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Animal and Plant Health Inspection Service

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National Animal Health Monitoring System

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Report 2

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Equine 2015

Changes in the U.S. Equine Industry, 1998–2015

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Items of Note

This report is primarily devoted to comparing the study findings from NAHMS Equine '98, 2005, and 2015 studies for selected equine health and management practices. The same 28 States participated in the 1998 and 2005 studies, and 20 of the 28 States in the 2015 study also participated in the 1998 and 2005 studies. For the 2005 and 2015 studies, data were collected in the participating States on operations with five or more equids. For ease of comparison, data from the 1998 study were reanalyzed to include only operations with five or more equids on January 1, 1998.

Equine demographics

According to the 2012 Census of Agriculture, there were 3,621,348 horses and ponies on U.S farms in 2012, which was a decline from 4,028,827 horses and ponies reported in the 2007 Census of Agriculture. While the number of horses and ponies declined from 2007 to 2012, the number of mules, burros, and donkeys increased (283,806 to 292,590, respectively). In addition, several breed registries observed a decline in new foal registrations from 2007 to 2012, which was attributed to the financial recession.

Trends 1998–2015

In 1998, 2005, and 2015, the percentage of operations that primarily used equids for pleasure was similar (46.1, 45.7, and 47.2 percent, respectively), when considering the estimates/standard errors, as was the percentage of operations that primarily used equids for farm/ranch work (18.7, 24.8, and 25.0 percent, respectively).

Large operations (20 or more resident equids) represented a higher percentage of all equine operations in 1998 and 2015 than in 2005. Small operations (5 to 9 resident equids) made up the majority of all operations in each study year.

The percentage of equids on large operations was similar in 1998 and 2015 (39.4 and 41.9 percent, respectively) but lower in 2005 (29.7 percent). Over half of all equids resided on operations with 10 or more equids in 1998, 2005, and 2015.

In all three study years, over 90 percent of operations had full-size horses. A higher percentage of operations had donkeys or burros in 2005 and 2015 than in 1998. A higher percentage of operations had miniature horses in 2015 (12.7 percent) than in 1998 (5.4 percent) or 2005 (7.2 percent).

The percentage of the equine population 20 years of age or older increased across study years (5.6, 7.6, and 11.4 percent, respectively), while the percentage of the overall equine population less than 5 years of age was lower in 2015 than in 1998 or 2005. These

key findings suggest an aging equine population with fewer foals born in 2015 than in previous study years.

The percentage of operations that used computerized records as the primary method of recording equine health information was higher in 2005 and 2015 compared with 1998. Nearly half of operations used hand-written notes, either in a designated log or on a calendar or check book as the primary method of record keeping in 1998 and 2005, while only 41.1 percent did so in 2015.

The percentage of operators that had at least heard of equine infectious anemia (EIA) was higher in 2005 and 2015 than in 1998. The percentage of operations that tested at least one equid for EIA was similar in 1998 and 2005, but slightly lower in 2015.

The overall percentage of equids tested for EIA was similar in 1998, 2005, and 2015. The average cost of an EIA test (including call fee or transportation) increased from 1998 to 2005 and again in 2015.

The percentage of operations that vaccinated any resident equids during the previous 12 months was similar in 1998 and 2005, but lower in 2015.

The overall percentage of foals aged 30 days or less that died was similar in all three studies; between 4 and 6 percent of foals born alive died in the first 30 days of life.

The highest mortality rate in all three studies occurred in equids 20 years of age or older. The percentage of equids 20 years of age or older that died was lower in 2015 than in 1998 or 2005.

Trends in selected equine diseases

The prevalence of EIA has declined dramatically since the initiation of control efforts in 1972. In 2015, 1.35 million EIA tests were performed, and the prevalence of positive equids was 0.005 percent.

Fully licensed vaccines for protecting equids from West Nile virus (WNV) have been available since 2003. There has been a dramatic decline in the number of equine WNV cases since vaccines became available. For example, 5,181 WNV cases in equids were reported in 2003 compared with just 225 in 2015.

Large outbreaks of vesicular stomatitis (VS) occurred in 2014 and 2015; 435 premises in 4 States reported cases in 2014, and 823 premises in 8 States reported cases in 2015. Most VS cases were in equids.

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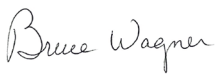
The Equine 2015 study was a cooperative effort between two U.S. Department of Agriculture agencies: the National Agricultural Statistics Service (NASS) and the Animal and Plant Health Inspection Service (APHIS). We would like to thank the NASS enumerators, who visited equine operations and collected data for this report, and the personnel at USDA–APHIS–Veterinary Services for their efforts in the design and implementation of the study. We would also like to thank our reviewers for providing invaluable guidance through their comments. All participants are commended for their willingness to volunteer their time. Without them this report would not be possible.



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Feedback

Feedback, comments, and suggestions regarding Equine 2015 study reports are welcomed. You may submit feedback via online survey at: http://www.aphis.usda.gov/nahms (Click on “FEEDBACK on NAHMS reports.”)

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Introduction

The National Animal Health Monitoring System (NAHMS) is a nonregulatory division of the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service's Veterinary Services (VS) and was designed to help meet the Nation's animal-health information needs. In 1983, promoters of the concept that would become USDA's National Animal Health Monitoring System (NAHMS) envisioned a program that would monitor changes and trends in national animal health and management, thereby providing periodic snapshots of U.S. livestock industries. Three snapshots of the U.S. equine industry have been performed via the Equine 1998, Equine 2005, and Equine 2015 studies.

Equine '98 was NAHMS first national study on equine baseline health and management. Equine '98 provided participants, industry, and animal-health officials with information on the Nation's equine population for education and research. The operations included in phase I of that study were selected from a combined National Agricultural Statistics Service (NASS) area and list data set (multiple-frame estimation) and included operations with one or more equids. For operations to qualify for phase II of the study they had to have had three or more horses on January 1, 1998. Multiple visits to operations participating in phase II were made by veterinary medical officers or animal health technicians in order to meet the study objectives.

Equine 2005 was the second NAHMS study of U.S. equine industry. Like Equine '98, it was designed to provide participants, industry, and animal-health officials with information on the Nation's equine population to serve as a basis for education, service, and research related to equine infectious disease control. NASS collaborated with VS to select a representative sample of operations with five or more equids from the 2002 Census of Agriculture.

Equine 2015 was the third NAHMS study of the U.S. equine industry. The study updates baseline health and management information for the equine industry and provides detailed information on vaccine use, parasite control, tick control and tick-borne diseases, prevalence of owner-reported lameness and management of lameness, and the cost of animal health care. In addition, the prevalence of *Salmonella* shedding, tick infestation and identification and the outcome of biosecurity assessments of equine operations are reported.

"Baseline Reference of Equine Health and Management, 2015" was the first in a series of reports containing information from the Equine 2015 study. This report focuses on health and management practices and contains information collected on equine operations with five or more equids based on the 2012 Census of Agricultural in 28 States.

“Changes in the U.S. Equine Industry, 1998–2015” is the second report in the series. Section I of this report presents demographic changes in the equine population from a historical perspective using data provided by NASS. Section II provides results from three NAHMS Equine studies—1998, 2005, and 2015. Appendix II includes historical data regarding equine infectious anemia, West Nile virus, Eastern equine encephalitis, and vesicular stomatitis.

Results of NAHMS Equine studies are available online at http://www.aphis.usda.gov/nahms.

Information on the methods used and the number of respondents in phase I of the Equine 2015 study can be found at the end of the “Baseline Reference of Equine Health and Management, 2015” report.

Terms Used in This Report

Area frame: A collection or listing of all parcels of land from which to sample. These land parcels can be defined based on factors such as ownership or easily identifiable boundaries. See the Methodology section for more information on area frames.

Endocrine system: A collection of glands that secrete hormones. The major endocrine glands include the pineal gland, pituitary gland, pancreas, ovaries, testes, thyroid gland, parathyroid gland, hypothalamus, gastrointestinal tract, and adrenal glands.

Equid: Animal of the family *Equidae.* Only domestic horses, miniature horses, ponies, mules, donkeys/burros, and zedonks (zebra-donkey cross) were included.

Foal: Equid less than 6 months of age.

Horse: Domestic equid generally more than 14.2 hands (58 inches) high at the shoulder (near the last hairs of the mane). An equid less than 14.2 hands high may also be considered a horse if its breed registry defines it as such (other than miniature horse). Horses include light breeds (e.g., Arabian, Quarter Horse, Appaloosa, Morgan, Trakehner) and draft horses (e.g., Clydesdale, Belgian, and Percheron).

List frame: A digital or hand-written list of sampling units (e.g., farms or operations) in a target population. See the Methodology section for more information on list frames.

Multiple frame: A combination of area-frame sample data and list-frame sample data. See the Methodology section for more information on multiple frames.

NA: Not applicable.

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

Operator: The person responsible for the day-to-day decisions on the operation.

Operation average: A single value for each operation is summed over all operations reporting and divided by the number of operations reporting.

Perceived cause (of illness or death): Causes of illnesses or deaths were derived from observations of clinical signs reported by participants and not necessarily confirmed by a veterinarian or by laboratory testing.

Percent equids: The total number of equids with a certain attribute, divided by the total number of equids for a given category and multiplied by 100.

Phase I: The first phase of each NAHMS equine study. During Phase I, NASS enumerators administered the study's baseline questionnaire via an in-person interview.

Phase II: The second phase of the equine study. During Phase II, operators who participated in Phase I and agreed to participate in Phase II completed a second questionnaire administered in person by veterinary medical officers and/or animal health technicians. Phase II participants were eligible to participae in biologic sampling and other aspects of Phase II. There was no Phase II in the Equine 2005 study.

Pigeon fever: Common name for *Corynebacterium psuedotuberculosis*, a bacterial infection of equids.

Primary function of operation: The main purpose of the operation, i.e., boarding/ training, breeding farm, farm/ranch, and residence with equids for personal use.

Primary use of equids: What the majority of equids on the operation are used for, i.e., pleasure, lessons/school, show/competition, breeding, racing, farm/ranch work.

Population estimates: Estimates in this report are provided with a measure of precision called the standard error. A 95-percent confidence interval can be created with bounds equal to the estimate, plus or minus two standard errors. If the only error is sampling error, the confidence intervals created in this manner will contain the true population mean 95 out of 100 times. For example, an estimate of 7.5 with a standard error of 1.0 results in limits of 5.5 to 9.5 (two times the standard error above and below the estimate). An estimate of 3.4 with a standard error of 0.3 and results in limits of 2.8 and 4.0. Alternatively, the 90-percent confidence interval would be created by multiplying the standard error by 1.65 instead of 2. Most estimates in this report are rounded to the nearest tenth. If rounded to 0, the standard error was reported (0.0). If there were no reports of the event, no standard error was reported (—).

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

Size of operation: Size groupings were based on number of equids present on July 1, 1998, for the Equine ’98 study, number of equids present on July 1, 2005, for the Equine 2005 study, and number of equids resident to the operation on May 1, 2015, for the Equine 2015 study. For the purposes of this report, small operations included operations that had five or more equids (primarily based on the Census of Agriculture performed prior to the NAHMS study), but had fewer than five equids at the time of NAHMS data collection in 2005 and 2015.

Section I: Demographic Changes in the U.S. Equine Industry, 1850–2012

This section presents data from sources other than the NAHMS Equine '98, 2005, and 2015 studies to provide demographic information on the U.S. equine population.

A. Historical Changes in the U.S. Equine INdustry

1. Inventory on farms and number of farms—Census of Agriculture

The Census of Agriculture has reported equine inventory numbers about every 5 years since 1850. Table A.1 shows inventory numbers from 1850 to 1920 at 10-year intervals and 5-year intervals thereafter. The Census of Agriculture aggregates and reports data from all places that qualify as a farm. The current definition of a farm, first used in 1974, is a place that could or did sell $1,000 of agricultural products annually. In addition, as of 1993 any operation that has five or more equids (other than commercial enterprises such as race tracks) qualifies as a farm, even if it has no other agricultural activity.

The total number of equids on farms can be derived by combining the reported Census inventories for horses and ponies with the inventories for mules, burros, and donkeys—with the exception of 1959 when the numbers were combined and reported under the "Horses and Ponies" category. However, the total number of farms with any equids cannot be similarly derived, as a given farm could have had more than one type of equid. Therefore, table A.1 does not provide the number of farms with equids.

Total equids increased rapidly from 4.9 million head in 1850 to a peak of 25.3 million head in 1920. Inventories thereafter mostly declined until 2002 and increased from 2002 to 2007. The number of equids then declined from 2007 to 2012. There were 3.9 million equids on farms in the United States in 2012, about three-fourths of the 4.9 million reported in 1850.

Horse and pony numbers peaked in 1910 at 19.8 million head. It is likely that the number of horses and ponies in the United States declined rapidly during the 1920s and 1930s because motorized vehicles replaced them as a means of transportation and field work. By 1950, the number of horses and ponies was only about one-third of what it was in 1925. The decline continued until the low of 1.6 million head in 1974.

There have always been fewer mules, burros, and donkeys than horses and ponies in the United States. The number of mules, donkeys, and burros peaked in 1925 at 5.7 million head, one-third the number of horses and ponies. The number of mules, burros, and donkeys declined rapidly in the late 1950s and 1960s to 66,124 head in 1969. In 2012, there were 292,590 mules, burros, and donkeys, almost three times the number in 2002.

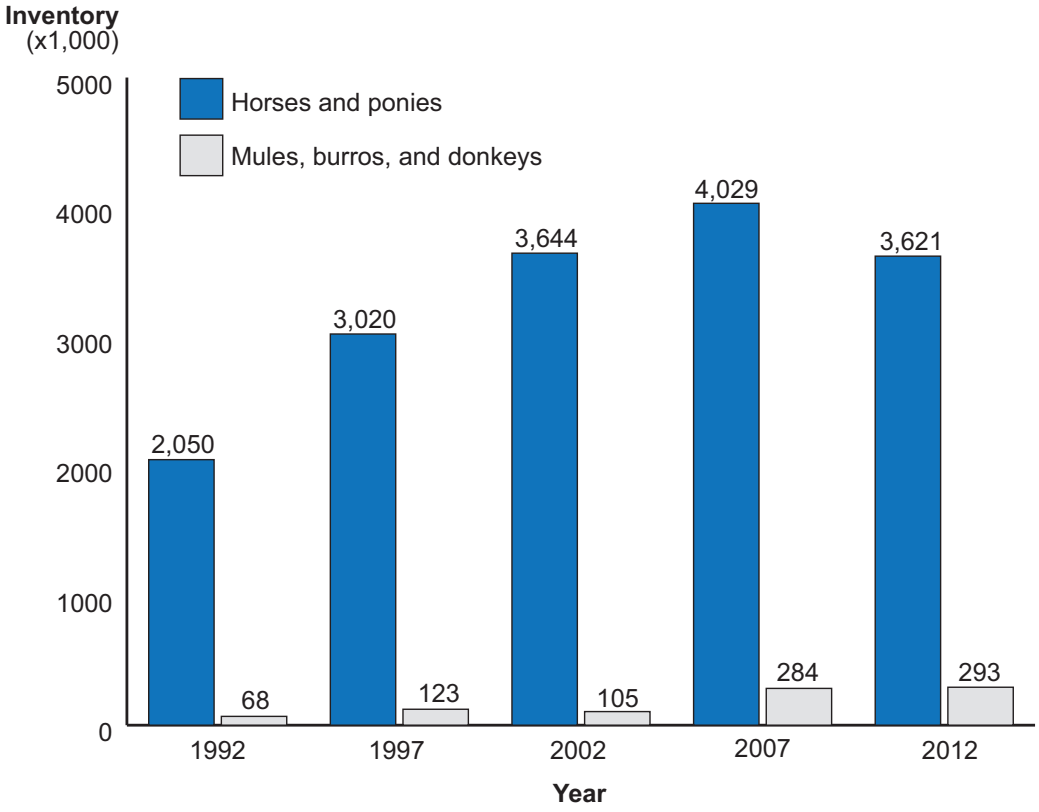
Interestingly, in 2012 the number of horses and ponies per farm (7.2 head) was at an all-time high.

A.1. Changes in U.S. equine inventory, 1850–2012:

Year/month	Horses and Ponies			Mules, Burros, and Donkeys				
	Total inventory	Number of farms	Avg. per farm	Total inventory	Number of farms	Avg. per farm	Total equine inventory	Pct. of 1850
1850 (June 1)	4,336,719	NA	NA	559,331	NA	NA	4,896,050	100.0
1860 (June 1)	6,249,174	NA	NA	1,151,148	NA	NA	7,400,322	151.1
1870 (June 1)	7,145,370	NA	NA	1,125,415	NA	NA	8,270,785	168.9
1880 (June 1)	10,357,488	NA	NA	1,812,808	NA	NA	12,170,296	248.6
1890 (June 1)	15,266,244	NA	NA	2,251,876[2]	NA	NA	17,518,120	357.8
1900 (June 1)	18,267,020	4,530,628	4.0	3,264,615[2]	1,480,652[2]	2.2	21,531,635[2]	439.8
1910 (Apr. 15)	19,833,113	4,692,814	4.2	4,209,769[2]	1,869,005[2]	2.3	24,042,882[2]	491.1
1920 (Jan. 1)	19,767,161	4,704,235	4.2	5,432,391[2]	2,259,746[2]	2.4	25,199,552[2]	514.7
1925 (Jan. 1)	16,400,623	5,365,513	3.1	5,680,897[2]	NA	NA	22,081,520[2]	451.0
1930 (Apr. 1)	13,510,839	5,024,713	2.7	5,375,017[2]	NA	NA	18,885,856[2]	385.7
1935 (Jan. 1)	11,857,850	3,536,597	3.4	4,818,160[2]	2,255,845[2]	2.1	16,676,010[2]	340.6
1940 (Apr. 1)	10,086,971	3,148,656	3.2	3,844,560[2]	1,845,517[2]	2.1	13,931,531[2]	284.5
1945 (Jan. 1)	8,499,204	2,828,412	3.0	3,129,590[2]	1,486,209[2]	2.1	11,628,794[2]	237.5
1950 (Apr. 1)	5,401,646	2,120,843	2.5	2,202,264[2]	1,101,799[2]	2.0	7,603,910[2]	155.3
1954 (Oct.–Nov)	4,141,288[1]	1,799,899[1]	2.3	NA	NA	NA	4,141,288[1]	84.6
1959 (Oct.–Nov.)	2,955,256[1]	1,138,986[1]	2.6	NA	NA	NA	2,955,256[1]	60.4
1964 (Nov.–Dec.)	NA	NA	NA	NA	NA	NA	NA	NA
1969 (Dec. 31)	2,237,981	547,246	4.1	66,128	34,309	1.9	2,304,109	47.1
1974 (Dec. 31)	1,595,640	359,051	4.4	NA	NA	NA	NA	NA
1978 (Dec. 31)	1,957,028	399,335	4.9	56,703	27,631	2.1	2,013,731	41.1
1982 (Dec. 31)	2,260,791	417,042	5.4	27,430	10,431	2.6	2,288,221	46.7
1987 (Dec. 31)	2,456,951	415,565	5.9	56,520	23,311	2.4	2,513,471	51.3
1992 (Dec. 31)	2,049,522	338,346	6.1	67,692	25,589	2.6	2,117,214	43.2
1997* (Dec. 31)	3,020,117	490,517	6.2	123,211	44,096	2.8	3,143,328	64.2
2002* (Dec. 31)	3,644,278	542,223	6.7	105,358	29,936	3.5	3,749,636	76.6
2007 (Dec. 31)	4,028,827	575,942	7.0	283,806	99,746	2.8	4,312,633	88.1
2012 (Dec. 31)	3,621,348	504,795	7.2	292,590	98,379	3.0	3,913,938	79.9

Notes:
1890–1954: Number of mules on farms. Donkeys and burros were excluded.
1940: Horse and pony inventory includes only animals older than 3 months.
1954 and 1959: Horse, pony, and mule inventories reported together.
1964: No equine data.
*1997 and 2002: Census of Agriculture adjusted for incompleteness.
Source: USDA–NASS Census of Agriculture 1997, 2002, 2012; 1850–1992 prepared by Commerce Department U.S. Bureau of the Census.
[1]Farms reporting horses and/or mules in some States.
[2]Excludes burros and donkeys.

