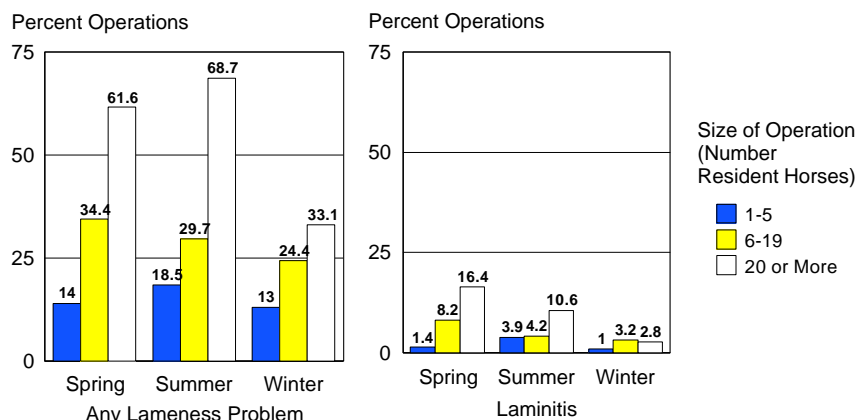
Larger operations were generally more likely than smaller operations to have had at least one lame horse on the day of the interviews. This finding was most apparent during the spring visit when 14.0 percent of operations with 1 to 5 resident horses had a lame horse, 34.4 percent of operations with 6 to 19 resident horses had a lame horse, and 61.6 percent of operations with 20 or more resident horses had at least one lame horse. There was a similar pattern for operations with at least one horse affected by laminitis on the day of the interview.

The largest seasonal difference was on operations with 20 or more horses between the spring or summer visits and the winter visit. Similar to the results shown in Table A.1.b, the apparent increased risk for larger operations having a lame horse is most likely due to the larger combined probability from having more individual horses at risk.

b. Percent of operations where one or more resident horses had any lameness problem (and, specifically, laminitis) on the day of the interview by season and by size of operation:

Size of Operation (Number of Resident Horses)	Percent Operations by Season ¹					
	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Any Lameness Problem						
1 - 5	14.0 ^{a,b}	(2.5)	18.5 ^a	(3.3)	13.0 ^b	(2.6)
6 - 19	34.4 ^a	(4.5)	29.7 ^{a,b}	(4.2)	24.4 ^b	(4.2)
20 or more	61.6 ^a	(7.3)	68.7 ^a	(6.3)	33.1 ^b	(6.5)
Laminitis						
1 - 5	1.4 ^b	(0.6)	3.9 ^a	(1.7)	1.0 ^b	(0.6)
6 - 19	8.2 ^a	(2.8)	4.2 ^b	(1.8)	3.2 ^b	(1.5)
20 or more	16.4 ^a	(4.9)	10.6 ^a	(4.6)	2.8 ^b	(1.5)

Percent Operations Where One or More Resident Horse Had Any Lameness Problem (and, Specifically, Laminitis) on the Day of the Interview by Size of Operation and by Season*



* Spring - 4/20-6/12/98; Summer - 6/15-9/11/98; Winter - 11/2/98-2/26/99.

#4196

1. ^{a,b} Percentages with superscripts in common across each row are not significantly (p>0.10) different from each other by season.

Larger percentages of operations had at least one lame horse on the days of the spring and summer visits compared with the winter visit regardless of type of operation. The most pronounced difference between types of operations was during the spring. The highest percentage (53.6 percent) of operations that had lameness on the day of an interview was in the spring for operations that were primarily boarding and training facilities, and the lowest percentage (12.9 percent) was for residence (personal use) facilities in the winter. More boarding/training facilities had lameness ($p < 0.10$) than residence (personal use) facilities at each of the spring, summer, and winter visits.

Operations with a primary function classified as 'Other' had the largest seasonal change in lameness (although differences were not statistically significant). This category was diverse including outfitters, carriage horse operations, and riding schools. It is likely that the amount of work horses performed in these types of operations varied during the year which could explain this finding.

Having a horse with laminitis was usually more common at the spring or summer visits compared with the winter visit. Boarding/training facilities had at least one horse with laminitis most often in the spring (21.4 percent) and farm/ranch operations reported having laminitis least often in the winter (0.6 percent). The largest seasonal difference in laminitis was for boarding/training facilities, from 21.4 percent in the spring to 3.5 percent in the winter.

c. Percent of operations where one or more resident horses had any lameness problem (and, specifically, laminitis) on the day of the interview by season and by primary function of operation:

Primary Function of Operation	Percent Operations by Season ¹					
	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Any Lameness Problem						
Boarding/training facility	53.6 ^a	(10.0)	45.6 ^a	(10.6)	38.2 ^a	(9.9)
Breeding farm	36.1 ^a	(8.0)	26.5 ^b	(7.6)	21.4 ^b	(8.0)
Farm/ranch	25.3 ^a	(4.2)	27.5 ^a	(4.9)	17.8 ^b	(3.5)
Residence (personal use)	14.6 ^{a,b}	(2.7)	19.9 ^a	(3.5)	12.9 ^b	(3.0)
Other	52.7 ^a	(12.7)	40.8 ^a	(12.2)	34.8 ^a	(11.7)
Laminitis						
Boarding/training facility	21.4 ^a	(9.7)	7.7 ^{a,b}	(3.8)	3.5 ^b	(2.7)
Breeding farm	7.5 ^a	(3.3)	4.5 ^a	(2.6)	2.5 ^a	(1.9)
Farm/ranch	2.6 ^a	(1.0)	2.7 ^a	(1.3)	0.6 ^b	(0.4)
Residence (personal use)	2.6 ^a	(1.2)	4.7 ^a	(2.2)	1.5 ^a	(0.8)
Other	11.2 ^a	(7.1)	8.2 ^a	(6.8)	8.0 ^a	(6.9)

1. a,b Percentages with superscripts in common across each *row* are not significantly ($p > 0.10$) different from each other by season.

