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Report 2

Beef 2017

Beef Cow-calf Health and Management Practices in the United States, 2017

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Cover photo courtesy of Geni Wren

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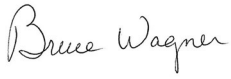

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Items of Note

The Beef 2017 study was conducted in 24 of the Nation's major cow-calf States (see map p 2) and provides valuable information to study participants, stakeholders, and the beef industry as a whole. Data collected for the study represented 78.9 percent of U.S. cow-calf operations and 86.6 percent of U.S. beef cows. Unless otherwise noted, estimates in this report refer to calendar year 2017. Where noted, estimates may refer to the previous 12 months from when the questionnaire was administered, which occurred from January through May of 2018.

Operations were placed in three size categories: small (1 to 49 cows), medium (50 to 199 cows), and large (200 or more cows).

Weaned calves are the main product of many U.S. cow calf operations. These calves might go to a stocker/backgrounder operation or to a feedlot. Some cow-calf operations are also stocker/backgrounder operations or feedlots. Seedstock operations primarily sell heifers and bulls to be used for breeding, but these operations are also likely to have cattle that end up in feedlots. As expected, most operations in 2017 (90.4 percent) sold weaned calves for purposes other than breeding (specifically calves destined for feedlot, backgrounder, or stocker operations).

Preconditioning practices help calves get ready to leave their operation of origin. For example, calves that have undergone preconditioning practices experience less stress when adjusting to a new location, such as a feedlot. Typical preconditioning practices include keeping calves on the operation for at least 45 days after weaning, dehorning (if horned), castration (bulls), administering appropriate vaccines, and deworming. Calves are also introduced to eating from a feed bunk and drinking from a water tank during this period. Of operations that sold any weaned calves for purposes other than breeding, 70.2 percent held calves fewer than 45 days after weaning, and 43.1 percent weaned and shipped calves off the operation on the same day.

Of operations that sold any weaned calves for purposes other than breeding in 2017, there were no differences by herd size in the percentages of operations that treated calves for internal or external parasites before they left the operation. Overall, 70.6 and 71.5 percent of operations treated calves for internal parasites and external parasites, respectively.

Of operations that sold any weaned calves for purposes other than breeding in 2017, 57.3 percent fed calves in a feed bunk prior to or after weaning. A lower percentage of operations in the West region (36.5 percent) fed calves in a feed bunk before or after weaning compared with operations in the Central and East regions (77.2 and 68.3 percent, respectively).

Of operations that sold any cows for purposes other than breeding (culls) in 2017, the highest percentages culled cows for age or bad teeth (57.7 percent) and for open or aborted pregnancy status (40.6 percent).

Overall, 74.5 percent of operations vaccinated any beef cattle or calves against any disease in 2017.

Overall, 57.5 percent of operations vaccinated calves against respiratory disease, and 72.8 percent of calves were on these operations.

Overall, 57.4 percent of operations vaccinated any cattle against bovine viral diarrhea (BVD) in 2017. A higher percentage of large operations (78.9 percent) vaccinated weaned replacement heifers through breeding against BVD compared with small operations (28.7 percent).

Of operations that administered killed BVD vaccines in calves 22 days old through weaning, 59.4 percent gave these calves a single dose. A single dose of killed BVD vaccine is unlikely to provide adequate protection against BVD.

For operations that vaccinated any cattle against BVD in 2017, 51.3 percent used only killed vaccines. In other words, any animal that received a BVD vaccine on these operations received only killed vaccines. Just 4.9 percent of operations administered BVD vaccines that only protected animals against genotype 1.

Just 3.7 percent of operations tested any beef cattle for persistent infection with BVD during the previous 3 years. Only 2.0 percent of operations marketed calves as PI-negative.

In 2017, the majority of operations (51.2 percent) had at least one beef calf that was born alive but died or was lost prior to weaning. Being lost refers to instances such as stolen calves or cases in which calves are killed by a predator and remains are never found. A higher percentage of large and medium operations had at least one calf that died or was lost prior to weaning compared with small operations.

Overall, 51.8 percent of operations used oral (bolus, drench, or drinking water) or injectable antibiotics to treat disease in 2017. A low percentage of cattle were treated with oral (bolus, drench, or drinking water) or injectable antibiotics in 2017, with 6.2 of unweaned calves, 5.0 of replacement heifers, and 1.9 of cows being treated at least once with oral or injectable antibiotics in 2017.