Changes in U.S. equine inventory, 1992–2012



Source: USDA–NASS Census of Agriculture.

Photograph courtesty of Josie Traub-Dargatz.

2. State-level inventory on farms and number of farms

A by-State comparison of data from the Census of Agriculture in 2007 and 2012 is presented in the following table. Note that in 2012 Texas had 10.9 percent of the horses and ponies and 12.7 percent of equine farms in the United States, with 395,816 head reported on 64,114 farms. The next States with the most horses and ponies were Oklahoma (158,918), California (142,555), and Kentucky (141,842). Texas had 21.3 percent of the U.S. mules, burros, and donkeys. Note also that this table identifies the 28 States in the NAHMS equine studies for which in-depth health and management practice trends are discussed in section III of this report.

A.2. Changes in equine inventories and number of farms with equids, by State, 2007 and 2012:

	Inventory—Animals on Farms (x1,000)						**Number of Farms with Equids** (x1,000)			
	Horses and ponies		**Mules, burros, and donkeys**		**All equids**		**Horses and ponies**		**Mules, burros, and donkeys**	
State	**2007**	**2012**	**2007**	**2012**	**2007**	**2012**	**2007**	**2012**	**2007**	**2012**
Alabama[1,2]	87.1	63.7	10.8	11.4	97.9	75.1	12.4	9.9	3.3	3.3
Alaska	2.3	1.6	0.1	0.1	2.4	1.6	0.2	0.2	0.0	0.0
Arizona[1]	68.7	92.4	2.0	3.0	70.7	95.4	9.0	11.3	0.8	1.2
Arkansas[1]	79.0	61.1	7.7	8.2	86.7	69.3	13.0	10.8	2.8	2.8
California[1,2]	180.7	142.6	7.2	6.7	187.9	149.3	20.3	14.9	2.5	2.1
Colorado[1,2]	119.0	110.4	5.0	5.9	124.0	116.3	14.7	14.2	1.9	2.0
Connecticut[1]	11.5	17.4	0.4	0.8	11.9	18.2	1.3	1.6	0.2	0.3
Delaware[1]	4.0	6.2	0.1	0.1	4.1	6.3	0.5	0.7	0.0	0.1
Florida[1,2]	120.6	121.0	6.2	8.6	126.8	129.7	13.8	13.8	2.3	3.0
Georgia[2]	76.7	69.9	9.0	8.9	85.7	78.7	11.9	9.5	3.2	3.1
Hawaii	6.5	5.1	0.3	0.4	6.8	5.5	0.8	0.7	0.1	.01
Idaho	74.0	61.4	3.8	3.9	77.8	65.3	10.4	9.0	1.3	1.2
Illinois[2]	79.5	62.7	4.4	3.8	83.9	66.5	11.8	8.4	1.7	1.3
Indiana[2]	81.2	97.4	4.4	5.1	85.6	102.5	12.3	13.7	1.5	1.6
Iowa	72.0	62.2	4.2	4.3	76.2	66.5	10.6	9.6	1.3	1.2
Kansas[1,2]	90.0	74.9	4.5	3.9	94.4	78.8	14.0	10.7	1.7	1.4
Kentucky[1,2]	175.5	141.8	11.8	12.6	187.3	154.5	22.2	19.0	4.2	4.3
Louisiana[2]	60.5	59.8	4.8	6.6	65.3	66.4	9.0	8.4	1.5	1.9
Maine	12.2	12.0	0.4	0.4	12.6	12.4	2.0	1.7	0.2	0.2
Maryland[1,2]	30.7	28.7	1.1	1.2	31.8	29.8	3.2	3.3	0.5	0.5
Massachusetts[1]	20.6	20.3	1.0	0.7	21.6	21.0	2.4	1.8	0.4	0.3
Michigan[1,2]	101.1	88.0	4.4	4.2	105.5	92.2	14.6	12.4	1.6	1.5
Minnesota[2]	90.1	66.4	3.7	3.2	93.8	69.6	13.0	9.5	1.4	1.2
Mississippi	65.3	58.7	7.0	8.3	72.3	67.0	10.0	8.8	2.4	2.5
Missouri[1,2]	149.2	117.3	12.0	10.3	161.2	127.6	24.5	19.8	4.1	3.6

continued→

A.2. Changes in equine inventories and number of farms with equids, by State, 2007 and 2012 (cont'd):

	Inventory—Animals on Farms (x1,000)						**Number of Farms with Equids** (x1,000)			
	Horses and ponies		**Mules, burros, and donkeys**		**All equids**		**Horses and ponies**		**Mules, burros, and donkeys**	
	2007	**2012**	**2007**	**2012**	**2007**	**2012**	**2007**	**2012**	**2007**	**2012**
Montana[1,2]	105.2	97.9	4.4	4.6	109.6	102.5	12.8	12.0	1.4	1.4
Nebraska	65.6	64.3	2.8	3.5	68.4	67.9	10.2	9.1	1.0	1.0
Nevada	18.4	22.5	0.4	0.5	18.8	23.0	1.9	2.2	0.2	0.2
New Hampshire	9.9	9.1	0.7	0.4	10.6	9.5	1.3	1.0	0.2	0.2
New Jersey[1,2]	30.1	27.7	1.2	1.0	31.3	28.6	3.0	3.1	0.4	0.4
New Mexico[2]	53.6	50.7	1.9	1.9	55.5	52.6	9.3	7.6	0.8	0.8
New York[1,2]	85.0	90.2	2.8	3.4	87.8	93.6	11.4	10.2	1.2	1.2
North Carolina[1]	78.4	66.9	8.5	9.1	86.9	76.0	13.0	10.3	3.1	3.0
North Dakota	44.8	45.3	0.8	1.1	45.6	46.4	5.9	5.4	0.4	0.4
Ohio[1,2]	119.2	114.1	6.6	7.0	125.8	121.1	18.3	16.3	2.4	2.4
Oklahoma[1,2]	165.6	158.9	13.3	13.5	178.9	172.4	26.4	24.0	4.8	4.8
Oregon[1,2]	89.4	70.4	4.8	3.7	94.2	74.2	13.0	9.7	1.8	1.4
Pennsylvania[1,2]	116.3	119.9	9.8	9.6	126.1	129.5	17.8	16.4	2.6	2.7
Rhode Island[1]	3.5	2.4	0.1	0.1	3.6	2.5	0.4	0.3	0.0	0.0
South Carolina	43.3	52.4	4.6	5.4	47.9	57.8	6.4	7.2	1.6	1.8
South Dakota	70.2	68.9	1.8	1.6	72.0	70.5	8.1	6.5	0.7	0.6
Tennessee[1,2]	142.0	96.5	18.4	15.5	160.4	112.0	21.9	16.1	6.3	5.1
Texas[1,2]	438.8	395.8	60.8	62.5	499.6	458.3	70.7	64.1	21.1	21.3
Utah	59.8	59.0	1.9	2.8	61.7	61.8	8.4	7.7	0.7	0.7
Vermont	13.3	11.7	1.0	1.2	14.3	12.9	1.8	1.4	0.2	0.2
Virginia[1,2]	90.4	86.8	6.7	6.9	97.1	93.8	13.5	12.1	2.5	2.6
Washington[2]	89.7	64.6	4.0	3.6	93.7	68.2	11.0	9.9	1.3	1.3
West Virginia	37.7	26.5	2.7	2.9	40.4	29.3	7.0	5.3	1.1	1.2
Wisconsin[1,2]	120.0	103.5	5.7	5.7	125.7	109.2	18.7	17.1	2.3	2.4
Wyoming[1,2]	80.5	72.5	2.2	2.6	82.7	75.0	6.1	6.2	0.7	0.8
Total[1,3] (28 States)	2,902.1	2,589.3	219.5	222.8	3,121.7	2,812.1	412.9	362.1	76.9	75.6
Total[3] (50 States)	4,028.8	3,621.4	283.8	292.6	4,313.0	3,913.9	575.9	504.8	99.7	98.4

[1]States participating in NAHMS Equine 2015 study.

[2]States participating in NAHMS Equine '98 and Equine 2005.

[3]Sum may not equal total because of rounding.

Source: USDA–NASS Census of Agriculture. Values of 0.0=fewer than 50 reported.

3. Value of U.S. livestock live-animal exports, 2006–15

From 2006 through 2015, the value of U.S. live-animal exports ranged from a low of $634 million in 2015 to $1,096 million in 2012, a 73-percent differential. While the value of equids exported also fluctuated, the fluctuation on a percentage basis was less—44 percent ($346 million in 2011 to $497 million in 2006). In terms of export value, as measured in dollars, equids dominate the live-animal total. With the exception of 2011, equids were the top live-animal export from 2006 to 2015, and, for 7 of the 10 years, equids represented over half the live-animal export value. In addition to the exports recorded here, some U.S. equids are temporarily transported to other countries for breeding and competition reasons; reliable estimates of temporary shipments were unavailable.

A.4. U.S. exports of live animals, 2006–15:

	Export Value (x$1,000)						
Year	**Equids[1]**	**Swine**	**Cattle[2]**	**Poultry**	**Sheep & goats[3]**	**Total value**	**Equids as % of total value**
2006	497,095	25,080	26,481	122,311	9,900	680,867	73.0
2007	419,078	19,443	47,988	150,012	8,745	645,266	64.9
2008	439,211	27,852	108,147	173,809	12,628	761,647	57.7
2009	469,018	9,563	58,793	174,699	10,742	722,815	64.9
2010	404,001	8,629	132,716	176,833	11,224	733,403	55.1
2011	345,576	24,129	378,401	198,052	4,895	951,053	36.3
2012	455,642	33,358	402,932	198,755	4,838	1,095,525	41.6
2013	369,058	30,506	280,404	202,644	5,678	888,290	41.5
2014	455,059	12,741	149,901	221,091	5,575	844,367	53.9
2015	362,688	16,867	98,666	152,391	2,906	633,518	57.2

Source: USDA, Foreign Agricultural Service, Global Agricultural Trade System https://apps.fas.usda.gov/GATS/default.aspx

[1]Horses for breeding: other horses, asses, mules.

[2]Beef cattle: breeding bulls, breeding females. Dairy cattle: breeding bulls, breeding females, “other cattle.”

[3]Not included with sheep in NAHMS Equine 2005, “Part II: Changes in the U.S. Equine Industry 1998–2005” report.

Section II: Management and Health Changes in the U.S. Equine Industry, 1998–2015

One objective of the Equine 2015 study was to estimate trends in equine health and management practices. This section is devoted to comparisons of study findings in 1998, 2005, and 2015.

A. Background

NAHMS' first national study of the U.S. equine industry, Equine '98, was based on selection criteria to represent any equine operation with 1 or more equids in 28 States; the sample provided 2,758 operations that completed the phase I study questionnaire. The 28-State target population represented 78.2 percent of U.S. horses and ponies and 78.0 percent of farms with horses and ponies.

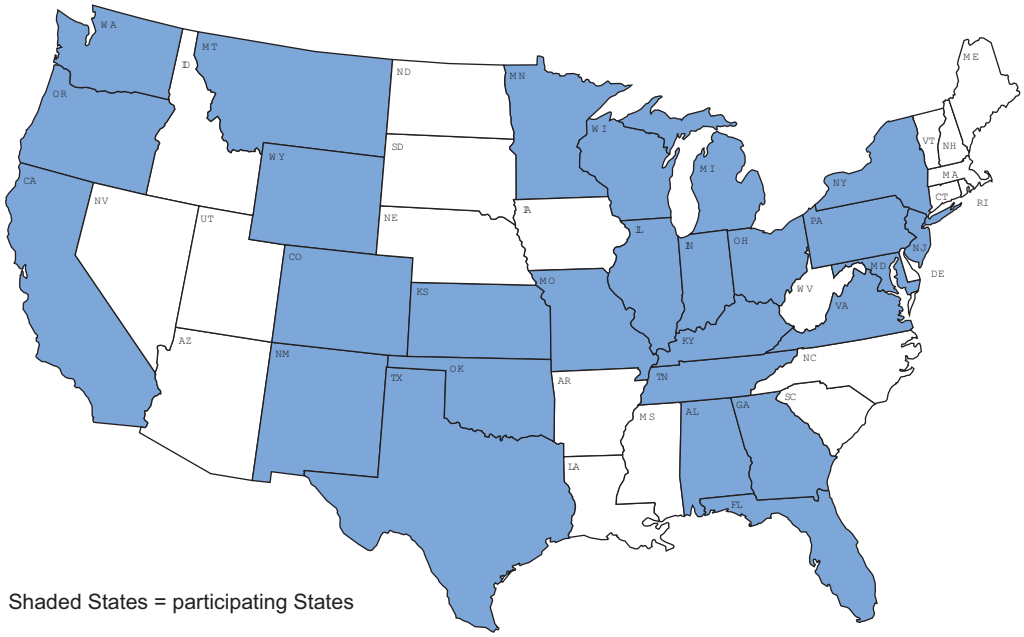
Equine 2005 focused on equine operations with 5 or more equids from the same 28 States included in the Equine '98 study. The sample provided 2,893 operations that completed the study questionnaire. The 28-State target population represented 78.0 percent of equids and 78.6 percent of operations with 5 or more equids in the United States.

Equine 2015, like Equine 2005, focused on equine operations with five or more equids. Twenty of the 28 States included in Equine 2015 also participated in the Equine '98 and Equine 2005 studies. The 28-State target population represented 71.8 percent of equids and 71.6 percent of equids on farms with five or more equids. These States accounted for 72.1 percent of farms with any equids and 70.9 percent of farms with five or more equids. The sample for Equine 2015 provided 1,920 operations that completed the phase I questionnaire.

To evaluate changes and trends, the data used to generate estimates based on the Equine '98 study were re-analyzed to represent operations with five or more equids present on January 1, 1998. The U.S. equine population is difficult to enumerate because of the diversity of the equine industry, the geographic breadth of the equine population, and the suburban areas not included in the traditional livestock enumeration. In addition, interpreting changes in estimates from three national studies conducted in 1998, 2005, and 2015 is difficult and may be speculative in nature. Differences observed in the factors could be true secular time trends in the equine industry or be due to changes in question wording or random variation. These differences are discussed here to aid in interpretation.

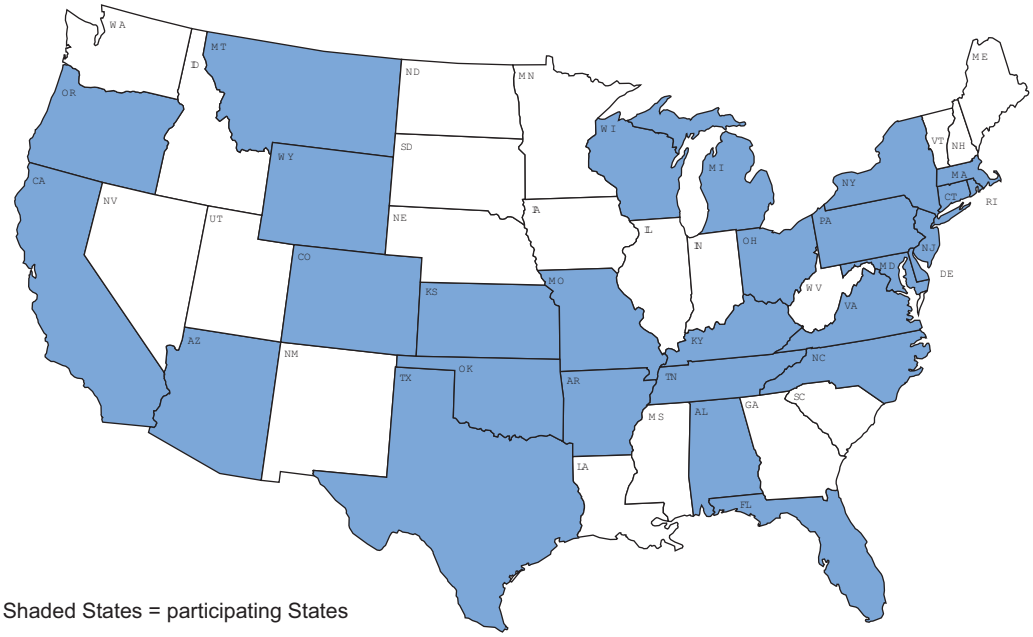
Most data are owner reported and may vary according to recollection, quality of health records, and consistency of the interpretation of questions. These concerns are minimized by extensively training interviewers, pretesting all questionnaires, encouraging respondents to consult their records, and validating data.

Equine ‘98 and 2005 participating States



Shaded States = participating States

Equine 2015 participating States



Shaded States = participating States

B. General

Note: Where appropriate, column or row totals are shown as 100.0 to aid in interpretation; however, estimates may not sum to 100.0 due to rounding.