2. Horses with lameness and laminitis by season

Overall, lameness was reported for 3.4 to 5.4 percent of resident horses during the spring, summer, and winter visits. Laminitis was more rare with less than 1 percent of resident horses affected during any season. Because these are estimates of prevalence (including both new and pre-existing lameness problems on the days of the visits), problems which tend to be chronic (including laminitis) are more likely to be present compared with conditions that tend to be acute and only last for a short time.

Lameness in resident horses was most commonly reported in the Western region and least commonly in the Southern region during each of the spring, summer, and winter interviews. The largest regional differences were in the spring when the Western region had 7.6 percent of resident horses lame and the Southern region had 2.9 percent of resident horses lame. Lameness was more common in the spring and summer compared with the winter in every region except the Northeast. The largest seasonal difference was in the Central region with 7.1 percent of horses lame in the spring and 3.2 percent of horses lame in the winter.

There were no significant regional differences in the percentages of resident horses with laminitis during any of the three interviews. Laminitis was more common in the spring compared with the winter in every region (although this difference was only significant in the Western and Central regions). The highest prevalence of laminitis was reported in the Central region (1.3 percent) during the spring visit and the lowest in the Northeast region during the winter visit (0.0 percent). The Central region also had the largest seasonal difference from spring (1.3 percent) to winter (0.4 percent).

A peak in the occurrence of laminitis has been reported in the spring and summer (Dorn 1975). However, other studies failed to identify a significant association between season and risk of laminitis (Slater 1995, Polzer 1996). Grazing lush pasture is a common cause of laminitis (Stashak 1987) and probably accounts for the seasonal patterns described here for operations (Table B.1.a) and horses.

- a. Percent of resident horses that had any lameness problem (and, specifically, laminitis) on the day of the interview by region and by season:

Region	Percent Resident Horses by Season ¹					
	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Any Lameness Problem						
Southern	2.9 ^a	(0.5)	3.5 ^a	(0.6)	1.3 ^b	(0.3)
Northeast	6.1 ^a	(1.5)	5.4 ^a	(1.5)	5.4 ^a	(3.0)
Western	7.6 ^a	(0.9)	7.3 ^a	(1.0)	5.8 ^b	(0.8)
Central	7.1 ^a	(1.5)	4.2 ^b	(0.9)	3.2 ^b	(0.8)
All resident horses	5.4 ^a	(0.5)	4.9 ^a	(0.5)	3.4 ^b	(0.6)
Laminitis						
Southern	0.5 ^{a,b}	(0.3)	1.0 ^a	(0.5)	0.1 ^b	(0.1)
Northeast	0.6 ^a	(0.3)	0.4 ^a	(0.3)	0.0 ^a	(0.0)
Western	1.0 ^a	(0.3)	0.7 ^{a,b}	(0.3)	0.4 ^b	(0.2)
Central	1.3 ^a	(0.6)	0.6 ^{a,b}	(0.5)	0.4 ^b	(0.3)
All resident horses	0.8 ^a	(0.2)	0.8 ^a	(0.2)	0.3 ^b	(0.1)

¹ ^{a,b} Percentages with superscripts in common across each *row* are not significantly ($p > 0.10$) different from each other by season.

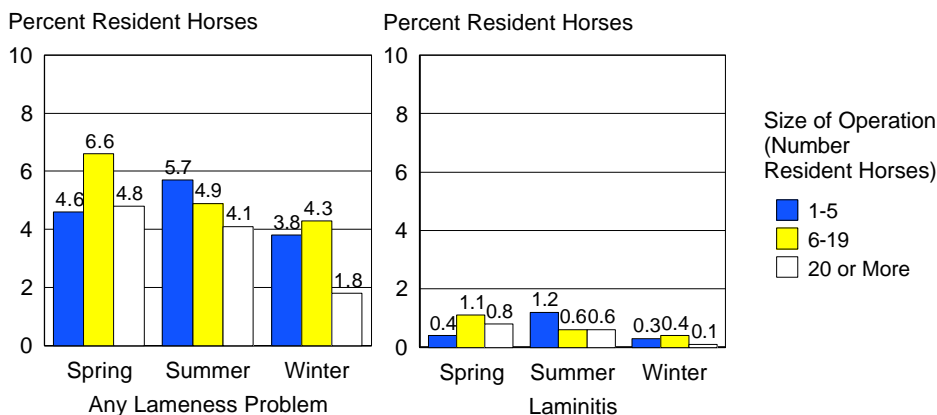
Operation size did not appear to have a substantial overall impact on risk of lameness or laminitis for individual horses. In the winter, however, operations with 20 or more resident horses had a smaller percentage of lame horses than did smaller operations. For operations with six or more horses, the percentages of horses with lameness problems and laminitis were higher in the spring, whereas operations with fewer than six horses had their largest percentage of horses with lameness problems and laminitis in the summer.

Results of the Michigan Equine Monitoring System (MEMS) suggested that horses residing on smaller operations were at increased risk of lameness, though the increase was small (Ross 1998). Considered together, the MEMS and Equine '98 studies do not suggest operation size has a substantial influence on the risk of lameness problems for individual horses.

b. Percent of resident horses that had any lameness problem (and, specifically, laminitis) on the day of the interview by size of operation and by season:

Size of Operation (Number of Resident Horses)	Percent Resident Horses by Season ¹					
	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Any Lameness Problem						
1 - 5	4.6 ^{a,b}	(0.8)	5.7 ^a	(1.0)	3.8 ^b	(0.8)
6 - 19	6.6 ^a	(1.0)	4.9 ^b	(0.8)	4.3 ^b	(1.2)
20 or more	4.8 ^a	(0.6)	4.1 ^a	(0.5)	1.8 ^b	(0.3)
Laminitis						
1 - 5	0.4 ^b	(0.2)	1.2 ^a	(0.5)	0.3 ^b	(0.2)
6 - 19	1.1 ^a	(0.4)	0.6 ^b	(0.3)	0.4 ^b	(0.2)
20 or more	0.8 ^a	(0.3)	0.6 ^{ab}	(0.4)	0.1 ^b	(0.0)

Percent Resident Horses with Any Lameness Problem (and, Specifically, Laminitis) on the Day of the Interview by Season* and by Size of Operation



* Spring - 4/20-6/12/98; Summer - 6/15-9/11/98; Winter - 11/2/98-2/26/99.