The use of medically important antibiotics in feed was not common on cow-calf operations, with only 9.5 percent of operations using this practice in 2017.

A higher percentage of medium operations (15.2 percent) used chlortetracycline for control of anaplasmosis in cattle in 2017 compared with small operations (1.4 percent). Overall, 4.4 percent of operations used chlortetracycline to control of anaplasmosis in cattle in 2017.

Overall, 80.7 percent of operations used the services of a veterinarian for their cattle in 2017. A higher percentage of large operations (98.4 percent) used the services of a veterinarian for cattle compared with medium and small operations (80.2 and 79.7 percent, respectively).

Using the same dewormer year after year can allow parasites to become resistant to that dewormer. Evaluating parasite burden in fecal samples can determine if a dewormer is needed, which can, in turn, prolong the effectiveness of dewormers. Overall, 16.5 percent of operations tested fecal matter to evaluate parasite burden during the previous 3 years.

A lower percentage of operations dewormed unweaned calves (53.9 percent) occasionally (defined as less than once a year but at least every 3 years) or more frequently than dewormed replacement heifers or cows at least occasionally (87.7 and 84.8 percent, respectively). Overall, 90.0 percent of operations dewormed any cattle or calves at least occasionally.

For operations that dewormed any cattle or calves at least occasionally, 95.4 percent used avermectin products. The highest percentage of operations (70.5 percent) considered a veterinarian an important or very important source for deworming information.

A lower percentage of small operations (9.2 percent) than medium and large operations (29.0 and 61.7 percent, respectively) submitted samples of any feed to a laboratory for nutritional analysis during the previous 5 years. Overall, 15.8 percent of operations submitted any feed samples to a laboratory for nutritional analysis during the previous 5 years.

Overall, 96.5 percent of operations fed any mineral and/or salt supplements to cows in 2017. A higher percentage of large operations (15.3 percent) identified any mineral deficiencies in cows during the last 5 years compared with small operations (1.6 percent).

A higher percentage of large operations (41.2 percent) used crop residue/aftermath as a feed source in 2017 compared with small operations (9.0 percent). Overall, 13.4 percent of operations used crop residue/aftermath as a feed source in 2017. For operations that used crop residue/aftermath as a feed source in 2017, 74.0 percent used cornstalk residue.

A higher percentage of large operations (38.1 percent) consulted an animal nutritionist during 2017 compared with small operations (6.5 percent). Overall, 10.8 percent of operations consulted an animal nutritionist during 2017.

Overall, producers on 53.3 percent of operations agreed with the statement “The United States is well prepared to handle outbreaks of livestock disease currently not found in this country,” (such as foot-and-mouth disease), while producers on 27.5 percent of operations disagreed with the statement and producers on 19.2 percent of operations had no opinion.

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Introduction

The National Animal Health Monitoring System (NAHMS) is a nonregulatory program of the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service. NAHMS is designed to help meet the Nation's animal health information needs and has collected data on cattle health and management practices on U.S. cow-calf operations through three previous studies. The NAHMS Beef 2017 study is the fourth in the series of studies on the U.S. cow-calf industry.

The NAHMS 1992-93 Cow-calf Health and Productivity Audit (CHAPA) provided the first national information on the health and management of cattle on cow-calf operations in the United States. While the study was in progress, the media began to report on "Mystery Calf Disease" throughout the United States. These media reports generated requests from stakeholders for information on the occurrence of this "new" disease—later referred to as weak calf syndrome. The CHAPA study became one vehicle that provided estimates of the frequency of occurrence and geographic distribution of the disease.