1. Primary function of operations

The percentage of operations with a primary function of equine boarding stable/training was higher in 1998 and 2015 than in 2005 (10.0, 9.3, and 5.9 percent, respectively). The percentage of operations with a primary function of farm/ranch was lower in 1998 than in 2005 and 2015. In 2005 and 2015, the selection of operations was based on operations that had five or more equids per the National Agricultural Statistics Service (NASS) list frame and met the NASS definition of a farm, which may explain the higher percentage of operations in 2005 and 2015 with a primary function of farm/ranch. The NASS definition of a farm is a place that could or did sell $1,000 of agricultural products annually.

The percentage of operations with a primary function of breeding farm decreased from 15.1 percent in 1998 to 7.6 percent in 2015, which may correlate with the decline in equine population from 2007 to 2012 (table A.1).

B.1. Percentage of operations by primary function of operation:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Primary function	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Equine boarding stable/training[1]	10.0	(1.4)	5.9	(0.4)	9.3	(0.6)
Equine breeding farm	15.1	(1.7)	14.4	(0.7)	7.6	(0.7)
Farm/ranch	30.1	(2.3)	40.3	(1.0)	39.5	(1.3)
Residence with equids for personal use (show, pleasure, etc.)	38.3	(2.7)	37.0	(1.0)	38.8	(1.3)
Other	6.5[2]	(1.2)	2.4[3]	(0.3)	4.8[4]	(0.5)
Total	100.0		100.0		100.0	

[1]1998 choices: Boarding stable only, training facility only, and boarding stable/training.
[2]Includes outfitter, carriage service operation, lesson/horses for teaching operation.
[3]Includes riding stable, guest ranch, motion picture facility, party service facility, sanctuary, and carriage service operation.
[4]Includes riding stable, rescue/rehabilitation facility, guest ranch, and other.

2. Primary use of equids

In 1998, 2005, and 2015, nearly half of operations (46.1, 45.7, and 47.2 percent, respectively) used equids primarily for pleasure, and about one-fifth to one-fourth used equids primarily for farm/ranch work (18.7, 24.8, and 25.0 percent, respectively). The percentage of operations that had equids primarily for racing decreased from 4.6 percent in 1998 to 1.4 percent in 2005 and was 1.6 percent in 2015 (horses housed at race tracks were not included in the NAHMS equine health studies). The 1998 study did not include a "lessons/school" category, which may account for the lower percentage of operations in the "other" category in 2005 and 2015 than in 1998. In 1998 and 2005, "retired, not in use" was not offered as a choice. The percentage of operations that primarily used equids for breeding was lower in 2015 than in 1998 and 2005, which may correlate with a decline in the equine population from 2007 to 2012 (table A.1).

B.2. Percentage of operations by primary use of equids:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Primary use	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Pleasure	46.1	(2.6)	45.7	(1.0)	47.2	(1.3)
Lessons/school	NA		1.4	(0.2)	3.2	(0.4)
Show/competition (not betting)	10.4	(1.5)	9.6	(0.6)	8.1	(0.7)
Breeding	15.8	(1.8)	15.9	(0.7)	8.5	(0.7)
Racing	4.6	(1.1)	1.4	(0.2)	1.6	(0.3)
Farm/ranch work	18.7	(1.9)	24.8	(0.9)	25.0	(1.1)
Retired, not in use*	NA		NA		4.7	(0.6)
Other	4.4	(0.9)	1.2	(0.2)	1.8	(0.3)
Total	100.0		100.0		100.0	

*In 1998 and 2005, Retired, not in use was not offered as a choice.

3. Size of operation

Large operations made up a higher percentage of all equid operations in 1998 and 2015 than in 2005. Small operations made up the majority of all operations in each study year.

B.3.a. Percentage of operations by size of operation:

	Percent Operations					
	Equine '98[1]		Equine 2005		Equine 2015	
Size of operation[2] (number of resident equids)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (5 to 9)	63.1	(2.4)	66.1	(0.8)	67.3	(1.0)
Medium (10 to 19)	23.7	(2.2)	26.1	(0.8)	21.6	(1.0)
Large (20 or more)	13.2	(1.4)	7.8	(0.3)	11.1	(0.5)
Total	100.0		100.0		100.0	

[1]Size of operation based on number of equids present, whether resident or not.

[2]See Terms Used in This Report for details on size of operation.

The percentage of equids on large operations was similar in 1998 and 2015 (39.4 and 41.9 percent, respectively), but lower in 2005 (29.7 percent). Over half of all equids resided on operations with 10 or more equids in 1998, 2005, and 2015.

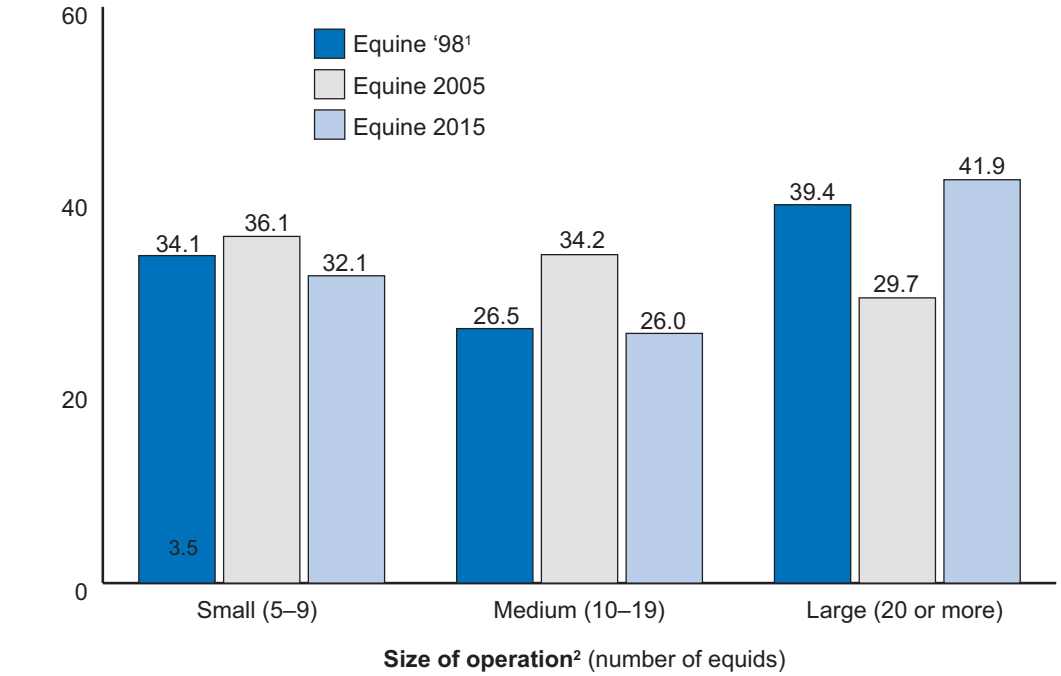
B.3.b. Percentage of equids by size of operation:

	Percent Equids					
	Equine '98[1]		Equine 2005		Equine 2015	
Size of operation[2] (number of resident equids)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (5 to 9)	34.1	(2.2)	36.1	(0.8)	32.1	(1.1)
Medium (10 to 19)	26.5	(2.4)	34.2	(1.0)	26.0	(1.2)
Large (20 or more)	39.4	(2.6)	29.7	(1.1)	41.9	(1.6)
Total	100.0		100.0		100.0	

[1]Size of operation based on number of equids present, whether resident or not.

[2]See Terms Used in This Report for details on size of operation.

Percentage of equids by size of operation



[1]Size of operation based on number of equids present, whether resident or not.
[2]See Terms Used in This Report for details on size of operation.

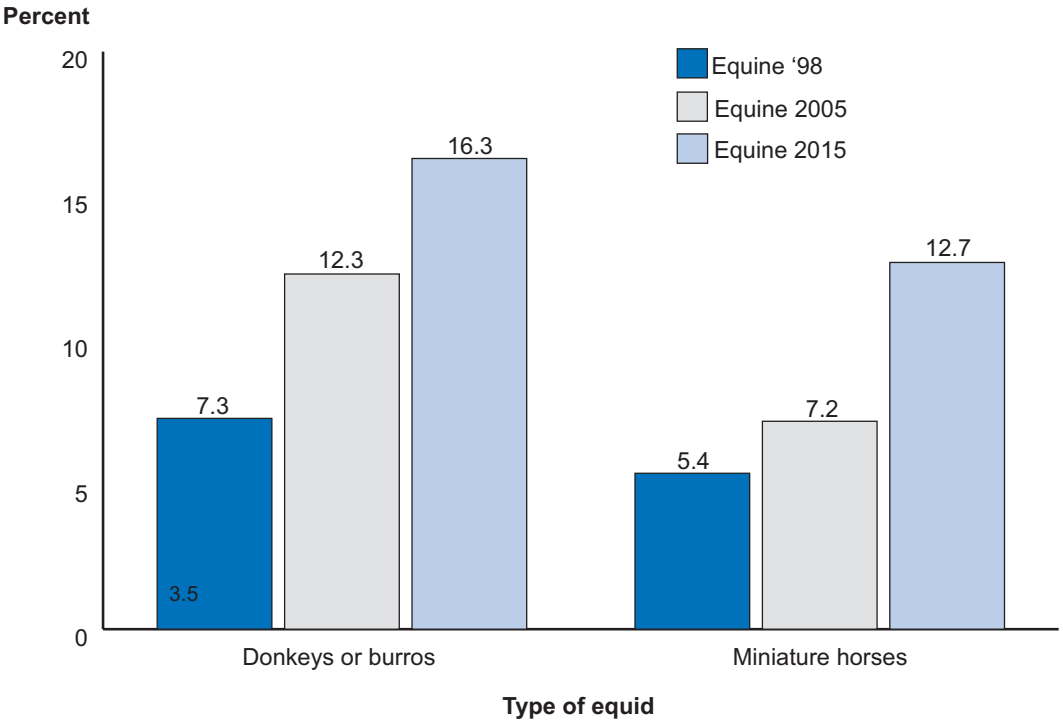
4. Type of equid

In all three study years, over 90 percent of operations had full-sized resident horses. A higher percentage of operations had resident donkeys or burros in 2005 and 2015 than in 1998. A higher percentage of operations had miniature horses in 2015 (12.7 percent) than in 1998 (5.4 percent) or 2005 (7.2 percent).

B.4.a. Percentage of operations by type of resident equid:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Type of resident equid	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Donkeys or burros	7.3	(1.4)	12.3	(0.7)	16.3	(1.0)
Mules	9.5	(1.4)	7.8	(0.5)	7.7	(0.6)
Ponies	18.2	(1.8)	15.3	(0.7)	16.1	(0.8)
Miniature horses	5.4	(1.0)	7.2	(0.5)	12.7	(0.8)
Horses (excluding miniature horses)	98.3	(0.5)	95.7	(0.4)	93.8	(0.7)
Other equids	0.2	(0.1)	0.2	(0.1)	0.1	(0.1)

Percentage of operations that had resident donkeys or burros and percentage that had miniature horses



The percentages of all resident equids represented by donkeys or burros and miniature horses were higher in 2005 and 2015 compared with 1998. This finding may be due to the increased popularity of these animals or a difference in the studies' population samples. For example, in 1998 the list of potential operations used to select participating operations included any operation with one or more equids; the list was the combination of a list and area frame (see Methodology). In 2005 and 2015, the list used for selection was based on the Census of Agriculture and operations with five or more equids.

B.4.b. Percentage of resident equids by type of equid:

	Percent Resident Equids					
	Equine '98		Equine 2005		Equine 2015	
Type of equid	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Donkeys or burros	2.1	(0.5)	3.8	(0.3)	4.5	(0.4)
Mules	2.2	(0.4)	2.4	(0.2)	2.0	(0.2)
Ponies	4.8	(0.7)	3.4	(0.2)	3.4	(0.2)
Miniature horses	1.9	(0.4)	3.6	(0.3)	4.6	(0.5)
Horses (excluding miniature horses)	89.0	(1.0)	86.7	(0.5)	85.5	(0.7)
Other equids	0.0	(0.0)	0.1	(0.0)	0.0	(0.0)
Total	100.0		100.0		100.0	

5. Age of resident equids

The percentage of resident equids 20 years of age or older increased from 5.6 percent of equids in 1998 to 11.4 percent in 2015, while the percentage of equids less than 5 years of age decreased from 37.6 percent in 1998 to 22.9 percent in 2015. These findings suggest an aging equine population with fewer foals born in 2015 than in previous study years.

B.5. Percentage of resident equids by age:

	Percent Resident Equids					
	Equine '98		Equine 2005		Equine 2015	
Age	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Birth to 30 days	6.8	(0.5)	0.8	(0.1)	1.4	(0.1)
31 days but less than 6 months			7.4	(0.3)	2.9	(0.3)
6 months to less than 5 years	30.8	(1.2)	27.5	(0.5)	18.6	(0.7)
5 years to less than 20 years	55.4	(1.2)	56.7	(0.5)	65.6	(0.8)
20 years to less than 30 years	5.6[1]	(0.5)	6.9	(0.3)	9.9	(0.4)
30 years or older			0.7	(0.1)	1.5	(0.2)
Unknown[2]	1.4	(0.6)	NA		NA	
Total	100.0		100.0		100.0	

[1]The age category in 1998 was 20 or more years for the oldest age option.

[2]Unknown age was not offered as an option to respondents in 2005 and 2015.

6. Identification method

The methods of equid identification (ID) were not mutually exclusive, as more than one form of ID could be used on an operation or on the same equid. Certain forms of ID are unique to a given equid, such as a tattoo on the upper lip (used to identify horses for racing), a permanent brand inspection card, registration papers, Coggins papers, and a microchip. In 1998 and 2005, the question was how many resident equids were uniquely identified with the following identification methods (each equid has a different ID; no two equids have the same ID). In 2015, the question was how many resident equids had the following type(s) of identification.

A similar percentage of operations used a microchip as an equine ID method in 1998, 2005, and 2015. A higher percentage of operations in 2015 indicated the use of hot-iron brand or freeze brand than in 2005. This finding could be due to a difference in the question asked or to a real increase in the use of these equine ID methods. A lower percentage of operations used a tattoo as a means of equine ID in 2005 and 2015 compared with 1998. This likely reflects a lower percentage of equids used for racing. Historically, in most racing jurisdictions, a lip tattoo has been required for horses before they can compete.

B.6.a. Percentage of operations by type of ID used for resident equids:

	Percent Operations					
	Equine '98[1]		Equine 2005[1]		Equine 2015[2]	
ID type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Hot-iron brand	13.9	(1.4)	12.2	(0.6)	18.3	(1.0)
Freeze brand	10.7	(1.3)	13.8	(0.7)	20.3	(1.0)
Microchip	2.1	(0.8)	3.1	(0.3)	3.4	(0.4)
Tattoo	20.8	(2.1)	11.7	(0.6)	12.8	(0.8)
Permanent brand inspection (card with markings indicated or sketch)	6.9	(1.1)	7.5	(0.5)	9.6	(0.7)
Registration papers[3]	57.0	(2.6)	61.7	(1.0)	57.5	(1.3)
Coggins test papers (laboratory test results)	NA		40.0	(1.0)	42.2	(1.3)
Halters or collars with name or number	3.9	(0.8)	4.1	(0.4)	6.5	(0.6)
DNA (blood or hair)	NA		NA		17.8	(1.0)
Passport	NA		1.1	(0.2)	2.3	(0.3)
Other ID	4.8	(0.9)	3.9	(0.4)	3.3	(0.4)

[1]Unique equine ID for 1998 and 2005 studies was defined as "each equid has a different ID; no two equids have the same ID."

[2]In 2015, the question asked how many resident equids had the listed forms of ID.

[3]In 1998, category was photograph, sketch, or registration papers instead of just registration papers.

A higher percentage of resident equids had a freeze brand in 2015 than in 1998. This finding could be due to differences in question format in 2015 or because this form of ID was used more in 2015 than in 1998. The percentages of resident equids with a microchip or registration papers were similar across the three studies, when the standard errors are considered.

B.6.b. Percentage of resident equids with the following type(s) of ID.

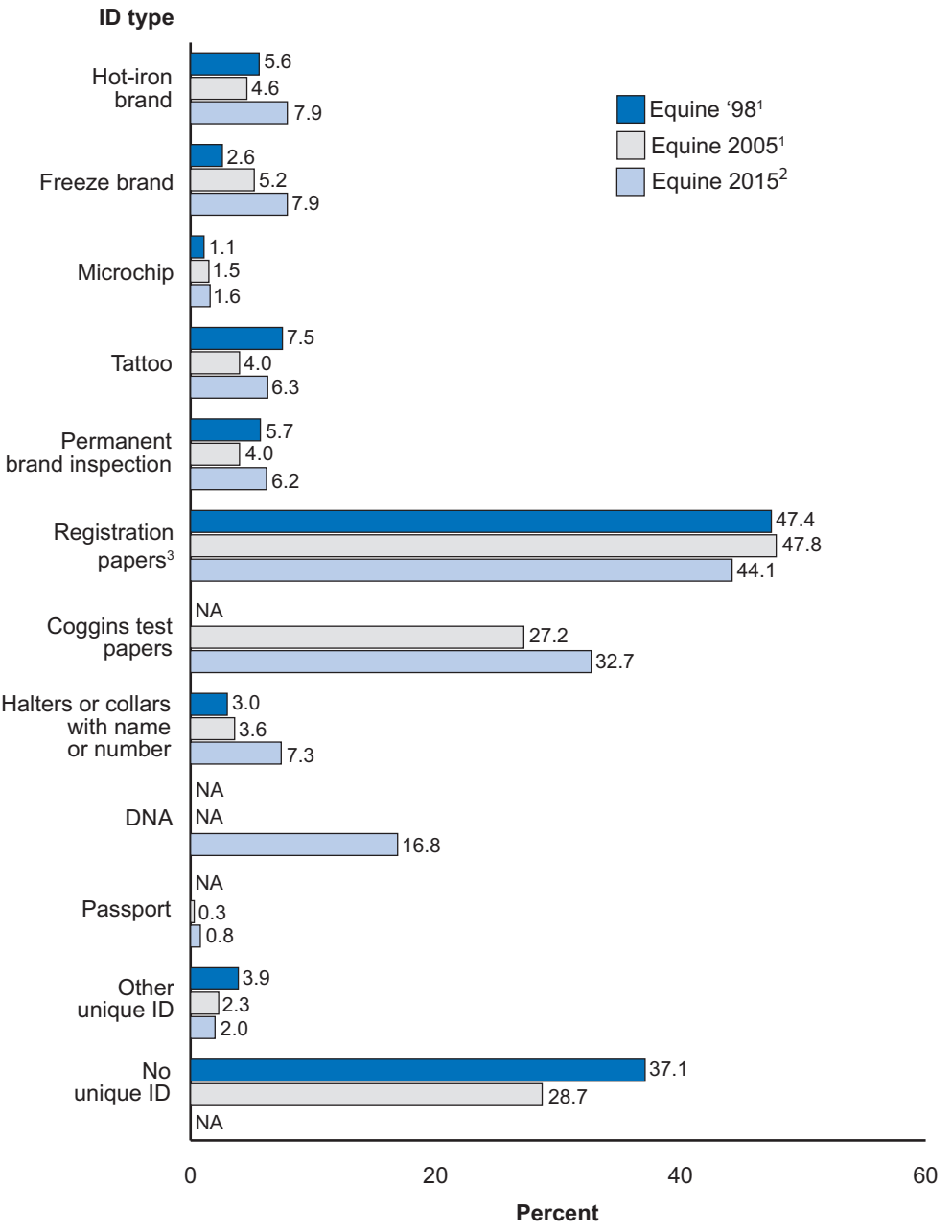
	Percent Resident Equids					
	Equine '98[1]		Equine 2005[1]		Equine 2015[2]	
ID type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Hot-iron brand	5.6	(0.9)	4.6	(0.4)	7.9	(0.8)
Freeze brand	2.6	(0.4)	5.2	(0.5)	7.9	(0.8)
Microchip	1.1	(0.4)	1.5	(0.2)	1.6	(0.3)
Tattoo	7.5	(0.9)	4.0	(0.3)	6.3	(0.7)
Permanent brand inspection (card with markings indicated or sketch)	5.7	(1.1)	4.0	(0.3)	6.2	(0.6)
Registration papers[3]	47.4	(2.3)	47.8	(1.0)	44.1	(1.5)
Coggins test papers (laboratory test results)	NA		27.2	(0.8)	32.7	(1.2)
Halters or collars with name or number	3.0	(0.5)	3.6	(0.4)	7.3	(1.0)
DNA (blood or hair)	NA		NA		16.8	(1.8)
Passport	NA		0.3	(0.1)	0.8	(0.2)
Other unique ID	3.9	(0.9)	2.3	(0.3)	2.0	(0.3)
No unique ID	37.1	(2.1)	28.7	(0.8)	NA	

[1]Unique equine ID for the 1998 and 2005 studies was defined as "each equid has a different ID; no two equids have the same ID."