#4197

1 ^{a,b} Percentages with superscripts in common across each row are not significantly (p>0.10) different from each other by season.

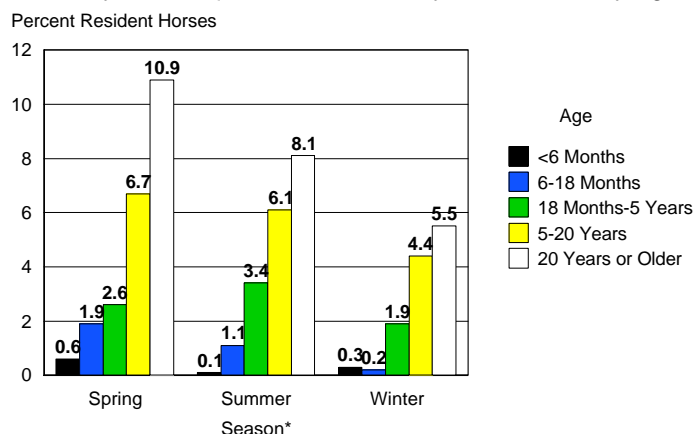
The percentages of horses 5 or more years of age that were lame at each visit were significantly higher than the percentages for horses under 5 years of age. The highest percentage of reported lameness was for horses 20 or more years of age during the spring visit (10.9 percent), and the lowest was for horses less than 6 months of age during the summer visit (0.1 percent).

The percentage of horses with laminitis increased with age after 18 months, though this effect was only significant ($p < 0.10$) during the spring visit. Although it can occur in yearlings and horses under 18 months of age, laminitis is rare in juvenile horses. In this study, laminitis was never reported in horses less than 18 months of age and occurred in less than 0.1 percent of horses less than 5 years of age at the winter visit.

c. Percent of resident horses that had any lameness problem (and, specifically, laminitis) on the day of the interview by age and by season:

Age	Percent Resident Horses by Season ¹					
	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Any Lameness Problem						
Less than 6 months old	0.6 ^a	(0.6)	0.1 ^a	(0.0)	0.3 ^a	(0.2)
6 months up to 18 months old	1.9 ^a	(0.7)	1.1 ^a	(0.4)	0.2 ^b	(0.1)
18 months up to 5 years old	2.6 ^{a, b}	(0.5)	3.4 ^a	(0.7)	1.9 ^b	(0.5)
5 years up to 20 years old	6.7 ^a	(0.7)	6.1 ^a	(0.7)	4.4 ^b	(0.9)
20 years or older	10.9 ^a	(2.8)	8.1 ^{ab}	(1.7)	5.5 ^b	(1.7)
Laminitis						
Less than 6 months old	0.0 ^a	(--)	0.0 ^a	(--)	0.0 ^a	(--)
6 months up to 18 months old	0.0 ^a	(--)	0.0 ^a	(--)	0.0 ^a	(--)
18 months up to 5 years old	0.1 ^a	(0.1)	0.2 ^a	(0.2)	0.0 ^a	(0.0)
5 years up to 20 years old	0.9 ^a	(0.2)	1.0 ^a	(0.3)	0.3 ^b	(0.1)
20 years or older	3.3 ^a	(1.3)	2.1 ^a	(0.9)	1.1 ^a	(0.8)

Percent Resident Horses That Had Any Lameness Problem on the Day of the Equine '98 Interview by Season* and by Age



* Spring - 4/20-6/12/98; Summer - 6/15-9/11/98; Winter - 11/2/98-2/26/99. #4198

1 ^{a, b} Percentages with superscripts in common across each row are not significantly ($p > 0.10$) different from each other by season.

At each visit, the highest percentage of resident horses at least 18 months of age with any lameness was for racehorses. However, only during the spring visit was this percentage (17.7 percent) significantly ($p < 0.1$) greater than those for other uses. Many of these racehorses could have been off the track (horses housed at the racetrack were not included in this portion of Equine '98) recuperating from a lameness problem, which could explain this finding.

Horses primarily used for showing or competition, not related to betting, were the least likely to be reported as lame during the spring visit, and horses primarily used for breeding had the lowest percentage of individuals with lameness during the summer and winter visits. Typically, larger percentages of horses were reported with lameness in the spring and summer compared with the winter except among pleasure and farm/ranch horses which each showed no seasonal differences.

Over 1 percent of horses that were primarily used for breeding were affected with laminitis at both the spring and summer visits, while 0.1 percent or less of horses that were primarily used for racing and those used for activities categorized as 'Other' were affected at all three visits.

d. Percent of resident horses 18 months or older that had any lameness problem (and, specifically, laminitis) on the day of the interview by primary use of horses and by season:

Primary Use of Horses	Percent Resident Horses by Season ¹					
	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Any Lameness Problem						
Pleasure	5.3 ^a	(0.9)	5.2 ^a	(0.7)	4.2 ^a	(1.0)
Showing/competition (not betting)	4.9 ^{a,b}	(1.0)	6.5 ^a	(1.9)	3.6 ^b	(1.1)
Breeding	5.5 ^a	(1.2)	4.1 ^a	(1.0)	1.8 ^b	(0.5)
Racing	17.7 ^a	(5.9)	10.7 ^{a,b}	(4.5)	7.7 ^b	(1.4)
Farm/ranch	5.4 ^a	(1.1)	6.2 ^a	(1.4)	4.5 ^a	(1.1)
Other	8.4 ^a	(3.1)	10.4 ^a	(4.6)	2.1 ^b	(1.2)
All resident horses 18 months of age or older	6.1 ^a	(0.6)	5.6 ^a	(0.5)	3.8 ^b	(0.6)
Laminitis						
Pleasure	1.1 ^a	(0.3)	0.8 ^{a,b}	(0.3)	0.5 ^b	(0.2)
Showing/competition (not betting)	0.3 ^a	(0.2)	0.6 ^a	(0.5)	0.1 ^a	(0.0)
Breeding	1.5 ^a	(0.7)	1.3 ^{a,b}	(0.7)	0.2 ^b	(0.1)
Racing	0.0 ^b	(0.0)	0.1 ^a	(0.0)	0.0 ^{a,b}	(0.0)
Farm/ranch	0.1 ^a	(0.1)	1.4 ^a	(1.1)	0.0 ^a	(0.0)
Other	0.0 ^a	(0.0)	0.1 ^a	(0.0)	0.0 ^a	(0.0)
All resident horses 18 months of age or older	0.9 ^a	(0.2)	0.9 ^a	(0.3)	0.3 ^b	(0.1)

¹ ^{ab} Percentages with superscripts in common across each *row* are not significantly ($p > 0.10$) different from each other by season.