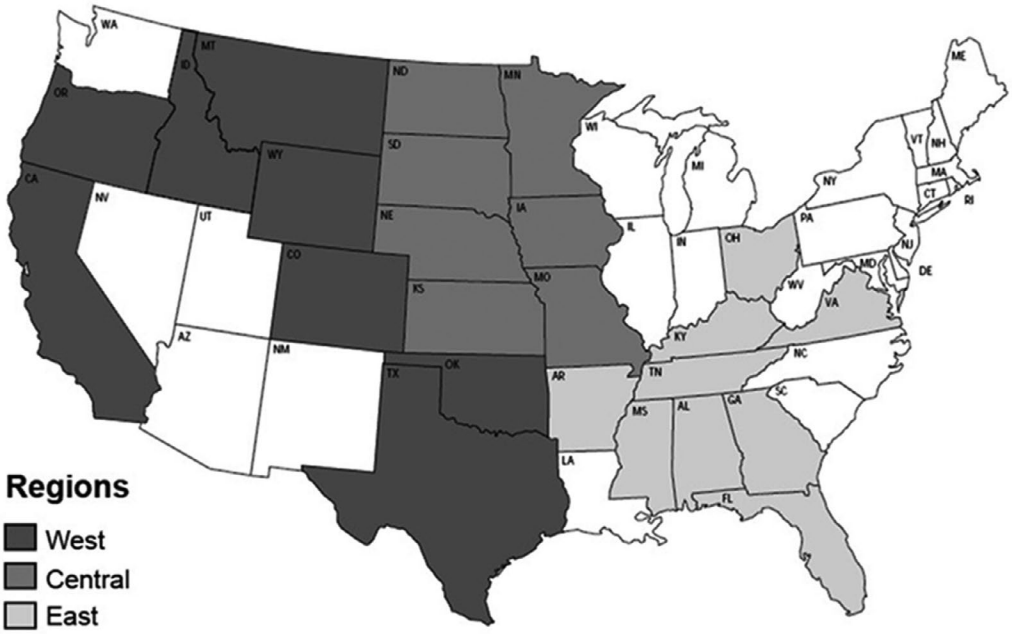
The NAHMS Beef '97 study was conducted in 23 States and represented 85.7 percent of U.S. beef cows and 77.6 percent of U.S. beef operations. Information from the NAHMS Beef '97 Study helped the U.S. beef industry identify educational needs and prioritize research efforts on topics such as antibiotic usage and Johne's disease, as well as potential foodborne pathogens, including *Salmonella*. Data from the Beef '97 Study were also critical in designing the enhanced surveillance plan for bovine spongiform encephalopathy (BSE).

The NAHMS Beef 2007-08 study was conducted in 24 States with the largest beef cow populations and provided valuable information representing 79.6 percent of U.S. cow-calf operations and 87.8 percent of U.S. beef cows. The NAHMS Beef 2007-08 study estimated the prevalence of persistent infection of bovine viral diarrhea (BVD) in beef calves and also helped the U.S. beef industry with estimates regarding producer awareness of BVD and management practices used to control it. In addition, the NAHMS Beef 2007-08 study estimated the prevalence of internal parasites in beef cows as well as an assessment of the effectiveness of anthelmintic treatment programs on reducing fecal egg counts in U.S. beef cow-calf operations.

The NAHMS Beef 2017 study was conducted in the 24 States with the Nation's largest beef cow populations. The study continues NAHMS' previous efforts of collecting vital information about the U.S. beef cow-calf industry as well as changes in industry practices and health management over time. The Beef 2017 study provided participants, stakeholders, and the industry as a whole with valuable information representing 78.9 percent of U.S. cow-calf operations and 86.6 percent of U.S. beef cows.

“Beef Cow-calf Health and Management Practices in the United States, 2017,” is the second in a series of reports containing national information from the NAHMS Beef 2017 study. This report contains information collected from 262 U.S. beef cow-calf operations.

States/regions participating in the NAHMS Beef 2017study



Terms Used in This Report

Animal average—The average value for all animals; the single reported value for each operation multiplied by the number of animals on that operation is summed over all operations and divided by the number of animals on all operations. This way, the result is adjusted for the number of animals on each operation. For an example, see the average number of days weaned calves were held before leaving the operation on p 13.

Backgrounder operation—Often used interchangeably with a stocker operation, a backgrounder operation is a farm or ranch that raises weaned calves prior to entering a feedlot. Calves that have spent time on backgrounder/stocker operations have recovered from the stress of weaning and tend to adapt more smoothly to a feedlot environment compared with freshly weaned calves. Sometimes, distinctions are made between backgrounder and stocker operations. For example, stocker operations are more likely to keep calves for longer periods than backgrounder operations, which typically keep calves just long enough for them to get over the stress of weaning or leaving the farm or ranch of origin before they enter a feedlot environment. In addition, backgrounder operations typically haul feed to the calves, while stocker operations expect calves to graze on pasture for most of their nutritional needs. In general, a backgrounder or stocker operation is an intermediate step for calves between the farm or ranch of origin and a feedlot.

Beef bull—Male bovine that has not been castrated.

Beef cow—Female bovine that has calved at least once.

Beef heifer—Female bovine that has not yet calved.

Born alive—Calves born alive and surviving at least 2 hours following birth.