[2]In 2015, the question asked how many resident equids had the listed forms of ID.

[3]In 1998, category was photograph, sketch, or registration papers instead of just registration papers.

Percentage of resident equids with the following type(s) of ID



[1]Unique equine ID for 1998 and 2005 studies was defined as "each equid has a different ID: no two equids have the same ID."
[2]In 2015, the question asked how many resident equids had the listed forms of ID.
[3]In 1998, category was photograph, sketch, or registration papers instead of just registraiton papers.

C. Health and Health Management

1. Primary method of recording equine health information

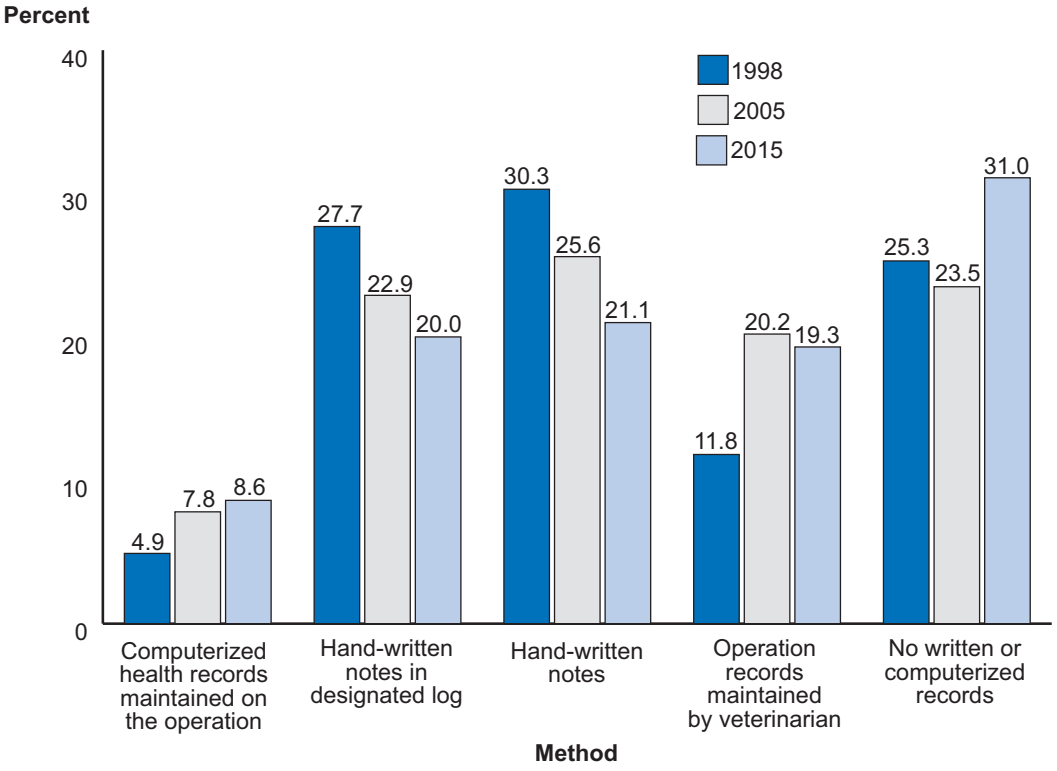
Recording equine health information such as vaccination, deworming, and health events is an important part of equine management, especially on operations with multiple equids.

The percentage of operations that used computerized records as the primary method of recording equine health information was slightly higher in 2005 and 2015 than in 1998. The percentage of operations that used hand-written notes in a designated log or on a calendar or checkbook declined from 58.0 percent in 1998 to 41.1 percent in 2015. The percentage of operations with no written or computerized equine health records was higher in 2015 (31.0 percent) than in 1998 (25.3 percent).

C.1. Percentage of operations by primary method of recording equine health information:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Primary method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Computerized health records maintained on the operation	4.9	(0.9)	7.8	(0.5)	8.6	(0.7)
Hand-written in designated log (e.g., health card, logbook)	27.7	(2.2)	22.9	(0.9)	20.0	(1.0)
Hand-written notes (e.g., calendar, checkbook)	30.3	(2.2)	25.6	(0.9)	21.1	(1.1)
Operation records maintained by veterinarian	11.8	(1.6)	20.2	(0.9)	19.3	(1.0)
No written or computerized records	25.3	(2.2)	23.5	(0.9)	31.0	(1.2)
Total	100.0		100.0		100.0	

Percentage of operations by primary method of recording equine health information



2. Testing

The percentage of operations that conducted fecal testing for parasites during the previous 12 months was similar in 1998 and 2015 but lower in 2005. The percentages of operations that performed a feed or pasture analysis or a water analysis were similar in 1998, 2005, and 2015.

C.2. Percentage of operations by test(s) performed during the previous 12 months:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Test	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Fecal test for parasites	20.0	(1.8)	13.5	(0.7)	17.5	(0.9)
Feed or pasture analysis	7.9	(1.1)	8.1	(0.5)	9.0	(0.7)
Water analysis	7.5	(1.4)	7.8	(0.5)	5.8	(0.6)

3. Familiarity with EIA

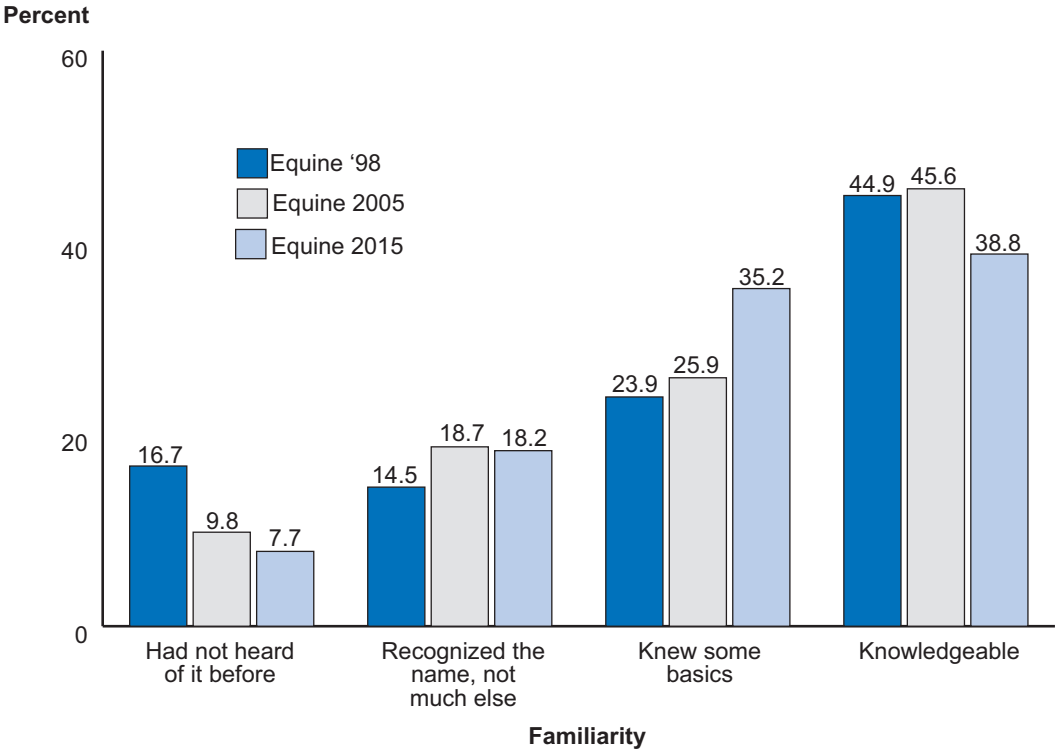
Equine infectious anemia (EIA) is a viral disease of equids. Serologic testing programs for EIA were adopted in 1972 and have resulted in a dramatic decline in the prevalence of EIA in the United States; however, EIA cases still occur every year. Reasons for EIA testing include interstate travel, attending an equine event, private facility policy, signs of disease, and change in ownership.

The percentage of operators that had not heard of EIA decreased from 1998 (16.7 percent) to 2005 (9.8 percent) and 2015 (7.7 percent). USDA–APHIS–Veterinary Services began an educational initiative regarding EIA in 1996, which included an educational video and brochure. It is possible this initiative, along with other EIA educational efforts, improved operators' familiarity with EIA.

C.3. Percentage of operations by operator familiarity with EIA:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Operator familiarity	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Had not heard of it before	16.7	(1.9)	9.8	(0.6)	7.7	(0.7)
Recognized the name, not much else	14.5	(1.6)	18.7	(0.8)	18.2	(1.0)
Knew some basics	23.9	(2.1)	25.9	(0.9)	35.2	(1.3)
Knowledgeable	44.9	(2.7)	45.6	(1.0)	38.8	(1.2)
Total	100.0		100.0		100.0	

Percentage of operations by operator familiarity with EIA



4. EIA testing

The percentage of operations that tested at least one equid for EIA was similar in 1998 and 2005 and slightly lower in 2015. The decrease in 2015 might be due to changes in movement or use of equids; a decrease in the equine population; changes in requirements for testing; or economic factors, such as higher test costs or a decrease in the number of equids changing ownership. More information on EIA is available in appendix II.

C.4.a. Percentage of operations that performed at least one Coggins or other test for EIA during the previous 12 months:

Percent Operations					
Equine '98		Equine 2005		Equine 2015	
Percent	Std. error	Percent	Std. error	Percent	Std. error
58.7	(2.6)	54.1	(1.0)	47.1	(1.3)

The overall percentage of equids tested for EIA was similar in 1998, 2005, and 2015.

C.4.b. Percentage of resident equids tested for EIA on all operations during the previous 12 months:

Percent Resident Equids					
Equine '98		Equine 2005		Equine 2015	
Percent	Std. error	Percent	Std. error	Percent	Std. error
36.6	(2.0)	37.6	(0.8)	36.8	(1.4)

The average cost of testing an equid for EIA increased from 1998 ($22.95) to 2005 ($27.33) to 2015 ($40.77). The increase in cost nearly doubled from 1998 to 2015.

C.4.c. For operations that tested for EIA, average cost per test (including call fee or cost of transportation):

Average Cost per Test					
Equine '98		Equine 2005		Equine 2015	
Dollars	Std. error	Dollars	Std. error	Dollars	Std. error
$22.95	(0.67)	$27.33	(0.59)	$40.77	(1.53)

In all three studies, the highest percentage of operations indicated that the primary reason for EIA testing was to meet a show or event requirement within their State. The percentage of operations on which testing for interstate movement was the primary reason for testing was lower in 2015 than in 1998 and 2005. The percentage of operations that tested primarily for change of ownership within State was lower in 2005 and 2015 than in 1998. Testing for personal knowledge was a primary reason for EIA testing by 12 percent or more of operations in all three studies, while suspicion of disease and international movement were given as primary reasons for testing by less than 1.8 percent of operations.

C.4.d. For operations that tested for EIA, percentage of operations by primary reason for testing:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Primary reason[1]	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Change of ownership within State	14.5	(2.2)	8.2	(0.7)	6.7	(0.9)
Show or event requirement within State	42.2	(3.0)	38.0	(1.3)	38.2	(1.8)
Facility (e.g., boarding, breeding) requirement within State	NA[2]		11.1	(0.8)	9.1	(1.0)
Interstate movement (between two or more States)	21.5	(2.5)	19.2	(1.1)	12.9	(1.2)
Within-State movement other than change of ownership or show/event	NA[3]		NA[3]		9.6	(1.2)
International movement	1.3	(0.6)	0.3	(0.1)	0.5	(0.4)
Personal knowledge	12.1	(1.8)	18.8	(1.1)	13.0	(1.3)
Suspicion of equine illness	1.7	(0.8)	1.0	(0.3)	0.1	(0.1)
Requirement for riding on public land	NA[2]		NA[2]		8.3	(1.0)
Other	6.7	(1.4)	3.4	(0.5)	1.6	(0.5)
Total	100.0		100.0		100.0	

[1]The percentage of operations that replied "other" primary reason was lower in 2015 than in 1998 and 2005 and is likely due to offering additional reasons for testing on the 2015 questionnaire.
[2]Facility requirement not an option in 1998.
[3]Within-State movement other than change of ownership or show/event was not offered as a choice in 1998 and 2005.

5. Vaccinations

The percentages of operations that vaccinated any resident equids during the previous 12 months were similar in 1998 and 2005, but lower in 2015.

C.5.a. Percentage of operations that administered any vaccine to resident equids during the previous 12 months:

Percent Operations					
Equine '98		Equine 2005		Equine 2015	
Percent	Std. error	Percent	Std. error	Percent	Std. error
75.1	(2.4)	75.9	(0.9)	66.7	(1.2)

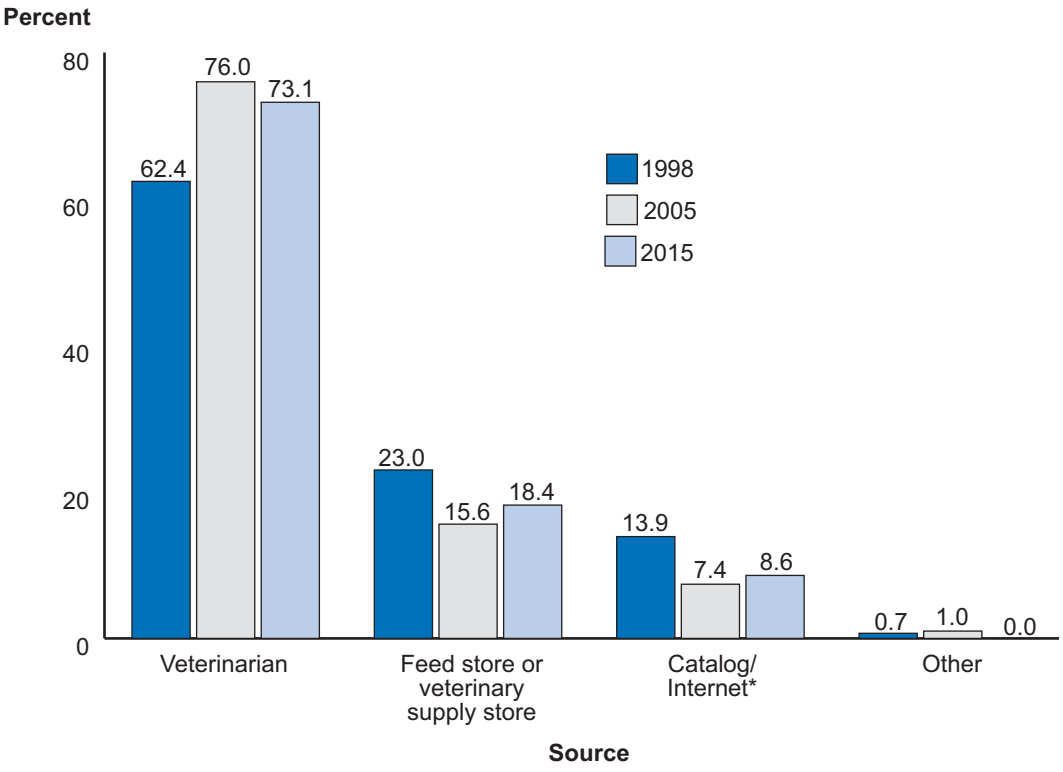
Of operations that administered any vaccine to resident equids, the highest percentage used a veterinarian as the primary source of equine vaccines in 1998, 2005, and 2015. The percentage of operations that used a veterinarian as the primary source of vaccines was higher in 2005 and 2015 than in 1998.

C.5.b. For operations that administered any vaccine to resident equids during the previous 12 months, percentage of operations by primary source of vaccines:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Primary source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Veterinarian	62.4	(2.7)	76.0	(1.0)	73.1	(1.4)
Feed store or veterinary supply store	23.0	(2.2)	15.6	(0.9)	18.4	(1.2)
Catalog/Internet*	13.9	(2.1)	7.4	(0.6)	8.6	(0.9)
Other	0.7	(0.3)	1.0	(0.2)	0.0	(—)
Total	100.0		100.0		100.0	

*In 1998, this category included "catalog" but not "Internet."

For operations that administered any vaccine to resident equids during the previous 12 months, percentage of operations by primary source of vaccines



Of operations that administered any vaccine to resident equids, the percentage that used a veterinarian to administer the majority of vaccines was higher in 2005 and 2015 than in 1998. A lower percentage of operations used their own personnel to administer the majority of vaccines in 2005 (49.4 percent) and 2015 (47.4 percent) than in 1998 (58.3 percent).