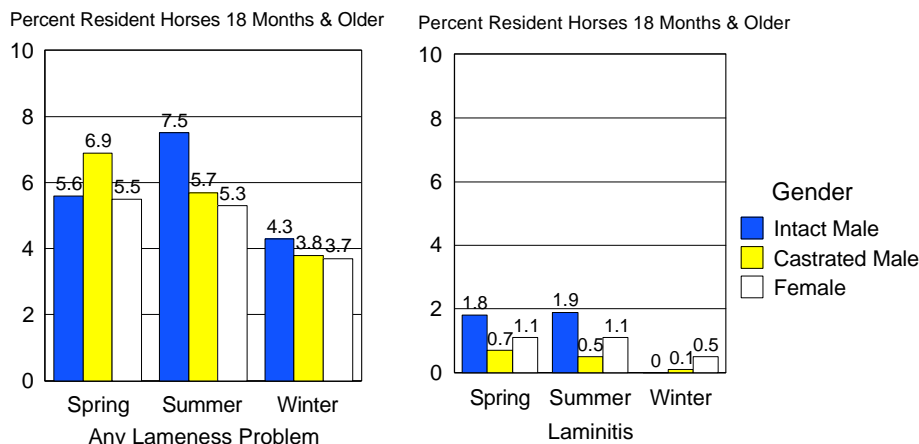
Among horses 18 months of age or older, gender did not have a significant effect on risk of lameness during any season. Intact males had the highest prevalence of laminitis at the spring and summer interviews, although females had a higher prevalence during the winter. Geldings and females were more commonly affected by lameness and laminitis in spring and summer compared with winter. There was no detectable seasonal effect on the prevalence of lameness or laminitis for intact males.

Although early studies of the occurrence of laminitis suggested intact males were at increased risk (Dorn 1975), other, more recent studies of laminitis also identified no association between gender and the occurrence of laminitis (Polzer 1996, Slater 1995).

e. Percent of resident horses 18 months or older that had any lameness problem (and, specifically, laminitis) on the day of the interview by gender and by season:

Gender	Percent Resident Horses by Season ¹					
	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Any Lameness Problem						
Intact male (stallion or colt)	5.6 ^a	(1.9)	7.5 ^a	(2.3)	4.3 ^a	(1.5)
Castrated male (gelding)	6.9 ^a	(0.9)	5.7 ^a	(0.8)	3.8 ^b	(0.7)
Female	5.5 ^a	(0.6)	5.3 ^a	(0.8)	3.7 ^b	(0.9)
Laminitis						
Intact male (stallion or colt)	1.8 ^a	(1.3)	1.9 ^a	(1.4)	0.0 ^a	(0.0)
Castrated male (gelding)	0.7 ^a	(0.3)	0.5 ^a	(0.2)	0.1 ^b	(0.1)
Female	1.1 ^a	(0.3)	1.1 ^a	(0.4)	0.5 ^b	(0.2)

Percent Resident Horses 18 Months or Older that Had Any Lameness Problem (and, Specifically, Laminitis) on the Day of the Interview by Gender and by Season*



* Spring - 4/20-6/12/98; Summer - 6/15-9/11/98; Winter - 11/2/98-2/26/99.

#4199

1 ^{a,b} Percentages with superscripts in common across each row are not significantly (p>0.10) different from each other by season.

Descriptions of 2,113 cases of lameness were collected during the spring interview; 1,437 during the summer interview; and 1,086 during the winter interview. Tables B.3.a-e are weighted estimates based on these data. This section provides a more detailed description of lame horses in the study.

3. Description of lameness cases

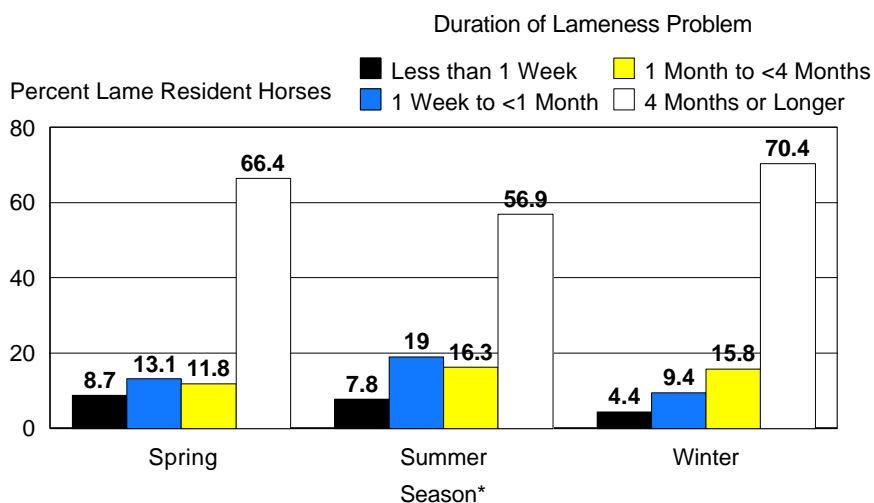
Over 50 percent of horses with lameness on the days of the interviews had been lame for 4 months or longer at the time of the interview. This result is somewhat surprising in light of the MEMS study which reported a median duration of lameness of only 18 days (Ross 1999). There were no clear seasonal patterns to the duration of the lameness problems reported.

a. For resident horses with a lameness problem on the day of the interview, percent of horses by season and by duration of lameness problem:

Percent Lame Resident Horses by Season¹

Duration	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Less than 1 week	8.7 ^a	(2.5)	7.8 ^a	(1.9)	4.4 ^a	(2.0)
1 week up to 1 month	13.1 ^{a,b}	(2.6)	19.0 ^a	(4.4)	9.4 ^b	(3.1)
1 month up to 4 months	11.8 ^a	(2.8)	16.3 ^a	(3.0)	15.8 ^a	(4.0)
4 months or longer	66.4 ^a	(3.2)	56.9 ^b	(5.1)	70.4 ^a	(5.7)
Total	100.0		100.0		100.0	

Percent Lame Resident Horses on the Day of the Equine '98 Interview by Duration of Lameness Problem and by Season*



* Spring - 4/20-6/12/98; Summer - 6/15-9/11/98; Winter - 11/2/98-2/26/99. #4200

^{a,b} Percentages with superscripts in common across each row are not significantly (p>0.10) different from each other by season.

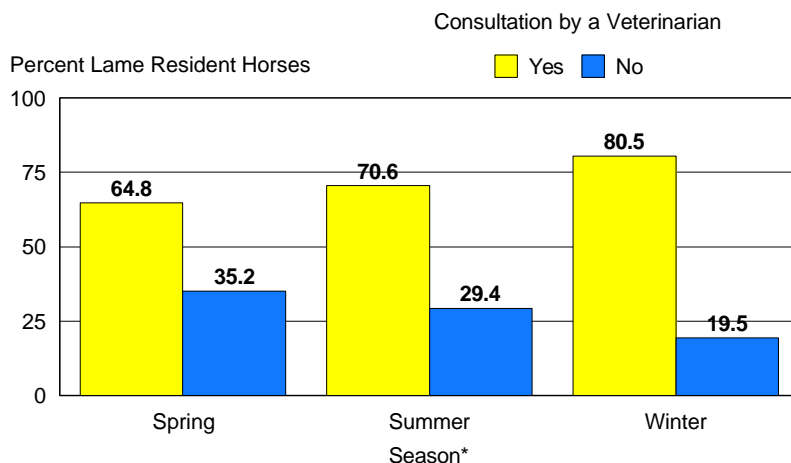
Although fewer lameness problems were reported during the winter, a veterinarian was consulted for a higher percentage of lameness cases in the winter (80.5 percent) compared with those reported in the spring (64.8 percent) or summer (70.6 percent) interviews.

b. For resident horses with a lameness problem on the day of the interview, percent of horses by season and by consultation by a veterinarian:

Percent Lamé Resident Horses by Season¹

Consultation by a Veterinarian	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Yes	64.8 ^b	(5.8)	70.6 ^b	(4.3)	80.5 ^a	(4.9)
No	35.2 ^a	(5.8)	29.4 ^a	(4.3)	19.5 ^b	(4.9)
Total	100.0		100.0		100.0	

Percent Lamé Resident Horses on the Day of the Equine '98 Interview by Consultation by a Veterinarian and by Season*



* Spring - 4/20-6/12/98; Summer - 6/15-9/11/98; Winter - 11/2/98-2/26/99. #4217

1 ^{a,b} Percentages with superscripts in common across each **row** are not significantly ($p > 0.10$) different from each other by season.

More resident horses were noticed first as lame during turnout, work, or at an unknown time than when at rest (in a stall or otherwise confined). During turnout was the most common time lameness was noticed in the summer and winter.

- c. For resident horses with a lameness problem on the day of the interview, percent of horses by season and by the activity during which horse first became lame:

Percent Lameness Resident Horses by Season¹

Activity	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Working or exercising	30.8 ^a	(3.7)	24.4 ^a	(3.8)	26.0 ^a	(5.3)
Turned out	30.2 ^b	(4.8)	41.5 ^a	(5.3)	39.9 ^{a,b}	(6.8)
At rest	6.6 ^a	(1.7)	10.4 ^a	(2.7)	8.6 ^a	(2.6)
Unknown	<u>32.4^a</u>	(5.3)	<u>23.7^a</u>	(5.0)	<u>25.5^a</u>	(4.2)
Total	100.0		100.0		100.0	

Approximately one-third of lame resident horses described during the spring, summer, and winter interviews received some form of corrective shoeing for the current lameness problem.

- d. For resident horses with a lameness problem on the day of the interview, percent of horses by season and by whether or not the horse received corrective shoeing for current lameness:

Percent Lameness Resident Horses by Season¹

Corrective Shoeing	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Yes	31.8 ^a	(3.7)	34.5 ^a	(3.9)	33.5 ^a	(4.5)
No	<u>68.2^a</u>	(3.7)	<u>65.5^a</u>	(3.9)	<u>66.5^a</u>	(4.5)
Total	100.0		100.0		100.0	

¹ ^{ab} Percentages with superscripts in common across each *row* are not significantly ($p > 0.10$) different from each other by season.

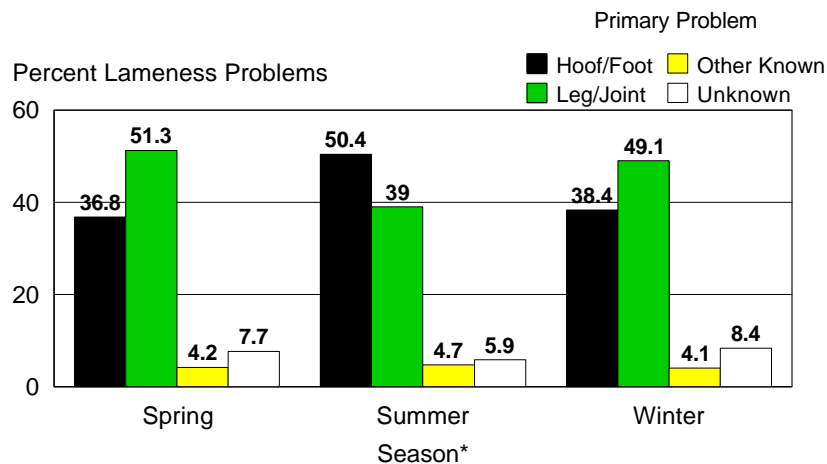
Leg or joint problems were the most commonly perceived cause of lameness in the spring and winter. Hoof or foot problems (including laminitis) were more commonly perceived as the cause of lameness problems in the summer. Less than 10 percent of all lameness problems were attributed to an unknown problem.