C.5.c. For operations that administered any vaccine to resident equids during the previous 12 months, percentage of operations by person who administered the majority of vaccines:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Person	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Veterinarian	40.7	(3.0)	50.3	(1.2)	51.7	(1.6)
Operation personnel (including operator/ equine owner)	58.3	(3.0)	49.4	(1.2)	47.4	(1.6)
Other	1.0	(0.5)	0.3	(0.1)	0.8	(0.3)
Total	100.0		100.0		100.0	

6. Operations by age of equids

Note: The following table is provided to allow for interpretation of subsequent tables related to equine health and deaths.

Nearly all operations across study years had equids over 6 months of age; less than 18 percent of operations in 1998 and 2015 had foals compared with about 35 percent of operations in 2005.

C.6. Percentage of operations by age of equids:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Age (mo)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 6 (foals)	17.5	(1.2)	35.6	(0.9)	15.9	(0.8)
6 or older	99.9	(0.1)	100.0	(0.0)	99.8	(0.1)

7. Foal health

Having an awareness of health events that occur in various equine age groups allows owners to compare their equids' health with national estimates on equine health, while identifying areas in need of research and/or services.

The percentages of operations on which foals were affected by condition(s) in the following table were similar across the three studies for the majority of conditions listed. The percentage of operations that had foals with digestive problems other than colic, such as diarrhea, was lower in 2005 than in 1998.

C.7.a. For operations that had any resident foals less than 6 months of age during the previous 12 months (table C.6), percentage of operations on which foals were affected by the following condition(s):

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Condition	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Colic	2.7	(1.0)	2.8	(0.5)	2.9	(0.8)
Other digestive problems (e.g., diarrhea)	13.1	(2.8)	5.7	(0.7)	7.2	(1.4)
Respiratory problems (e.g., pneumonia, strangles, *Rhodococcus equi,* etc.)	4.8	(1.7)	5.2	(0.7)	4.2	(1.2)
Eye problems	1.9	(0.7)	1.4	(0.3)	2.7	(1.0)
Skin problems	0.7	(0.4)	1.2	(0.3)	1.4	(0.5)
Reproductive tract problems (e.g., hermaphrodite, cryptorchid)	2.0	(1.2)	0.5	(0.2)	0.1	(0.1)
Behavioral problems (e.g., unusual, affects use or safety)	0.1	(0.1)	0.3	(0.2)	0.9	(0.6)
Injury/wounds/trauma	12.5	(2.1)	13.9	(1.1)	10.0	(1.8)
Lameness, leg, or hoof problems (could not be used for intended purpose without treatment)*	3.2	(0.8)	3.6	(0.6)	7.2	(1.6)

continued→

C.7.a. For operations that had any resident foals less than 6 months of age during the previous 12 months (table C.6), percentage of operations on which foals were affected by the following condition(s) [cont'd]:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Condition	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Neurologic problems	0.4	(0.2)	0.4	(0.2)	0.8	(0.4)
Infectious disease unrelated to specific body system (septicemia, blood infection)	0.9	(0.5)	1.6	(0.4)	1.5	(0.5)
Chronic weight loss	1.0	(0.5)	0.2	(0.1)	0.4	(0.2)
Overweight/obese	0.3	(0.3)	0.2	(0.1)	0.5	(0.3)
Failure to get milk or colostrum from mare/dam	NA		3.6	(0.6)	4.8	(1.0)
Complications from birthing/dystocia	NA		1.2	(0.2)	NA	
Fever of undetermined origin	NA		1.2	(0.3)	1.4	(0.5)
Dental problems excluding routine floating	NA		NA		0.1	(0.1)
Pigeon fever caused by *Corynebacterium pseudotuberculosis*	NA		NA		0.1	(0.1)
Liver or kidney disease	NA		NA		0.3	(0.3)
Other	NA		1.3	(0.4)	2.4	(1.0)

*Question in 1998 was worded as leg or hoof problems instead of lameness, leg, or hoof problems.

The percentages of foals affected by condition(s) listed in the following table were similar across studies, with the exception of digestive problems other than colic, which was lower in 2005 and 2015 than in 1998. Additional categories for foal conditions were added to the 2005 and 2015 questionnaires: failure to get milk and fever of undetermined origin. Thus, no comparisons with 1998 can be made for these two categories. Common foal conditions across all study years were digestive problems such as diarrhea, respiratory problems, and injury/wounds/trauma.

C.7.b. For operations that had any resident foals less than 6 months of age during the previous 12 months (table C.6), percentage of foals affected by the following condition(s):

	Percent Resident Foals					
	Equine '98		Equine 2005		Equine 2015	
Condition	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Colic	2.1	(0.7)	4.2	(2.5)	1.2	(0.3)
Other digestive problems (e.g., diarrhea)	21.5	(5.2)	6.3	(0.9)	6.8	(2.1)
Respiratory problems (e.g., pneumonia, strangles, *Rhodococcus equi,* etc.)	9.3	(4.5)	4.3	(0.6)	4.3	(1.7)
Eye problems	1.3	(0.4)	1.0	(0.2)	1.0	(0.4)
Skin problems	0.8	(0.3)	0.8	(0.3)	1.0	(0.5)
Reproductive tract problems (e.g., hermaphrodite, cryptorchid)	1.3	(0.7)	0.3	(0.1)	0.0	(0.0)
Behavioral problems (e.g., unusual, affects use or safety)	0.1	(0.0)	0.2	(0.1)	0.4	(0.2)
Injury, wounds, or trauma	12.2	(2.6)	9.2	(0.8)	4.8	(1.2)
Lameness, leg, or hoof problems (could not be used for intended purpose without treatment)[1]	2.4	(0.5)	2.6	(0.4)	3.0	(0.6)

continued→

C.7.b. For operations that had any resident foals less than 6 months of age during the previous 12 months (table C.6), percentage of foals affected by the following condition(s) (cont'd):

	Percent Resident Foals					
	Equine '98		Equine 2005		Equine 2015	
Condition	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Neurologic problems	0.4	(0.2)	5.7[2]	(5.1)	0.3	(0.1)
Infectious disease unrelated to specific body system (septicemia, blood infection)	0.8	(0.4)	1.0	(0.3)	0.7	(0.3)
Chronic weight loss	0.7	(0.3)	0.1	(0.1)	0.2	(0.1)
Overweight/obese	0.4	(0.4)	0.2	(0.1)	0.2	(0.1)
Failure to get milk or colostrum from mare/ dam	NA		2.0	(0.3)	2.9	(0.9)
Complications from birthing/dystocia	NA		1.0	(0.2)	NA	
Fever of undetermined origin	NA		0.8	(0.2)	0.7	(0.2)
Dental problems excluding routine floating	NA		NA		0.1	(0.1)
Pigeon fever caused by *Corynebacterium pseudotuberculosis*	NA		NA		0.1	(0.1)
Liver or kidney disease	NA		NA		0.1	(0.1)
Other	NA		0.8	(0.2)	1.7	(0.8)

[1]Question from 1998 was worded as leg or hoof problems instead of lameness, leg, or hoof problems.
[2]Because of the large standard error in 2005, it is difficult to determine if there was a difference in neurologic problems between 1998, 2005, and 2015.

8. Equid health

In general, the percentages of operations on which resident equids 6 months of age or older were affected with conditions listed in the following table were lower in 2005 than in 1998 and 2015. This finding could be due to questionnaire structure; for example, the 2005 questionnaire had a lead-in question related to antimicrobial use that may have caused respondents to report only conditions that resulted in antibiotic use. In 2015, the question was in a chart format, with the first question relating to the listed conditions.

The percentage of operations with resident equids that had reproductive problems was higher in 1998 than in 2005 and 2015, likely because there was a lower percentage of breeding-farm operations in 2015 than in 1998 or 2005 (table B.1). A higher percentage of operations had resident equids with cancer in 2015 than in 2005.

C.8.a. For operations that had any resident equids 6 months of age or older during the previous 12 months (table C.6), percentage of operations on which equids were affected by the following condition(s):

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Condition	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Colic	26.5	(2.2)	10.4	(0.6)	16.5	(0.9)
Other digestive problems (e.g., diarrhea)	5.0	(1.0)	2.4	(0.3)	5.3	(0.5)
Dental problems	NA		5.3	(0.5)	8.0	(0.7)
Respiratory problems	12.3	(1.7)	9.1	(0.6)	8.4	(0.7)
Eye problems	12.5	(1.5)	6.5	(0.5)	10.4	(0.7)
Skin problems	11.2	(1.5)	5.4	(0.5)	10.0	(0.8)
Reproductive problems (e.g., infertility, dystocia)	7.5	(1.2)	3.3	(0.4)	3.1	(0.4)
Behavioral problems (e.g., unusual, affects use or safety)	2.9	(0.8)	1.0	(0.2)	2.3	(0.4)
Injury, wounds, or trauma	29.1	(2.2)	25.7	(0.9)	22.7	(1.1)
Lameness, leg, or hoof problems (could not be used for intended purpose without treatment)[1]	23.5	(2.1)	15.5	(0.8)	28.0	(1.1)

continued→

C.8.a. For operations that had any resident equids 6 months of age or older during the previous 12 months (table C.6), percentage of operations on which equids were affected by the following condition(s) (cont'd):

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Condition	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Neurologic problems (e.g., spinal problem, wobblers, seizure, West Nile virus, EPM)[2]	3.0	(0.8)	0.9	(0.2)	3.2	(0.4)
Infectious disease unrelated to specific body system (septicemia, blood infections)	2.5	(0.7)	1.6	(0.3)	1.1	(0.3)
Chronic weight loss	5.6	(1.1)	1.4	(0.2)	6.1	(0.6)
Overweight/obese	5.5	(1.3)	3.4	(0.4)	6.1	(0.6)
Liver or kidney disease	NA		0.5	(0.1)	0.6	(0.2)
Cancer	NA		1.1	(0.2)	3.1	(0.5)
Endocrine	NA		NA		3.4	(0.4)
Pigeon fever caused by *Corynebacterium pseudotuberculosis*	NA		NA		0.7	(0.2)
Fever of undetermined origin	NA		NA		1.8	(0.3)
Other	NA		1.8	(0.3)	2.5	(0.4)

[1]Question from 1998 was worded as leg or hoof problems instead of lameness, leg, or hoof problems.
[2]More information on WNV in appendix II.

The percentage of resident equids with colic was lower in 2005 and 2015 than in 1998. Similarly, a lower percentage of resident equids had respiratory problems in 2005 and 2015 than in 1998. In contrast, a higher percentage of resident equids had lameness, leg, or hoof problems in 2015 than in 1998 or 2005.

C.8.b. For operations that had any resident equids 6 months of age or older during the previous 12 months (table C.6), percentage of equids affected by the following condition(s):

	Percent Resident Equids					
	Equine '98		Equine 2005		Equine 2015	
Condition	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Colic	5.0	(0.6)	1.9	(0.1)	2.9	(0.2)
Other digestive problems (e.g., diarrhea)	0.8	(0.2)	0.5	(0.1)	0.9	(0.1)
Dental problems	NA		1.6	(0.2)	1.6	(0.2)
Respiratory problems	2.9	(0.5)	1.9	(0.1)	2.1	(0.3)
Eye problems	1.4	(0.2)	1.0	(0.1)	1.7	(0.1)
Skin problems	2.5	(0.5)	1.1	(0.1)	2.2	(0.2)
Reproductive problems (e.g., infertility, dystocia)	1.1	(0.2)	0.6	(0.1)	0.6	(0.1)
Behavioral problems (e.g., unusual, affects use or safety)	0.5	(0.1)	0.2	(0.0)	0.4	(0.1)
Injury/wounds/ trauma	6.2	(0.5)	4.7	(0.2)	4.9	(0.3)
Lameness, leg, or hoof problems (could not be used for intended purpose without treatment)*	4.1	(0.4)	2.8	(0.2)	6.5	(0.4)

continued→

C.8.b. For operations that had any resident equids 6 months of age or older during the previous 12 months (table C.6), percentage of equids affected by the following condition(s) (cont'd):

	Percent Resident Equids					
	Equine '98		Equine 2005		Equine 2015	
Condition	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Neurologic problems (e.g., spinal problem, wobblers, seizure, West Nile virus, EPM)	0.4	(0.1)	0.2	(0.0)	0.4	(0.1)
Infectious disease unrelated to specific body system (septicemia, blood infections)	0.8	(0.2)	0.3	(0.1)	0.2	(0.0)
Chronic weight loss	0.7	(0.2)	0.2	(0.0)	1.0	(0.1)
Overweight/obese	0.9	(0.2)	0.9	(0.1)	1.6	(0.2)
Liver or kidney disease	NA		0.1	(0.0)	0.1	(0.0)
Cancer	NA		0.1	(0.0)	0.3	(0.0)
Endocrine	NA		NA		0.7	(0.1)
Pigeon fever caused by *Corynebacterium pseudotuberculosis*	NA		NA		0.1	(0.0)
Fever of undetermined origin	NA		NA		0.5	(0.1)
Other	NA		0.3	(0.1)	0.3	(0.1)

*Question from 1998 was worded as leg or hoof problems instead of lameness, leg, or hoof problems.

Photograph courtesy of Kirsten Tillotson.

9. Births

The percentage of operations that had any equine births on the operation during the previous 12 months decreased from 1998 to 2005 and from 2005 to 2015.

C.9.a. Percentage of operations that had any equine births on the operation during the previous 12 months:

Percent Operations					
Equine '98		Equine 2005		Equine 2015	
Percent	Std. error	Percent	Std. error	Percent	Std. error
42.2	(2.4)	33.6	(0.9)	19.9	(0.9)

The percentage of foals born alive was similar in all three studies.

C.9.b. Percentage of foals by birth outcome during the previous 12 months:

	Percent Foals					
	Equine '98		Equine 2005		Equine 2015	
Births	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Born alive	92.9	(1.0)	93.5	(0.5)	93.4	(0.8)
Born dead or aborted*	7.1	(1.0)	6.5	(0.5)	6.6	(0.8)
Total	100.0		100.0		100.0	

*Options in 1998 were born alive, born dead full term, and born dead premature.

10. Foal deaths

The overall percentage of foals aged 30 days or less that died was similar in all three studies: between 4 and 6 percent of foals born alive died in the first 30 days of life. The percentage of foals that died in the first 2 days of life was approximately the same as the percentage of foals that died in the next 28 days, despite the longer time period.

C.10. For foals born alive, percentage of foals that died in the first 30 days of life (including born on or moved onto the operation) during the previous 12 months, by age at death:

	Percent Foals					
	Equine '98		Equine 2005		Equine 2015	
Age at death (days)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
2 or less	2.0	(0.4)	2.6	(0.3)	3.3	(0.5)
3 to 30	2.2	(0.6)	2.3	(0.3)	2.5	(0.8)
Total	4.2	(0.8)	4.9	(0.4)	5.8	(0.8)

11. Equid deaths

For equids 30 days or older, the highest mortality rates in all three studies occurred in equids 20 years of age or older. The percentage of equids 20 years of age or older that died was lower in 2015 than in 1998 or 2005, as was the rate of total deaths.

C.11.a. Percentage of resident equids more than 30 days of age that died or were euthanized during the previous 12 months, by age at death:

	Percent Resident Equids*					
	Equine '98		Equine 2005		Equine 2015	
Age at death	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
More than 30 days but less than 6 months	1.4	(0.5)	1.2	(0.2)	0.9	(0.8)
6 months to less than 5 years	1.5	(0.5)	1.1	(0.1)	0.6	(0.1)
5 years to less than 20 years	1.4	(0.3)	1.2	(0.1)	0.8	(0.1)
20 years or older	11.9	(2.2)	10.2	(0.8)	3.1	(0.4)
Total deaths of equids more than 30 days of age	2.0	(0.3)	1.8	(0.1)	0.8	(0.1)

*((Number of resident equids within each age class that died or were euthanized)/(resident equine inventory of age class))x100.

For equids less than 6 months of age at time of death, respiratory problems, injury/wounds/trauma, and failure to get colostrum/milk were common causes of death in 1998, 2005, and 2015. Common causes of death in equids 6 months or older were colic and injury/wounds/trauma in all three studies. Old age was not provided as a choice for cause of death in 2015, in an effort to have respondents choose a more specific cause; however, old age was a common write-in response for the other known cause category on the 2015 study questionnaire for equids over 20 years of age at time of death.

C.11.b. Percentage of equid deaths (including euthanasia), by cause of death and by age at death:

	Percent Equid Deaths									
	Age of Equids									
	Birth to less than 6 months					6 months or older				
	Equine '98		Equine 2005		Equine 2015	Equine '98		Equine 2005		Equine 2015
Cause	Pct.	Std. error	Pct.	Std. error	Pct. Std. error	Pct.	Std. error	Pct.	Std. error	Pct. Std. error
Colic	1.4	(1.0)	1.8	(1.0)	1.3 (1.3)	22.2	(5.5)	15.2	(1.8)	24.6 (3.0)
Other digestive problems (e.g., diarrhea)	2.1	(1.1)	6.7	(1.7)	21.1 (7.5)	1.3	(0.7)	3.0	(0.9)	2.2 (1.1)
Respiratory problems including strangles	1.7	(0.7)	4.2	(1.2)	11.3 (7.0)	3.1	(1.7)	2.7	(0.7)	7.9 (2.2)
Neurologic problems (e.g., spinal problem, wobblers, seizure, WNV, EPM)	3.7	(1.8)	0.4	(0.3)	2.1 (2.1)	1.8	(1.5)	3.3	(0.8)	6.8 (2.1)
Dystocia or birthing complications[1]	4.3	(2.6)	9.1	(2.2)	0.0 (—)	1.3	(0.6)	2.3	(0.6)	1.9 (0.8)
Reproductive problems other than dystocia	L		L			0.5	(0.3)	0.9	(0.4)	
Injury/wounds/ trauma	13.2	(6.8)	19.4	(3.0)	28.0 (10.9)	12.7	(5.8)	16.0	(1.7)	13.8 (2.3)

continued→

C.11.b. Percentage of equid deaths (including euthanasia), by cause of death and by age at death (cont'd):

	Percent Equid Deaths					
	Age of Equids					
	Birth to less than 6 months			6 months or older		
	Equine '98	Equine 2005	Equine 2015	Equine '98	Equine 2005	Equine 2015
Cause	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error
Old age	NA	NA	NA	24.8 (5.8)	30.4 (2.4)	NA
Lameness, leg, or hoof problems (could not be used for intended purpose without treatment)			0.0 (—)	6.9 (3.5)	7.7 (1.3)	6.8 (1.6)
Cancer	NA	L	NA	NA	2.7 (0.7)	7.8 (2.3)
Liver or kidney disease	NA	L	0.0 (—)	NA	1.9 (0.6)	0.8 (0.4)
Fire, lightning strike, flood, or other storm	NA	L	NA	NA	2.1 (0.9)	NA
Poisoning/toxicity (suspected or confirmed)	NA	L	NA	NA	0.3 (0.2)	NA
Fever of undetermined origin	NA	NA	0.0 (—)	NA	NA	0.4 (0.4)
Weight loss	NA	NA	0.0 (—)	NA	NA	6.1 (1.8)
Overweight	NA	NA	0.0 (—)	NA	NA	2.0 (2.0)
Birth defects	L	L	NA	NA	NA	NA
Failure to get colostrum/milk	NA	L	15.7 (7.9)	NA	NA	NA
Dental problems not including routine floating	NA	NA	0.0 (—)	NA	NA	1.4 (0.9)
Endocrine diseases such as hypothyroid or Cushings	NA	NA	NA	NA	NA	3.0 (1.0)
Eye problems	NA	NA	2.9 (2.7)	NA	NA	1.0 (0.6)
Skin problems	NA	NA	5.1 (4.8)	NA	NA	0.2 (0.2)

continued→

C.11.b. Percentage of equid deaths (including euthanasia), by cause of death and by age at death (cont'd):

	Percent Equid Deaths											
	Age of Equids											
	Birth to less than 6 months						6 months or older					
	Equine '98		Equine 2005		Equine 2015		Equine '98		Equine 2005		Equine 2015	
Cause	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Behavioral problems that affect use, health, or safety	NA		NA		0.0	(—)	NA		NA		0.2	(0.2)
Pigeon fever caused by *Corynebacterium pseudotuberculosis*	NA		NA		0.0	(—)	NA		NA		0.0	(—)
Other infectious disease	NA		NA		1.6	(1.6)	NA		NA		0.0	(—)
Other known cause	41.2	(7.9)	39.7	(3.8)	10.9	(9.9)	18.0	(3.6)	5.8	(1.1)	13.3	(3.0)
Unknown cause	32.3	(7.4)	18.7	(2.9)	NA		7.4	(3.0)	5.7	(1.0)	NA	
Total	100.0		100.0		100.0		100.0		100.0		100.0	

[1]2015 includes reproductive problems other than dystocia.

L=These causes were included in "other known cause."

NA=Not listed as a choice in that study year.

D. Biosecurity

Biosecurity refers to practices or policies used to reduce the risk of disease introduction or spread within a population of animals or people. Several estimates of risk posed by equine movement and the use of management practices to reduce the risk of disease were provided in earlier NAHMS studies. Estimates of equids' contact with other types of animals were also developed.

1. Nonresident equids

Equids visiting an operation on a temporary basis for breeding, competition, short-term boarding, or other reasons could pose a disease risk to resident equids if biosecurity practices are not used to reduce the risk.

The percentages of operations with 0, 1 to 9, and 10 or more nonresident equids that stayed for fewer than 30 consecutive days were similar in 1998, 2005, and 2015. Approximately 8 of 10 operations across studies had no nonresident equid visits during the previous 12 months.

D.1.a. Percentage of operations by number of nonresident equids that stayed on the operation for fewer than 30 consecutive days during the previous 12 months:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Number nonresident equids	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0	79.1	(2.0)	81.0	(0.8)	82.3	(0.9)
1 to 9	15.4	(1.7)	14.7	(0.7)	12.7	(0.8)
10 or more	5.5	(1.3)	4.3	(0.4)	5.0	(0.5)
Total	100.0		100.0		100.0	

Health requirements imposed for visiting nonresident equids can reduce the risk of disease introduction or disease spread.

For operations that had nonresident equids that stayed for less than 30 consecutive days, the percentages of operations that implemented the health requirements in the following table were similar across study years. In 2005 and 2015, additional health-requirement choices were included on the study questionnaire; however, it is unlikely these additional choices altered responses to other listed choices.

D.1.b. For operations that had nonresident equids that stayed for fewer than 30 consecutive days during the previous 12 months (table D.1.a), percentage of operations on which the following health requirements were always or sometimes implemented for the majority of nonresident equids:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Health requirement	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Official health certificate, i.e., certificate of veterinary inspection (CVI)	31.9	(4.9)	24.8	(1.9)	32.3	(2.7)
Veterinary examination other than CVI	30.7	(5.1)	18.4	(1.7)	20.8	(2.3)
Coggins test (EIA test)*	50.2	(5.3)	45.3	(2.2)	49.0	(2.8)
Vaccination within past year	43.5	(5.2)	36.3	(2.1)	38.9	(2.7)
Deworming within past year	43.2	(5.2)	33.6	(2.1)	37.0	(2.7)
Screening test for strangles or history of no occurrence in past 6 months	NA		9.7	(1.2)	14.4	(1.9)
Other past medical history from owner	NA		21.8	(1.7)	22.9	(2.4)
Quarantine prior to contact with resident equids	NA		17.2	(1.5)	22.4	(2.2)
Other	10.6	(3.1)	3.8	(0.8)	2.5	(1.0)

*More information on EIA in appendix II.

2. Additions

Introducing new resident equids to an operation can pose a risk of disease introduction. The health status of new equids and the number of new equids introduced are important factors in disease introduction.

The percentage of operations that added new resident equids and the percentage of resident equids added decreased from 1998 to 2015.

D.2.a. Percentage of operations that added new resident equids during the previous 12 months and percentage of equids added, including foals not born to a resident mare (excluding births):

	Percent					
	Equine '98		Equine 2005		Equine 2015	
Measure	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Percent operations	40.5	(2.3)	21.5	(0.8)	15.4	(0.9)
Percent resident equids*	11.3	(1.3)	6.3	(0.5)	5.8	(0.7)

*(Total number of equids added to resident equine population)/(total resident equine inventory)x100.

The percentage of operations that added new resident equids from various source locations was similar across study years.

D.2.b. For operations that added new resident equids during the previous 12 months (table D.2.a), percentage of operations by source location of added equids:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Within State	85.4	(2.4)	81.6	(1.6)	84.7	(2.0)
Outside State, within United States	28.1	(3.3)	29.9	(1.9)	32.6	(2.7)
Canada	1.2	(0.5)	1.1	(0.3)	1.9	(0.6)
Mexico	0.0	(--)	0.2	(0.1)	0.1	(0.1)
Outside North America	0.5	(0.3)	0.3	(0.1)	0.5	(0.3)
Not specified	0.2	(0.1)	1.0	(0.5)	2.2	(1.2)

The percentages of new resident equids by source location was similar across study years.

D.2.c. For operations that added new resident equids during the previous 12 months (table D.2.a), percentage of new additions by source location of added equids:

	Percent Additions*					
	Equine '98		Equine 2005		Equine 2015	
Source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Within State	73.9	(4.0)	70.7	(3.2)	63.3	(4.3)
Outside State, within United States	25.1	(3.9)	25.7	(3.0)	32.3	(4.3)
Canada	0.5	(0.2)	2.2	(1.4)	2.9	(1.5)
Mexico	0.0	(—)	0.5	(0.3)	0.0	(0.0)
Outside North America	0.3	(0.1)	0.4	(0.3)	0.3	(0.2)
Not specified	0.2	(0.1)	0.5	(0.3)	1.3	(0.7)
Total	100.0		100.0		100.0	

*((Number of equids added to resident equine population by source)/(total new additions from all sources)) x100.

Equine operation health requirements for new resident equids are intended to reduce the risk of disease introduction or spread. Some operations had multiple health requirements for newly added equids. A lower percentage of operations with newly added resident equids required an Official Certificate of Veterinary Inspection in 2005 than in 1998 or 2015.

The percentage of operations with "other" requirements beyond those listed in the 1998 questionnaire was higher than in 2005 and 2015 because common write-ins were added to a list of choices in the 2005 and 2015 study questionnaires. The percentage of operations with "other" health requirements declined in 2005 and 2015.

D.2.d. For operations that added new resident equids during the previous 12 months (table D.2.a), percentage of operations that always or sometimes implemented the following health requirements for new additions:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Health requirement	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Official health certificate (CVI)	53.1	(3.5)	34.6	(2.0)	46.8	(3.1)
Veterinary examination other than CVI	45.1	(3.7)	29.2	(1.9)	38.3	(2.9)
Coggins test (EIA test)	67.2	(3.7)	61.8	(2.0)	65.9	(2.9)
Vaccination within past year	57.0	(3.6)	49.2	(2.1)	58.7	(3.0)
Deworming within past year	65.8	(3.7)	48.9	(2.1)	58.9	(3.0)
Screening test for strangles or history of no occurrence in past 6 months	NA		14.2	(1.4)	20.0	(2.3)
Other past medical history from owner	NA		36.3	(2.0)	43.1	(3.0)
Quarantine prior to contact with resident equids	NA		32.0	(2.0)	44.0	(3.1)
Other	13.0	(2.5)	5.0	(0.9)	1.8	(0.7)

3. Contact with other animals

Contact with animals other than equids can pose a disease risk to equids. For example, *Salmonella,* a bacterium that can be shed in feces of many types of animals, can cause diarrhea, fever, and toxemia in equids.

The percentages of operations on which poultry or cattle had contact with resident equids were higher in 2005 and 2015 than in 1998. The percentages of operations on which the other listed animals had contact with resident equids or their feed were similar across study years. A higher percentage of operations with a primary function of farm/ranch participated in the 2005 and 2015 studies than in the 1998 study, which could explain the higher percentage of operations on which resident equids had contact with cattle or poultry (table B.1).

D.3. Percentage of operations on which the following animals had physical contact with resident equids or their feed:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Animal	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Poultry	13.4	(1.5)	18.6	(0.8)	19.2	(1.0)
Pigs*	3.7	(0.8)	4.7	(0.4)	6.0	(1.1)
Cattle	34.1	(2.3)	43.2	(1.0)	42.9	(1.3)
Sheep/goats	11.4	(1.3)	13.9	(0.7)	15.0	(0.9)
Llamas/alpacas	1.5	(0.5)	2.4	(0.3)	2.6	(0.4)
Emus/ostriches	1.0	(0.3)	1.2	(0.2)	0.8	(0.2)
Dogs	77.9	(1.9)	76.9	(0.9)	75.2	(1.1)
Cats	67.7	(2.3)	66.4	(1.0)	62.5	(1.3)

*In 2015, this category was called "domestic pigs."

Photograph courtesy of Josie Traub-Dargatz.

4. Direct contact with outside equids during trips

Equids that leave their home base for breeding, competition, trail riding, or other reasons often commingle with equids from other operations, which can put them at risk for disease exposure. There are various management practices that can help reduce the risk these traveling equids pose when they return to their home operation.

D.4.a. Percentage of operations that had resident equids that left the home operation and returned after direct contact with outside equids:

Percent Operations					
Equine '98		Equine 2005		Equine 2015	
Percent	Std. error	Percent	Std. error	Percent	Std. error
87.3	(2.4)	75.1	(0.9)	63.0	(1.3)

For operations that had resident equids that left the home operation and returned after direct contact with outside equids, the percentage of operations that routinely isolated returning equids was similar across studies. The percentage of operations that only isolated returning equids for a cause such as disease or because of exposure to disease increased across study years. The percentage of operations that never isolated returning equids decreased from 1998 to 2015. Changes in response categories across studies may have affected the percentages for some practices.

D.4.b. For operations that had resident equids that left the home operation and returned after direct contact with outside equids (table D.4.a), percentage of operations by infection-control method(s) used for returning equids:

	Percent Operations					
	Equine '98*		Equine 2005		Equine 2015	
Practice	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Routinely isolate returning equids	11.9	(2.5)	10.6	(0.7)	11.5	(1.0)
Only isolate returning equids for a cause such as disease or exposure to disease	15.8	(2.4)	26.0	(1.0)	44.4	(1.6)
Quarantine before arrival at home operation	NA		2.8	(0.4)	4.4	(0.7)
Never isolate returning equids	72.3	(3.2)	60.6	(1.1)	39.7	(1.6)
Total	100.0		100.0		100.0	

*Categories for 1998 were resident equids never leave premises, routinely isolated returning equids, isolated returning horses for a cause such as evidence of or exposure to disease, and never isolated returning horses.

5. Feed storage

In 1998 and 2005, more than 90 percent of operations fed and/or stored grain concentrate for resident equids, compared with more than 80 percent of operations in 2015.

D.5.a. Percentage of operations that fed and/or stored grain/concentrate for resident equids in the previous 12 months:

Percent Operations[1]					
Equine '98		Equine 2005		Equine 2015	
Percent	Std. error	Percent	Std. error	Percent	Std. error
95.9	(1.1)	90.1	(0.6)	81.8	(1.0)

[1]In 1998 and 2005, the study questionnaire asked if grain was fed, while the 2015 questionnaire asked if grain was stored.

Protecting stored feed from contamination by mice, rats, or their feces can reduce the risk of introducing disease-causing agents such as *Salmonella.* A higher percentage of operations in 2005 and 2015 than in 1998 stored grain/concentrate in a manner that helps prevent contamination by mice, rats, and their feces.

D.5.b. For operations that fed grain/concentrate (table D.5.a), percentage of operations that stored grain/concentrate in a manner that prevented contamination by mice, rats, or their feces:

Percent Operations					
Equine '98*		Equine 2005		Equine 2015	
Percent	Std. error	Percent	Std. error	Percent	Std. error
77.6	(2.1)	85.0	(0.8)	88.9	(0.9)

*Questionnaire in 1998 asked if feed was stored in rodent-proof containers.

6. Drinking water

Providing a pure water source to equids is an important aspect of health management. The predominant source of drinking water was similar across study years, when the standard errors are considered. Well water was the predominant water source for resident equids on over half of operations in 1998, 2005, and 2015.

D.6. Percentage of operations by predominant source of drinking water for resident equids during the previous 12 months:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Drinking water source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Well	58.9	(2.5)	57.5	(0.9)	55.5	(1.2)
Public/ municipal water supply	17.2	(2.3)	18.9	(0.8)	23.2	(1.1)
Spring	5.2	(1.0)	5.4	(0.5)	5.0	(0.6)
Surface water (pond, stream, river, or cistern)	18.2	(1.8)	18.1	(0.8)	16.0	(0.9)
Other	0.5	(0.3)	0.1	(0.0)	0.3	(0.1)
Total	100.0		100.0		100.0	

7. Insect control

Insects can be a major annoyance to equids during fly and mosquito season. Insects can also expose equids to disease agents. Insect control, therefore, is an important part of a biosecurity plan.

The methods of insect control in the following table were not mutually exclusive. In 2005 and 2015, several methods of insect control were added to the study questionnaire based on frequent write-in responses in the 1998 study. More than 88 percent of operations used at least one form of insect control.

The percentage of operations that used repellant applied to equids to control insects was lower in 2005 and 2015 than in 1998. The percentage of operations that applied insecticide in or near equine housing was higher in 2005 and 2015 than in 1998. The percentage of operations that used insect predators such as parasite wasps was higher in 2015 than in 1998 and 2005. This finding could reflect a true increase or it might be the result of slight rewording in the questionnaires, i.e., parasite wasps in 1998 and 2005 but insect predators in 2015. The use of fly sheets doubled from 2005 to 2015. The use of an insect-control product in feed was higher in 2015 than in 1998. Repellents applied to equids was the method used by the highest percentage of operations across study years.

D.7. Percentage of operations on which the following insect-control methods were used during summer:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Repellents applied to equids	86.5	(2.4)	73.1	(0.9)	76.0	(1.1)
Insecticides applied in or near equine housing area	26.1	(3.2)	36.0	(1.0)	36.8	(1.2)
Insecticides applied to pasture areas	1.2	(0.5)	5.5	(0.5)	7.4	(0.7)
Regional control program, such as aerial spraying	2.5	(0.7)	4.1	(0.4)	4.0	(0.5)
Sticky tape	26.7	(3.3)	20.9	(0.8)	31.8	(1.2)
Bug zapper	NA		8.4	(0.6)	8.6	(0.7)
Parasitic wasps specifically brought onto operation[1]	2.4	(0.8)	3.1	(0.3)	10.1	(0.8)
Face mask on equid	32.3	(3.7)	27.2	(0.9)	32.6	(1.2)
Fly tags attached to equine halters	3.5	(1.4)	4.1	(0.4)	4.5	(0.5)
Fly sheets on equid	NA		7.3	(0.5)	14.6	(0.8)
Insect control product in feed, such as using Equitrol®[2]	2.8	(1.0)	5.6	(0.5)	7.0	(0.7)
Mosquito treatment in drinking water (mosquito dunks)	NA		6.3	(0.5)	8.3	(0.8)
Water container emptied and refilled with fresh water at least weekly	NA		58.5	(1.0)	58.7	(1.3)
Frequent removal of weeds and manure from premises	NA		51.3	(1.0)	51.8	(1.3)
Screened-in stalls	NA		2.4	(0.3)	3.5	(0.4)
Other	13.1	(2.4)	5.9	(0.5)	2.0	(0.3)
Any method	91.3	(2.1)	88.9	(0.7)	88.7	(0.9)

[1]In 2015, choice was insect predators specifically brought onto operation.

[2]In 2015, choice was insect control product in feed or as feed through.

8. Manure management

Manure management is an important part of farm hygiene and biosecurity. Manure and soiled bedding, if allowed to accumulate, can adversely affect stabling and loafing areas and indoor air quality. In addition, manure, depending on where it is stored, can attract insects and pose a risk of pathogen introduction to equine feed or housing due to runoff.

Methods of disposing of manure and waste bedding were not mutually exclusive. The percentages of operations that used various disposal methods were similar across study years, when standard errors are considered, with the exception of a lower percentage of operations that sold or gave away manure in 2005 compared with 1998. The most common methods used in all three study years were applied to fields and allowed to accumulate or left to nature.

D.8. Percentage of operations by method of manure (including composted manure and/or waste bedding) disposal used during the previous 12 months:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Routine garbage pickup	1.7	(0.7)	2.6	(0.3)	3.8	(0.5)
Hauled to landfill (not routine garbage pickup)	0.7	(0.3)	1.5	(0.2)	2.1	(0.4)
Hauled away, other than to landfill	9.0	(1.2)	10.9	(0.6)	12.5	(0.8)
Applied on fields on the operation where any livestock (including equids) graze	39.6	(2.6)	37.2	(1.0)	39.2	(1.3)
Applied on fields on the operation where no livestock graze	40.9	(2.4)	42.0	(0.9)	38.7	(1.2)
Manure/waste bedding allowed to accumulate or left to nature	31.6	(2.1)	32.4	(1.0)	35.4	(1.2)
Sold or gave away	24.9	(2.1)	16.9	(0.7)	19.5	(0.9)
Other	5.0	(1.1)	2.3	(0.3)	1.7	(0.3)

E. Equid Movement

1. Vehicle transportation

Knowing how often and where equids are transported can help estimate the impact that stopping equine travel during disease outbreaks would have on the business continuity of the equine industry.