e. For resident horses with a lameness problem on the day of the interview, percent of horses by primary problem and by season:

Percent Lame Resident Horses by Season¹

Primary Problem	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Hoof or foot problem	36.8 ^b	(3.5)	50.4 ^a	(4.7)	38.4 ^b	(4.7)
Leg or joint problem	51.3 ^a	(3.5)	39.0 ^b	(4.1)	49.1 ^{a,b}	(5.6)
Other known problem	4.2 ^a	(1.8)	4.7 ^a	(1.8)	4.1 ^a	(2.2)
Unknown problem	7.7 ^a	(2.0)	5.9 ^a	(2.0)	8.4 ^a	(3.2)
Total	100.0		100.0		100.0	

Percent Lame Resident Horses on the Day of the Equine '98 Interview by Season* and by Primary Problem



* Spring - 4/20-6/12/98; Summer - 6/15-9/11/98; Winter - 11/2/98-2/26/99. #4202

^{a,b} Percentages with superscripts in common across each row are not significantly (p>0.10) different from each other by season.

Laminitis (sometimes known as founder), navicular disease, and sole bruises or abscesses were the most commonly perceived causes of hoof or foot problems, and together accounted for 70 to 80 percent of those problems reported. Laminitis was more common than any other cause in the spring. Navicular disease was the most commonly perceived cause of hoof or foot problems in the winter. Laminitis and navicular disease both tend to be chronic conditions, which could explain why they were reported more often when any new or existing lameness problem was recorded in this study. Conditions which tend to be acute and shorter in duration (e.g., sole bruises or abscesses) would seem less common in comparison.

Hoof or foot problems identified as the cause of lameness in the 'Other' category included non-specific foot soreness, hoof wall defects, injuries, and improper shoeing.

f. Percent of hoof or foot problems causing lameness on the day of the Equine '98 interview by cause and by season:

Cause of Hoof or Foot Problems	Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
	Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
Laminitis or founder	40.2 ^a	(5.7)	31.1 ^{a,b}	(7.5)	19.5 ^b	(4.5)
Navicular disease	20.1 ^b	(4.3)	23.3 ^b	(6.2)	38.5 ^a	(8.8)
Sole bruise/abscess	21.1 ^a	(5.3)	17.0 ^a	(4.1)	19.5 ^a	(7.0)
Quarter crack	5.9 ^a	(2.4)	4.0 ^a	(2.1)	4.5 ^a	(3.4)
Thrush	0.9 ^a	(0.8)	1.8 ^a	(1.2)	2.1 ^a	(1.9)
Other known problem	9.9 ^{a,b}	(3.0)	21.1 ^a	(6.4)	8.5 ^b	(3.8)
Unknown problem	1.9 ^a	(1.0)	1.7 ^a	(0.7)	7.4 ^a	(4.2)
Total	100.0		100.0		100.0	

Laminitis accounted for 19.5 (winter) to 40.2 percent (spring) of hoof or foot problems (see Table B.3.f above) and 7.5 (winter) to 15.7 (summer) percent of all lameness problems (see Table B.3.g below).

g. Percent of any lameness problems due to laminitis by season¹:

Spring (4/20 - 6/12/98)		Summer (6/15 - 9/11/98)		Winter (11/2/98 - 2/26/99)	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
14.8 ^a	(2.9)	15.7 ^a	(4.1)	7.5 ^b	(2.6)

¹ ^{ab} Percentages with superscripts in common across each *row* are not significantly ($p>0.10$) different from each other by season.

During the spring visit, each participant in the study was asked to identify the most recent case of lameness that had occurred. These cases (824 horses total) were followed in detail through the summer and winter visits.

Results shown here were weighted to represent the most recent lameness problem on all operations in the population represented by the study.

C. Most Recent Lameness Problem

1. Lameness by breed, age, and primary use

The breed distribution of lameness was no different than one might expect given the breed distribution of the horses included in the study. For example, more Quarter Horses were reported to be lame (43.0 percent) than any other breed, but Quarter Horses were also the most common type of horse included in the study (40.4 percent).

a. Percent of most recent lameness problems (and percent of resident horse inventory) by breed of horse:

Breed	Percent Lameness Problems	Standard Error	Percent Resident Horse Inventory ¹	Standard Error
Appaloosa	4.2	(1.4)	7.4	(1.4)
Arabian	12.5	(2.8)	7.2	(1.1)
Draft breed	2.7	(0.9)	4.2	(0.9)
Paint	5.2	(2.1)	7.5	(1.2)
Standardbred	2.7	(1.3)	2.7	(0.6)
Tennessee Walker	6.3	(2.0)	4.9	(1.2)
Thoroughbred	10.6	(2.3)	9.8	(1.7)
Quarter horse	43.0	(3.9)	40.4	(2.3)
Other registered breed	9.4	(2.5)	9.4	(1.4)
Other non-registered breed	<u>3.4</u>	(1.3)	<u>6.5</u>	(1.4)
Total	100.0		100.0	

¹ Inventory at the time of the Equine '98 spring VMO interview.

2. Primary problem of laminitis

a. Percent of most recent lameness problems that were due to laminitis:

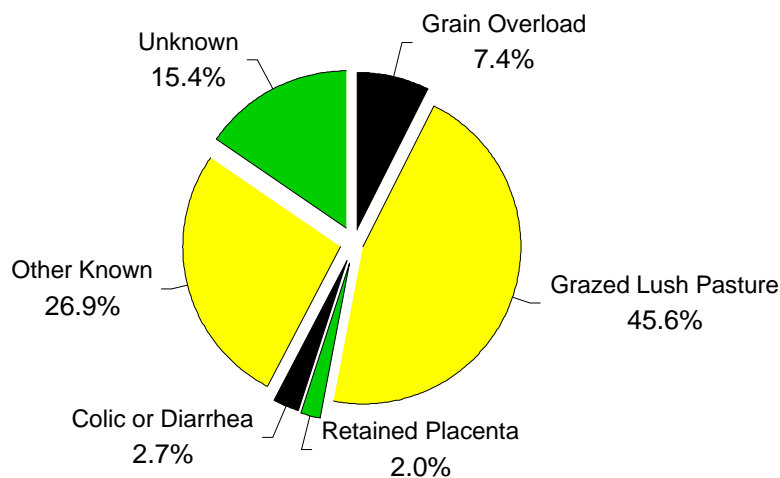
Percent Lameness Problems	Standard Error
15.0	(3.1)