The percentage of operations that transported any resident equids by vehicle off the home operation and returned them during the previous 12 months was lower in 2005 and 2015 than in 1998. Operations with a primary function of farm or ranch probably accounted for much of the difference, as these operations moved equids less frequently and accounted for a higher percentage of operations in the 2005 and 2015 studies.[1,2]

E.1. Percentage of operations that transported any resident equids off the home operation by vehicle for any purpose and returned them during the previous 12 months:

Percent Operations					
Equine '98		Equine 2005		Equine 2015	
Percent	Std. Error	Percent	Std. error	Percent	Std. error
73.5	(2.3)	58.4	(1.0)	57.8	(1.3)

[1]USDA–APHIS–VS. Equine 2005 Part I: "Baseline Reference of Equine Health and Management, 2005," p 6.

[2]USDA–APHIS–VS. Equine 2015: "Baseline reference of equine health and management, 2015," p 8.

2. Destination

The destinations of transported equids were not mutually exclusive. For example, an operation could have transported equids within the State for one trip and to Canada for another. Equine movement patterns were similar across studies.

E.2. For operations that transported resident equids by vehicle off the home operation and returned the equids during the previous 12 months (table E.1), percentage of operations by destination of equids:

	Percent Operations					
	Equine '98		Equine 2005		Equine 2015	
Destination	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Within State	96.6	(1.2)	94.8	(0.6)	95.8	(0.8)
Adjacent State	30.8*	(2.5)	34.3	(1.2)	29.7	(1.5)
Beyond adjacent States (including Alaska and Hawaii)			11.9	(0.8)	11.8	(1.0)
Canada	1.3	(0.5)	0.7	(0.2)	0.8	(0.2)
Mexico	0.0	(0.0)	0.3	(0.2)	0.1	(0.1)
Outside North America	0.2	(0.1)	0.2	(0.1)	0.7	(0.3)

*1998 questionnaire: outside State, within United States.

Section III: Methodology

NAHMS Equine '98

NAHMS Equine '98 study was the first study NAHMS conducted to gather equine health and management information. NAHMS partnered with the National Agricultural Statistics Service (NASS) to develop a list of equine operations in the United States and to collect phase I data. In preparation for the NAHMS Equine '98 study, NASS used an area frame and a list frame to develop a multiple frame estimation of equine operations in the 48 contiguous States. A detailed explanation of NASS area, list, and multiple frames is available in the methodology section of the NAHMS "Part I: Baseline Reference of Equine Health and Management" report available at the NAHMS Web site: www.aphis.usda.gov/nahms.

The 28 States[3] included in the NAHMS Equine '98 study were selected based on the size of the equine inventory and for geographic representation or optimization of personnel resources. These 28 States represented 78.2 percent of U.S. horses and ponies and 78.0 percent of U.S. farms with horses and ponies, as reported in the 1992 Census of Agriculture.

The combined NASS list and area frame dataset became the basis for selecting the sample for the Equine '98 study in the 28 target States. Operations with one or more equids on January 1, 1998, were eligible for selection for participation in the study. Sampling was done within State and size group strata (equine inventory).

NASS enumerators collected questionnaire data for phase I of the Equine '98 study. The sample of 3,985 selected equine operations yielded 2,758 operations with completed questionnaires for phase I of the study.

For the evaluation of changes or trends in equine health and management, the data from phase I of the study was used to generate the Equine '98 estimates. The Equine '98 phase I data were re-analyzed to represent operations with five or more equids present on January 1, 1998, in order to be comparable to the 2005 and 2015 studies.

[3]Alabama, California, Colorado, Florida, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Missouri, Montana, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, Virginia, Washington, Wisconsin, and Wyoming.

NAHMS Equine 2005

Equine 2005 was the second NAHMS study of the U.S. equine industry. The same 28 States that were included in the Equine '98 study were included in the Equine 2005 study.[4] The Equine 2005 sampling frame comprised all active operations on NASS' list frame that had at least 5 equids in 28 States. The sampling frame was stratified by State and size group and a simple random sample was employed by strata to select 4,002 equine operations. Completed questionnaires were obtained from 2,847 operations.

NAHMS Equine 2015

Equine 2015 was the third NAHMS study of the U.S. equine industry. The 28 States[5] included in the NAHMS Equine 2015 study were selected based on the size of their equine inventory, the density of their horse/pony population (number of horses and ponies over square miles within the State), and for geographic representation or optimization of personnel resources. These 28 States represented 71.8 percent of all equids and 71.6 percent of equids on farms with five or more equids. These same States represented 72.1 percent of farms with any equids and 70.9 percent of farms with five or more equids There were 20 States included in Equine 2015 that were also included in the Equine '98 and Equine 2005 studies. The NASS list frame from the 2012 Census of Agriculture was used to select operations for participation in the study. The sampling frame comprised all active operations on NASS' list frame that had at least 5 equids in 28 States. The sampling frame was stratified by State and size group and a simple random sample was employed by strata to select 3,997 equine operations. Completed questionnaires were obtained from 1,920 operations.

[4]Alabama, California, Colorado, Florida, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Missouri, Montana, New Jersey, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, Virginia, Washington, Wisconsin, and Wyoming.

[5]Alabama, Arkansas, Arizona, California, Colorado, Connecticut, Delaware, Florida, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Missouri, Montana, New Jersey, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, Tennessee, Texas, Virginia, Wisconsin, and Wyoming.

Appendix I: Study Objectives and Related Outputs

1. Describe trends in equine care and health management for study years 1998, 2005, and 2015
    - “Changes in the U.S. Equine Industry, 1998–2015,” descriptive report
    - “Baseline Reference of Equine Health and Management, 2015,” descriptive report,
    - Information Sources and Providers of Equine Health Care, 2015, information sheet
    - Equine Biosecurity and Biocontainment Practices on U.S. Equine Operations, 2015, information sheet,
    - Equine Mortality, 2015, information sheet
    - End-of-life Planning for Equids in the United States, 2015, information sheet
    - Testing for Equine Infectious Anemia in the United States, 2015, information sheet
    - Equine Movement and Disposition of U.S. Equids, 2015, information sheet
    - Demographics of the U.S. Equine Population, information sheet
    - Trends in EIA Awareness and Testing, information sheet
    - Trends in Biosecurity Practices for U.S. Equids, information sheet
2. Estimate the occurrence of owner-reported lameness and describe practices associated with the management of lameness
    - Lameness Occurrence and Management, information sheet
    - “U.S. Equine Health and Selected Management Topics, 2015,” descriptive report
3. Describe health and management practices associated with important equine infectious diseases
    - “U.S. Equine Health and Selected Management Topics, 2015,” descriptive report
4. Describe animal health related costs of equine ownership
    - “U.S. Equine Health and Selected Management Topics, 2015,” descriptive report
    - Cost of equine ownership in the United States, 2015, information sheet
5. Evaluate control practices for gastrointestinal parasites
    - “U.S. Equine Health and Selected Management Topics, 2015,” descriptive report
    - Parasite Control Practices, information sheet
6. Evaluate equids for presence of ticks and describe tick-control practices used on equine operations
    - “U.S. Equine Health and Selected Management Topics, 2015,” descriptive report
    - Tick Occurrence and Identification on Equids, 2015, information sheet
7. Collect equine sera along with equine demographic information to create a serum bank for future studies.

Appendix II: Specific Disease Surveillance in the U.S. Equine Industry

This appendix presents data from sources other than the NAHMS equine studies and provides comprehensive information on four equine diseases: equine infectious anemia (EIA), West Nile virus, Eastern equine encephalitis, and vesicular stomatitis.

A. Equine Infectious Anemia

EIA is a disease of horses and other equids caused by a lentivirus of the family *Retroviridae*. This disease was historically referred to as swamp fever. Clinical signs vary widely but may include recurrent fever, inappetence, weight loss, icterus, lethargy, thrombocytopenia, and anemia. Infection can result in a life-long inappetent state.

Blood transfer from an infected equid to a susceptible equid is the most important source of EIA virus (EIAV). Blood transfer by blood-feeding insects to susceptible equids is the primary method of natural transmission of EIAV. Horseflies and deerflies are the primary insects involved in natural transmission of EIAV. Studies indicate that EIAV is not transmitted by mosquitoes. Other means of blood transfer include reusing needles and syringes, using contaminated dental or surgical equipment, and transfusing blood. Vertical transmission of EIAV (from mare to foal) may occur in utero or at parturition. This method of transmission appears to occur rarely. Venereal transmission is also rare, but is possible when semen from an infected stallion is used to breed mares.

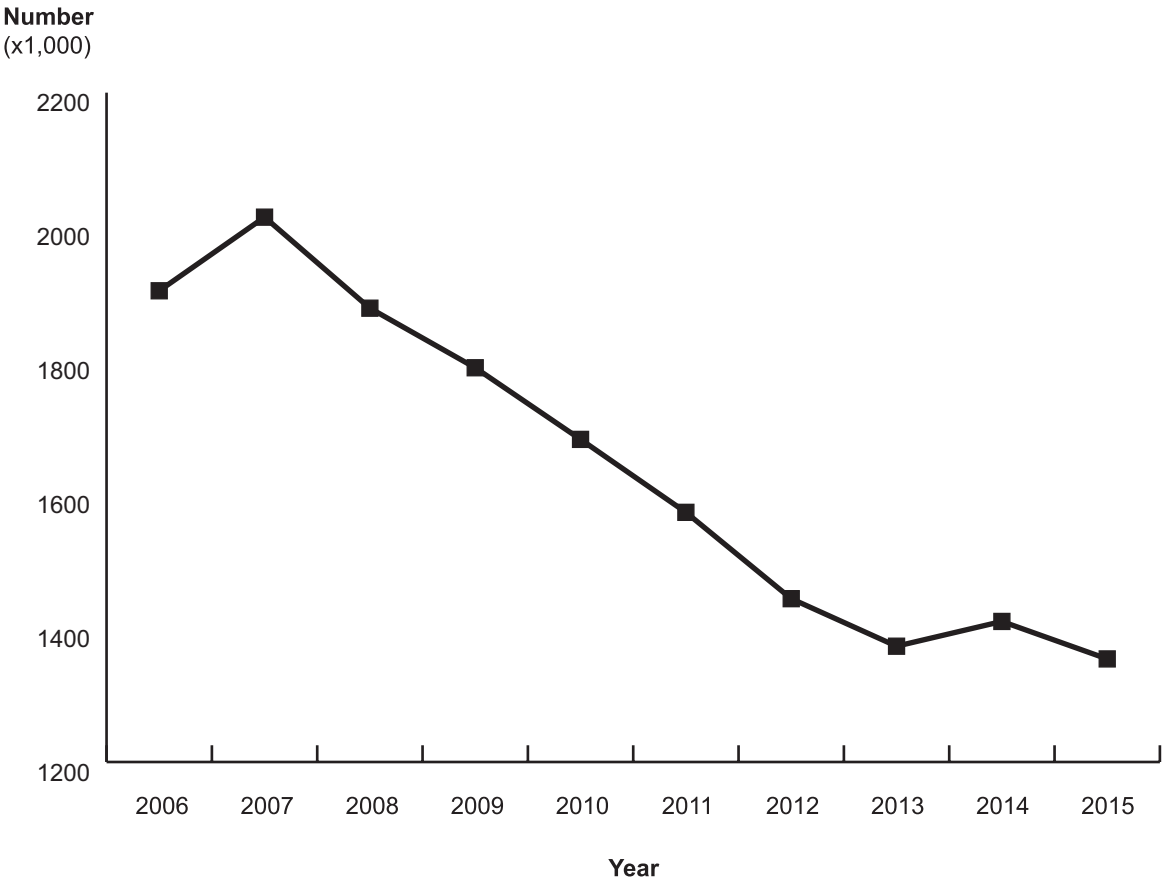
A reliable serologic test for EIA was developed in the early 1970s by Leroy Coggins. This test became the basis for EIA control efforts in the United States. Since the development of the Coggins test, multiple other serologic tests have been developed and licensed for use in detection of EIA in equids.

The prevalence of EIA among tested equids in the United States has declined precipitously since the onset of control efforts in the 1970s. Efforts to control EIA include State animal health requirements, requirements for entry into equine events and private equine facilities, and oversight of laboratory testing. The prevalence of EIA among the general equine population in the United States is not definitively known, as not all equids are tested. There is no vaccine available to prevent EIAV infection in equids, and there is no known treatment for the infection.

1. Number of EIA tests, 2006–15

Testing for EIA in the United States utilizing the Coggins test began in 1972. Since then, other tests for detecting EIA have been developed and approved. The number of EIA tests conducted in the United States decreased from 2006 to 2015. EIA testing can be required for movement, sale, attending events, or to ride on certain public lands. The decrease in number of EIA tests could be due in part to a decline in the equine population from 2007 to 2012 (table A.1), changes in movement or use of equids; and changes in requirements, economic factors, or variation in methods used for data collection.

Number of EIA tests performed in the United States, 2006–15*

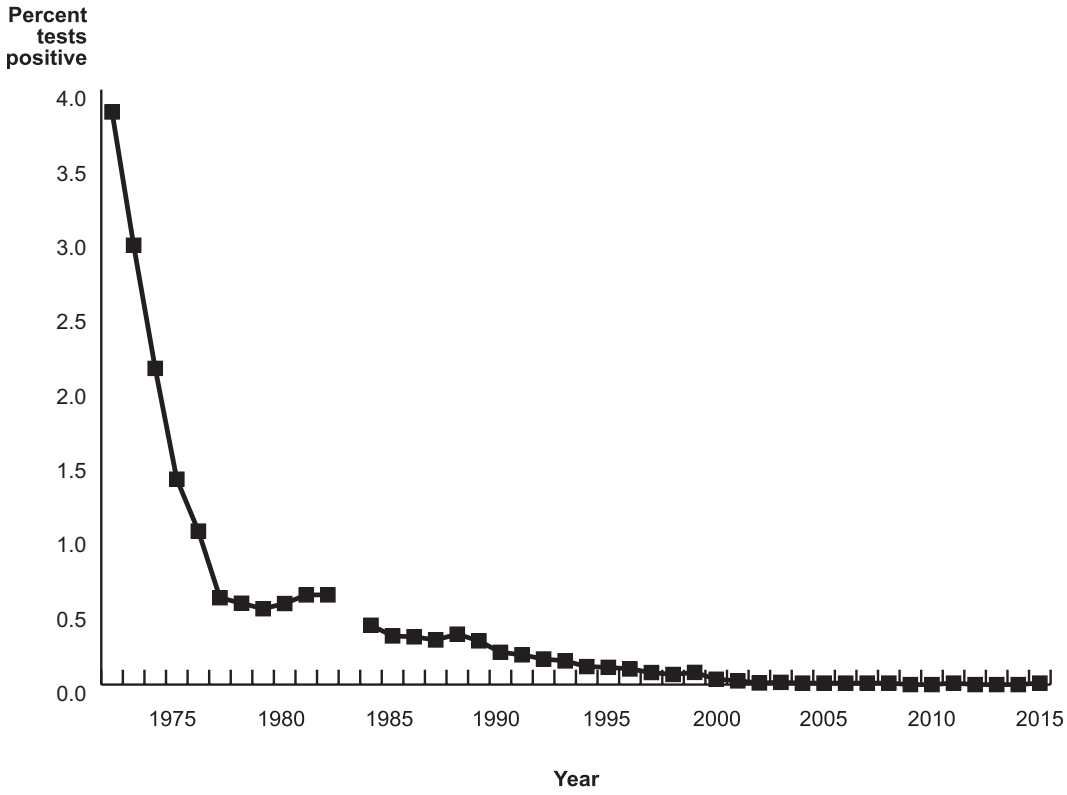


*Data for previous years (1972–2005) available in Equine 2005 “Part II: Changes in the U.S. Equine Industry, 1998–2005” (p 10).

2. Percentage of positive EIA tests, 1972–2005

The percentage of positive tests declined steadily from nearly 4 percent in 1972 to less than 0.1 percent in 2005 and to 0.005 percent in 2015, with the most dramatic decline occurring from 1972 to 1978.

Percentage of samples that tested positive for EIA in the United States, 1972–2005



Source: USDA–APHIS–VS.
Data not available for 1983.

3. Number of EIA tests by State, 2009–15

An individual equid could be tested more than once a year, so the number of equids tested per State is not available, only the number of tests conducted. Thus, the percentage positive provided in the following table is the number of positive equids divided by the number of tests multiplied by 100.

The number of EIA tests performed nationally declined from 2009 (1.79 million) to 2015 (1.35 million). The percentage of test-positive equids increased in 2015 (0.005) compared with 2009 (0.002). The number of EIA tests conducted in a given State is affected by intra- and interstate movement requirements and can vary over time based on changes in regulations and movement patterns. States with the highest number of EIA positives in 2009 were Oklahoma, Texas, Massachusetts, and Arkansas. The States with the highest number of EIA positives in 2015 were Mississippi, Louisiana, Texas, California, Tennessee, Arkansas, and Washington.

At the 2014 U.S. Animal Health Association meeting, the California Department of Food and Agriculture and the Texas Animal Health Commission reported on an investigation of EIA in the Quarter horse racing population. From 2012 until fall 2014 in California, 34 horses were confirmed positive for EIA. Ten of these EIA-infected horses were also infected with *Theileria equi*, the causative agent of equine piroplasmosis. From 2012 to 2014, 12 horses in Texas were found to be infected with EIA based on the State requirement for EIA testing for change of ownership and for attendance at an equine event. Epidemiologic investigation indicated the majority of the infected horses had potential exposure to high-risk practices such as shared needles and other blood-contaminated medical equipment or use of contaminated blood products.