Grazing lush pasture was the single most commonly perceived cause (45.6 percent) of laminitis in the most recent cases of lameness described. ‘Other known’ causes, such as feed problems and complications of injury, obesity, or pregnancy, were perceived responsible for 26.9 percent of laminitis cases. Grain overload, colic or diarrhea, and retained placenta combined caused less than 15 percent of laminitis cases described.

b. Percent of most recent laminitis cases by perceived cause:

Perceived Cause	Percent Laminitis Cases	Standard Error
Grain overload	7.4	(3.7)
Grazed lush pasture	45.6	(11.5)
Retained placenta	2.0	(1.6)
Colic or diarrhea	2.7	(2.7)
Other known	26.9	(11.1)
Unknown	<u>15.4</u>	(6.4)
Total	100.0	

Percent Most Recent Laminitis Cases by Perceived Cause



#4204

3. Lameness outcome

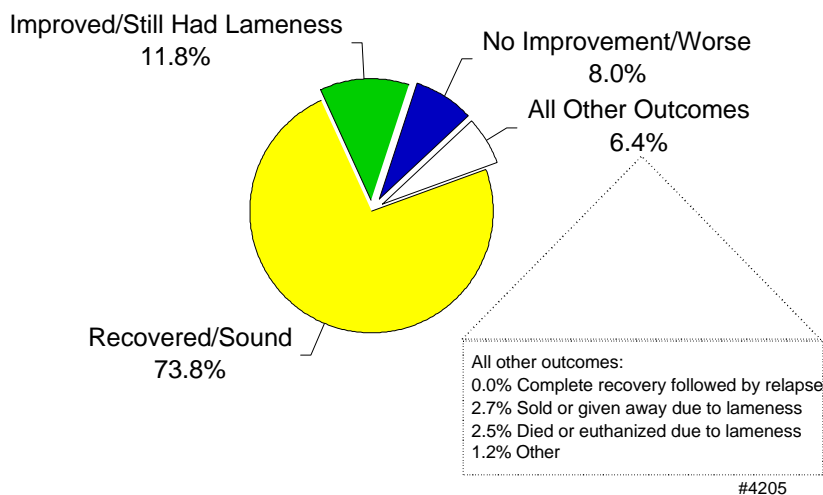
The majority (73.8 percent) of the most recent cases of lameness recovered before the end of the follow-up period (April 20, 1998, through February 26, 1999). Only 2.7 percent were sold or given away, and 2.5 percent died or were euthanized. These findings are similar to those from the MEMS study where 78 percent of the horses were reported to have recovered from lameness (Ross 1999).

For those horses that had laminitis, outcomes were similar with 73.7 percent of horses with laminitis recovering completely and 4.7 percent dying or requiring euthanasia. These outcomes for horses with laminitis are considerably better than those previously reported for horses referred to a veterinary teaching hospital where only 29.5 percent returned to athletic soundness and 50.2 percent died or were euthanized (Hunt 1993). Cases seen at teaching hospitals would generally be more severe which probably explains the difference between these studies.

a. Percent of most recent lameness problems (and, specifically, laminitis) by final outcome:

Outcome	Percent All Lameness Problems		Percent Laminitis	
	Percent	Standard Error	Percent	Standard Error
Recovered or sound	73.8	(3.2)	73.7	(8.7)
Improved but still had lameness	11.8	(2.3)	7.5	(3.6)
No improvement or worse	8.0	(1.9)	12.1	(7.2)
Complete recovery followed by relapse	0.0	(0.0)	0.0	(--)
Sold or given away due to lameness	2.7	(1.1)	0.0	(0.0)
Died or euthanized due to lameness	2.5	(0.9)	4.7	(3.5)
Other	<u>1.2</u>	(0.6)	<u>2.0</u>	(1.3)
Total	100.0		100.0	

Percent Most Recent Lamenesses by Final Outcome



The primary use permanently changed for 9.5 percent of the horses that did not die as a result of their lameness.

b. For lameness problems where the horses did not die, percent of most recent lameness problems where primary use of the horse permanently changed as a result of the lameness episode:

Percent Lameness Problems	Standard Error
9.5	(2.0)

For those horses that had a change in their primary use after the lameness episode, show/competition and farm/ranch horses had the most dramatic decrease. Only 0.1 percent of the horses were used for breeding when the lameness started, although 54.8 percent became breeding animals as a result of their lameness. The tendency to place performance animals into the breeding pool after a lameness problem may be a concern if the cause of the problem could be inherited.

c. For the most recent lameness problems where the primary use of the horse changed (excluding lameness problems where the horse died), percent of most recent lameness problems by primary use of equids at the time of and after the lameness episode:

Percent Lameness Problems by Primary Use
At Time of and After the Lameness Episode

Primary Use	At Time of		After	
	Percent	Standard Error	Percent	Standard Error
Pleasure	25.0	(9.2)	37.3	(9.9)
Show or competition (not betting)	36.1	(10.3)	0.0	(0.0)
Breeding	0.1	(0.0)	54.8	(10.4)
Racing	11.5	(5.6)	0.0	(0.0)
Farm/ranch	24.9	(9.4)	0.5	(0.3)
Other	<u>2.4</u>	(1.9)	<u>7.4</u>	(6.7)
Total	100.0		100.0	

References

- Dorn CR, Garner HE, Coffman JR, Hahn AW, Tritschler LG. 1975. Castration and other factors affecting the risk of equine laminitis, *Cornell Vet*, 65: 57-64.
- Estberg L, Stover SM, Gardner IA, Drake CM, Johnson B, Ardans A. 1996. High-speed exercise history and catastrophic racing fracture in Thoroughbreds, *Am J Vet Res*, 57: 1549-1555.
- Hood DM. 1999. Laminitis in the horse, *Vet Clin North Am Equine Pract*, 15: 287-294.
- Hunt RJ. 1993. A retrospective evaluation of laminitis in horses, *Equine Vet J*, 25: 61-64.
- Jeffcott LB, Rossdale PD, Freestone J, Frank CJ, Towers-Clark PF. 1982. An assessment of wastage in Thoroughbred racing from conception to 4 years of age, *Equine Vet J*, 14: 185-198.
- Kaneene JB, Ross WA, Miller R. 1997. The Michigan equine monitoring system. II. Frequencies and impact of selected health problems, *Prev Vet Med*, 29: 277-292.
- Lindner A, Dingerkus A. 1993. Incidence of training failure among Thoroughbred horses at Cologne, Germany, *Prev Vet Med*, 16: 85-94.
- Polzer J, Slater MR. 1996. Age, breed, sex and seasonality as risk factors for equine laminitis, *Prev Vet Med*, 29: 179-184.
- Ross WA, Kaneene JB. 1996. An operation-level prospective study of risk factors associated with the incidence density of lameness in Michigan (USA) equine operations, *Prev Vet Med*, 28: 209-224.
- Ross WA, Kaneene JB, Gardiner JC. 1998. Survival analysis of risk factors associated with the occurrence of lameness in a Michigan horse population, *Am J Vet Res*, 59: 23-29.
- Ross WA, Kaneene JB, Caron JP, Gallagher KF, Gardiner JC. 1999. Factors influencing recovery from and duration of lameness in Michigan (USA) horses, *Prev Vet Med*, 40: 127-138.
- Slater MR, Hood DM, Carter GK. 1995. Descriptive epidemiological study of equine laminitis, *Equine Vet J*, 27: 364-367.
- Stashak TS. Lameness. In: Stashak TS, ed. *Adam's lameness in horses* 4th ed. Philadelphia: Lea and Febiger, 1987; p. 487.
- USDA. 1995. *Catalog of Opportunities for Equine Health Monitoring*. USDA:APHIS:VS, CEAH. National Animal Health Monitoring System. Fort Collins, CO #N180.495.
- USDA. 1997. *Equine '98: Needs Assessment Survey Results*. USDA:APHIS:VS, CEAH. National Animal Health Monitoring System. Fort Collins, CO #N236.597.
- USDA. 1998. *Part I: Baseline Reference of 1998 Equine Health and Management*. USDA:APHIS:VS, CEAH. National Animal Health Monitoring System. Fort Collins, CO #N280.898.

Appendix: Sample Profile

A. Responding Operations

1. Region

Region	Number Responding Operations		
	Spring (4/20-6/12/98)	Summer (6/15-9/11/98)	Winter (11/2/98-2/26/99)
Southern	435	418	395
Northeast	155	153	146
Western	323	307	288
Central	<u>265</u>	<u>258</u>	<u>243</u>
Total	1,178	1,136	1,072

2. Size of operation (number of resident horses on hand at the time of the spring interview, April 20 - June 2, 1998)

Number	Number Responding Operations		
	Spring (4/20-6/12/98)	Summer (6/15-9/11/98)	Winter (11/2/98-2/26/99)
1 - 5	267	260	248
6 - 19	467	448	420
20 or more	<u>444</u>	<u>428</u>	<u>404</u>
Total	1,178	1,136	1,072

3. Type of operation

Primary Function of Operation	Number Responding Operations		
	Spring (4/20-6/12/98)	Summer (6/15-9/11/98)	Winter (11/2/98-2/26/99)
Boarding/Training facility	381	368	350
Breeding farm	199	194	179
Farm/Ranch	219	208	194
Residence with equids for personal use	228	217	208
Other	<u>151</u>	<u>149</u>	<u>141</u>
Total	1,178	1,136	1,072



Completed and Expected Equine '98 Study Outputs and Related Study Objectives

1. Provide baseline information on equine health.
 - Part I: Baseline Reference of 1998 Equine Health and Management, August 1998
 - Part II: Baseline Reference of 1998 Equine Health and Management, September 1998
 - Equine morbidity and mortality (info sheet), September 1998
2. Estimate uses of equine health-related management practices.
 - Part II: Baseline Reference of 1998 Equine Health and Management, September 1998
 - Part III: Management and Health of Horses in the U.S., 1998, January 1999
 - Part IV: Reference of Health Management for Horses and Highlighted Diseases, 1998, May 1999
 - Sources of information/use of veterinarian (info sheet), August 1998
 - Biosecurity practices on U.S. equine facilities (info sheet), August 1998
 - Information sources and use of veterinarians for equine health care, August 1998
 - Unique identification methods for U.S. equids (info sheet), May 1999
 - Equine management practices (info sheet), January 1999
 - Transportation of U.S. equids (info sheet), January 1999
3. Determine type and use of animals in the U.S. equine population by type of operation.
 - Part I: Baseline Reference of 1998 Equine Health and Management, August 1998
 - Composition of the U.S. equine population (info sheet), August 1998
4. Measure the prevalence of specific infectious agents or frequency of antibodies to specific infectious agents.
 - *Salmonella* and the U.S. horse population (info sheet), expected summer 2000
 - Internal parasites: strongyles and ascarids (info sheets), April 2000
5. Gather data related to specific health problems.
 - Testing for equine infectious anemia (EIA) in the U.S. (info sheet), September 1998
 - Equine Viral Arteritis (EVA) and the U.S. Horse Industry (interpretive report), April 2000
 - Equine Protozoal Myeloencephalitis, EPM (interpretive report), expected summer 2000
 - ***Lameness and Laminitis in U.S. Horses*** (interpretive report), April 2000
 - Colic (info sheet), expected spring 2000
 - Respiratory disease (info sheet), expected spring 2000
6. Feed problems.
 - Endophytes in U.S. horse pastures (info sheet), April 2000
 - Fumonisin toxin B₁ in on-farm horse grain/concentrate in the U.S. (info sheet), April 2000

Centers for Epidemiology and Animal Health
USDA:APHIS:VS, attn. NAHMS
2150 Centre Ave., Bldg. B, MS 2E7; Fort Collins, CO 80526-8117
Telephone: (970) 494-7000
NAHMSweb@usda.gov
<http://www.aphis.usda.gov/vs/ceah/cahm>

#N318.0400