A.3. Number of tests for EIA and percentage positive for EIA, 2009–15:

	2009			Number EIA tests					2015		
State	No. tests	No. pos. equids	Percent positive	2010	2011	2012	2013	2014	No. tests	No. pos. equids	Percent positive
Alabama*	20,262	0	0.000	25,930	23,846	22,073	21,068	18,730	16,889	0	0.000
Alaska	449	0	0.000	599	625	35	88	120	39	0	0.000
Arizona*	10,472	1	0.009	12,293	6,332	5,701	9,521	10,326	10,376	0	0.000
Arkansas*	40,051	3	0.007	38,929	40,089	40,803	49,495	46,562	37,870	5	0.013
California*	32,729	1	0.003	25,662	23,322	22,399	25,292	29,712	30,400	7	0.023
Colorado*	22,323	0	0.000	20,471	20,141	21,637	22,285	21,218	22,620	0	0.000
Connecticut*	11,656	0	0.000	10,811	9,839	10,372	10,861	10,716	10,060	0	0.000
Delaware*	6,264	0	0.000	4,504	4,088	2,908	3,099	2,292	2,694	0	0.000
Florida*	134,231	0	0.000	126,757	114,892	107,231	77,138	114,085	111,146	0	0.000
Georgia	47,770	0	0.000	45,869	43,106	35,804	32,090	32,929	33,411	0	0.000
Hawaii	292	0	0.000	231	169	87	214	248	251	0	0.000
Idaho	15,322	0	0.000	11,103	11,241	10,875	9,903	10,959	10,936	0	0.000
Illinois	54,998	0	0.000	49,539	30,851	32,747	24,951	33,297	31,041	1	0.003
Indiana	28,655	0	0.000	27,038	25,083	24,624	22,314	22,087	22,381	0	0.000
Iowa	18,622	0	0.000	17,237	16,387	14,146	14,139	11,860	14,721	0	0.000
Kansas*	11,387	0	0.000	13,668	7,162	11,267	12,230	9,760	12,705	0	0.000
Kentucky*	96,179	0	0.000	95,384	86,903	83,297	77,001	74,782	64,455	4	0.006
Louisiana	50,782	2	0.004	42,971	42,279	40,821	37,872	37,570	36,958	10	0.027
Maine	4,994	0	0.000	4,939	4,313	5,149	4,292	3,815	3,466	0	0.000
Maryland*	32,363	0	0.000	32,339	30,304	28,547	28,380	28,397	11,741	0	0.000
Massachu-setts*	15,000	4	0.027	12,300	12,962	5,243	5,830	4,853	4,422	0	0.000
Michigan*	42,479	0	0.000	49,357	46,390	44,832	45,344	42,087	38,329	0	0.000
Minnesota	40,818	0	0.000	34,939	33,200	35,027	25,004	34,579	22,041	0	0.000
Mississippi	36,355	2	0.005	33,570	31,132	30,617	29,709	30,467	27,896	11	0.039
Missouri*	85,918	0	0.000	81,053	80,249	80,855	70,186	83,624	78,941	0	0.000
Montana*	20,675	0	0.000	18,109	16,210	15,538	15,211	17,116	17,620	0	0.000
Nebraska	10,505	1	0.009	10,113	9,497	8,193	9,783	9,177	8,724	0	0.000
Nevada	7,933	0	0.000	8,912	9,217	8,050	4,952	5,813	7,636	0	0.000

continued→

A.3. Number of tests for EIA and percentage positive for EIA, 2009–15 (cont'd):

	2009			Number EIA tests					2015		
State	No. tests	No. pos. equids	Percent positive	2010	2011	2012	2013	2014	No. tests	No. pos. equids	Percent positive
New Hampshire	10,805	0	0.000	13,556	9,932	15,705	13,927	9,481	12,938	0	0.000
New Jersey*	16,657	1	0.006	21,763	16,833	14,258	13,862	22,005	12,843	0	0.000
New Mexico	18,237	0	0.000	20,412	20,388	19,974	16,860	15,149	15,439	1	0.006
New York*	53,403	0	0.000	48,256	45,175	42,184	43,579	44,194	45,422	3	0.007
North Carolina*	62,973	0	0.000	55,904	58,206	46,665	34,767	32,375	32,112	0	0.000
North Dakota	9,394	0	0.000	7,876	8,055	6,539	8,418	7,376	8,020	0	0.000
Ohio*	35,971	0	0.000	45,347	38,373	46,275	44,807	34,424	48,961	0	0.000
Oklahoma*	84,678	12	0.014	74,907	81,297	78,184	70,327	68,356	67,559	2	0.003
Oregon*	6,611	0	0.000	6,890	6,597	6,053	6,079	4,959	5,789	3	0.052
Pennsylvania*	57,090	0	0.000	59,766	53,325	35,071	41,106	31,500	37,801	0	0.000
Rhode Island*	1,328	0	0.000	1,266	1,082	2,000	1,719	540	1,894	0	0.000
South Carolina	38,340	0	0.000	32,994	32,577	36,919	37,263	36,863	29,504	0	0.000
South Dakota	11,222	0	0.000	11,779	10,098	10,161	9,184	8,348	8,503	0	0.000
Tennessee*	75,536	0	0.000	36,929	22,161	41,621	56,616	55,363	53,576	7	0.013
Texas*	240,484	10	0.004	235,654	236,282	153,873	140,895	162,643	149,040	5	0.003
Utah	11,330	0	0.000	10,762	11,793	9,952	9,051	7,874	8,767	0	0.000
Vermont	11,686	0	0.000	8,794	6,805	1,261	3,734	7,756	7,348	0	0.000
Virginia*	62,585	0	0.000	60,149	59,835	58,365	60,972	41,168	48,971	0	0.000
Washington	2,794	0	0.000	3,244	3,294	3,237	8,048	8,388	9,168	10	0.109
West Virginia	20,314	0	0.000	14,511	13,079	12,210	11,105	10,831	9,875	0	0.000
Wisconsin*	44,261	0	0.000	42,103	42,148	39,634	38,862	39,467	37,305	0	0.000
Wyoming*	13,732	0	0.000	14,081	15,704	14,940	13,575	13,789	13,786	0	0.000
Total (28 States)	1,337,298	32	0.002	1,270,582	1,199,747	1,081,826	1,040,107	1,065,043	1,025,327	36	0.004
Total (50 States)	1,788,915	37	0.002	1,681,570	1,572,868	1,443,959	1,373,008	1,410,030	1,354,390	69	0.005

Source: USDA–APHIS–VS. http://www.aphis.usda.gov/animal-health/equine-health.

*States participating in NAHMS Equine 2015 study.

B West Nile Virus

1. Background

West Nile virus (WNV) is spread primarily by mosquitoes to birds and other animals. Humans and horses appear to be the most susceptible mammals. West Nile virus was first reported in the United States in 1999, with recognized illness and death due to the infection in birds, humans, and horses in New York. Humans and horses are the most commonly affected mammals. In 2000, seven States reported equine WNV cases, with the largest numbers of infected horses occurring in New Jersey and New York. In 2001, WNV was reported in 20 States as the virus moved south from the Northeast through the eastern coastal States. In 2001, Florida reported the largest number of equine WNV infections with just under 500 cases, over 7 times as many as any other State that year.

From 1999 through 2001, equine WNV infections were considered an emerging disease occurrence. Testing for the disease in horses was performed through the National Veterinary Services Laboratories (NVSL). In 2002, WNV was redefined by USDA–APHIS–VS as an endemic disease to the United States, and testing moved to regional veterinary diagnostic laboratories as well as NVSL. The ability to track cases became more challenging as testing and reporting became more dispersed. USDA–APHIS–Veterinary Services collaborates with the Centers for Disease Control and Prevention (CDC) and State and public health officials to facilitate communication about arbovirus disease cases in equids and confirm cases in each State. Current information and surveillance data on WNV is available at: http://www.aphis.usda.gov/animal-health/equine-health.

Strategies for controlling equine WNV include vaccinating equids against the infection before the vector season, reducing insect populations on the premises, and applying insect repellants on the horses. The first vaccine available for protecting equids from WNV became available in 2001 under a conditional licensure.

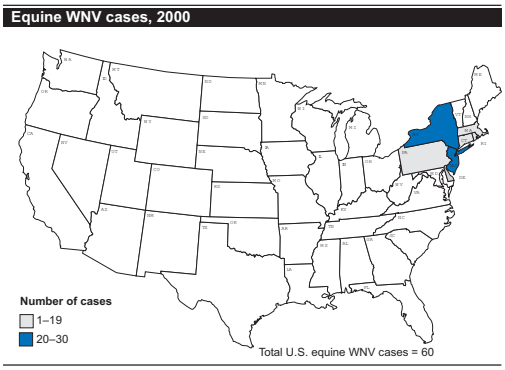
Since 2003, there have been fully licensed WNV vaccines for inoculation of horses. In 2003 there were 5,181 equine WNV cases in the United States; the number of equine cases declined from 2004 to 2007 (see maps, p 61). There were fewer than 300 equine WNV cases per year from 2008 through 2011. There was a spike in cases in 2012 and 2013. In 2014 and 2015, the number of cases again fell below 300. In 2015, one to five equine WNV cases were reported in Arkansas, Delaware, Idaho, Iowa, Maryland, Michigan, Minnesota, Mississippi, Montana, Nevada, New Mexico, New Jersey, Pennsylvania, Tennessee, Utah, Virginia, Wisconsin, and Wyoming. States with 6 to 30 equine WNV cases in 2015 were California, Colorado, Florida, Illinois, Indiana, Kentucky, Missouri, Oklahoma, and Oregon. Texas had 31 cases and Washington had 36 WNV cases in 2015.

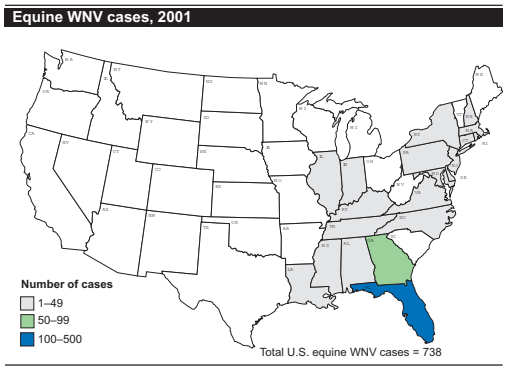
B.1. Number of U.S. Equine WNV Cases, 2009–15:

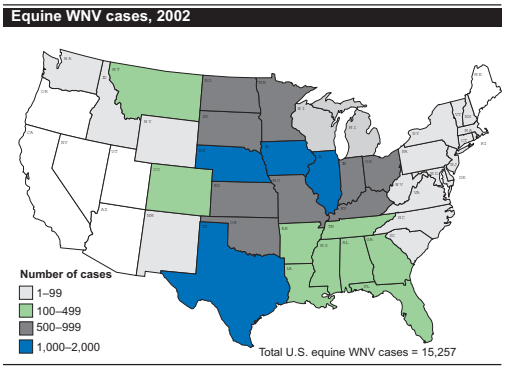
2009	2010	2011	2012	2013	2014	2015
276	125	87	627	377	141	225

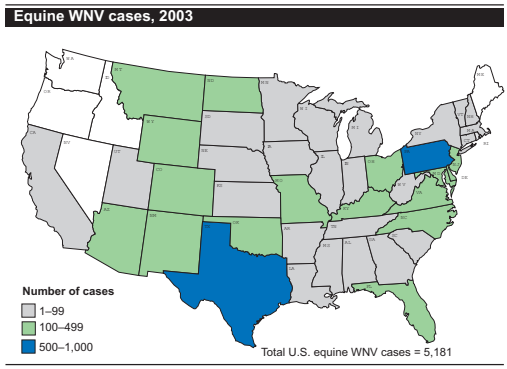
2. Chronological spread of equine WNV across the United States

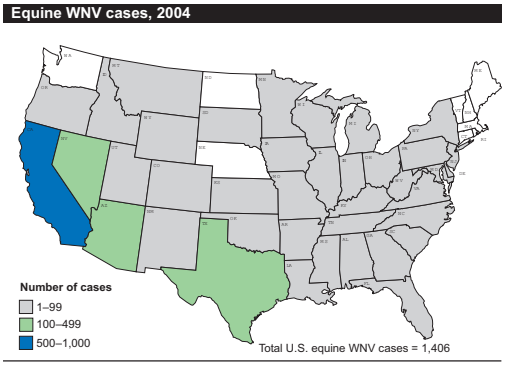
From the initial identification of WNV in New York in 1999, the disease spread rapidly to other States, and by 2003 WNV was reported in California. By 2004, although the total number of equine WNV cases had declined to just under 1,400 nationally, one or more cases were reported from all but nine continental States. In 2005, there were equine WNV cases reported from all but 12 continental States, with most reporting fewer than 50 cases—if they reported any cases at all. To date, Hawaii and Alaska have not reported any equine WNV cases.

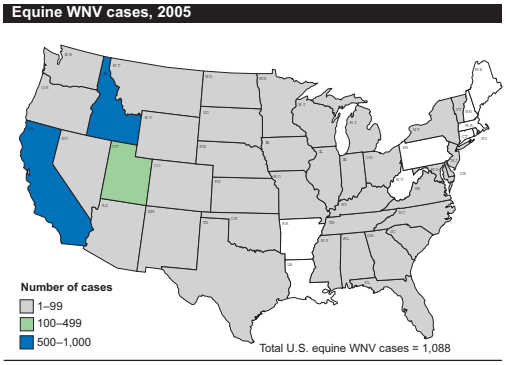












Source: USDA–APHIS–VS http://www.aphis.usda.gov/animal-health/equine-health.

C. Eastern Equine Encephalitis, 2009–15

1. Background

Eastern equine encephalomyelitis (EEE is a mosquito-borne viral disease. It is also known as sleeping sickness and is characterized by central nervous system dysfunction and a moderate-to-high case fatality rate. The causal virus is maintained in nature in an alternating infection cycle between mosquitoes and birds. Humans and horses serve as dead-end hosts. Although horses and humans are most often affected by the virus, birds may exhibit clinical signs, and infection and disease occasionally occur in other livestock, deer, dogs, and a variety of other species.

Caused by the EEE virus (EEEV, an *Alphavirus* of the family *Togaviridae,* the virus is closely related to the Western and Venezuelan equine encephalomyelitis viruses and Highlands J virus, all of which cause similar neurological dysfunction disorders in horses. There are two distinct antigenic variants of EEEV. The North American variant is more pathogenic than the South and Central American variant.

Horses infected with EEEV initially develop fever, lethargy, and anorexia. Neurological signs usually develop 5 days after infection and include cranial nerve abnormalities, altered mentation, impaired vision, circling, head pressing, wandering, and difficulties swallowing. In its more severe form, the disease progressed to hyperexcitability, ataxia, convulsions, and death. The case fatality rate in unvaccinated horses usually exceeds 90 percent and most deaths occur 2 to 3 days after onset of neurologic signs.

Annual vaccination of horses is recommended with more frequent vaccination in areas with year-long active vector mosquito activity. Detailed vaccination guidelines are available from the American Association of Equine Practitioners at: https://aaep.org/. Beyond vaccination of equids against EEE, insect vector control is conducted by elimination of breeding sites, frequent manure removal, weed control, mosquito protection of horses (insect repellents), and

shelters with fans and screens. Passive surveillance is accomplished during routine activities by attending veterinarians, State animal health officials, and others.

USDA–APHIS–VS collaborates with the CDC and State veterinary and public health officials to facilitate communication about arbovirus disease cases in equids and confirms equine cases in each State. USDA–APHIS–VS posts the number of confirmed Eastern equine encephalitis (EEE) cases to the USDA disease information Web site (http://www.aphis.usda.gov/animal-health/equine-health).

C.1. Number of equine EEE and number of States with equine EEE cases in the United States:

Year	Number equine EEE cases	Number States with equine EEE cases
2009	301	18
2010	247	18
2011	60	10
2012	209	19
2013	192	22
2014	136	15
2015	70	12

In 2015, States with equine EEE cases (number of equine cases) included: Alabama (3), Florida (23), Georgia (6), Indiana (1), Louisiana (7), Michigan (4), Mississippi (4), North Carolina (4), New Jersey (1), South Carolina (6), Texas (8), and Virginia (3).

D. Vesicular Stomatitis

1. Background

Vesicular stomatitis virus (VSV) is a rhabdovirus that causes vesicles and subsequently ulcers to form primarily on the lips and in the mouths of infected livestock. In some animals, lesions also occur on the coronary band, ears, sheath, and teats. The disease primarily affects horses and cattle, but can occasionally affect swine and less frequently other animals such as sheep and camelids. VSV is spread by direct contact and by insect vectors. Vesicular stomatitis outbreaks occur periodically in the Western United States.

2. Summary statistics

As of January 1, 2015, VS was delisted by the World Organization of Animal Health. In 2015, investigation of suspect VS cases in equids was led by State animal health officials. When suspect cases occur in livestock other than equids, the USDA initiates a foreign animal disease investigation because lesions of VS are indistinguishable from those caused by the foot-and-mouth disease virus.

D.2. Number of VS premises (all species) in the United States,* 2005–15:

State	2005	2006	2009	2010	2012	2014	2015
Arizona	27	0	0	2	0	2	36
Colorado	100	0	0	0	2	370	441
Idaho	2	0	0	0	0	0	0
Montana	46	0	0	0	0	0	0
Nebraska	3	0	0	0	0	1	38
New Mexico	23	0	3	0	34	0	52
South Dakota	0	0	0	0	0	0	50
Texas	1	0	2	0	0	62	4
Utah	104	0	0	0	0	0	56
Wyoming	139	13	0	0	0	0	146
Total	445	13	5	2	36	435	823

*Summary data for VS outbreaks is available at http://www.aphis.usda.gov/animal-health/equine-health

There were VS cases in seven of the years from 2005 through 2015 (no cases in 2007, 2008, 2011, and 2013). The highest number of affected premises occurred in 2005, 2014, and 2015.

In 2015, USDA–APHIS–VS and State animal health officials employed a modified response. New measures included a reduction in the quarantine period based on viral shedding from affected animals, activation of approved National Animal Health Laboratory Network laboratories to assist in VSV testing of affected equine species, flexibility to use accredited veterinarians for sample collection in equine species, and flexibility to use accredited veterinarians to manage affected equine premises.[6]

[6]Pelzel-McCluskey. 2015. A new approach to vesicular stomatitis and 2015 outbreak. USAHA: IDOHC 2015. Available at: http://www.usaha.org/upload/Committee/InfectiousHorses/report-hd-2015.pdf

E. Equine Disease Communication Center

The Equine Disease Communication Center (EDCC) was developed and implemented by the American Association of Equine Practitioners and the American Horse Council with support from USDA–APHIS–VS through a cooperative agreement. The EDCC serves as a reliable and timely source of equine disease outbreak information along with educational material on equine diseases and biosecurity. The EDCC moved from a pilot effort to fully functional in spring 2016.The Web site for the EDCC is available at http://www.equinediseasecc.org.

There is an option on the EDCC Web site to sign up for email disease alerts from the EDCC.