Commercial cattle—Animals raised and marketed primarily for beef consumption. Commercial cattle also includes breeding animals that are used to produce calves raised and marketed primarily for beef consumption.

Cow-calf operation—A livestock operation with beef cows raised for the purpose of giving birth to beef calves. For commercial operations, calves are often raised to sell to a stocker/backgrounder operation or feedlot. Calves can also be fed out on the cow-calf operation. If the operation is a seedstock operation, calves are usually raised for breeding purposes.

Endemic—Diseases constantly present in a population or region.

Herd size—Herd size was based on an operation's January 1, 2017, inventory. Operations were placed in three size categories: small (1 to 49 cows), medium (50 to 199 cows), and large (200 or more cows).

Intramuscular (IM)—An injection given in a muscle.

Intravenous (IV)—An injection given in a vein, such as the jugular.

Ionophore—A drug administered in feed that promotes the efficient use of feedstuffs by altering the fermentation pattern in the rumen. Monensin, lasalocid, and laidlomycin are the three ionophores approved for use in cattle. All three are approved for improving feed efficiency. Monensin and lasalocid are also approved for prevention and control of coccidiosis.

Operation—Premises with at least one beef cow on January 1, 2017.

Operation average—The average value for all operations; a single value for each operation is summed over all operations and is divided by the number of operations reporting. For an example, see the average weight of cows sold in 2017 for purposes other than breeding (culls) on p. 29, which is calculated by summing the reported average weight of cull cows over all operations divided by the number of operations.

Persistently infected calves—These calves shed large quantities of bovine viral diarrhea (BVD) virus throughout their lives via feces and nasal and oral secretions; these cattle will never clear the infection. Persistently infected calves may or may not have congenital defects. Typically, persistently infected calves are poor performers; however, some will gain and grow relatively well, and some will even make it into the breeding herd and become pregnant. Persistently infected heifers and cows always produce persistently infected calves. Most PI calves are the result of transient BVD infections of their dams during pregnancy.

Preconditioning practices—Practices that help calves prepare to leave the operation of origin by reducing the stress associated with adjusting to a new location, such as a feedlot. Typical recommended preconditioning practices include keeping the calves on the operation for at least 45 days after weaning, dehorning (if horned), castrating bulls, administering appropriate vaccines, deworming, and getting calves used to eating from a feed bunk and drinking from a water tank.

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 results in limits of 2.8 and 4.0. When estimates are reported as being ‘higher’ or ‘lower’, a statistical difference is implied

but was not tested. Not all statistically different estimates are mentioned in the text of this report. Most estimates in this report are rounded to the nearest tenth. If rounded to 0, the standard error was reported as (0.0). If there were no reports of the event, no standard error was reported (—).

Regions

West—California, Colorado, Idaho, Montana, Oklahoma, Oregon, Texas, Wyoming
Central—Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
East—Alabama, Arkansas, Florida, Georgia, Kentucky, Mississippi, Ohio, Tennessee, Virginia

Replacement beef heifers—Weaned females being kept with the intent of being bred and becoming beef cows.

Scours—Loose feces (diarrhea) in animals. On cow-calf operations, this is often referred to as “calf scours,” since it primarily occurs in young calves.

Seedstock cattle—Animals raised and marketed primarily as breeding stock rather than consumption.

Steer—A castrated male bovine (i.e., testicles are removed so the animal can no longer breed).

Stocker operation—Often used interchangeably with a backgrounder operation, a stocker operation is a farm or ranch that raises weaned calves prior to entering a feedlot. Calves that have spent time on backgrounder/stocker operations have recovered from the stress of weaning and tend to adapt more smoothly to a feedlot environment compared with freshly weaned calves. Sometimes, distinctions are made between backgrounder and stocker operations. For example, stocker operations are more likely to keep calves for longer periods than backgrounder operations, which typically keep calves just long enough for them to get over the stress of weaning or leaving the farm or ranch of origin before they enter a feedlot environment. In addition, backgrounder operations typically haul feed to the calves, while stocker operations expect calves to graze on pasture for most of their nutritional needs. In general, a backgrounder or stocker operation is an intermediate step for calves between the farm or ranch of origin and a feedlot.

Subcutaneous (SQ)—An injection given under the skin.

Unweaned calf—A calf still nursing a cow or consuming milk.

Veterinary Feed Directive (VFD)—A paper or electronic form that authorizes the owner or caretaker of animals to obtain and use animal feed containing medically important antibiotics (medically important to humans) to treat their animals in accordance with the U.S. Food and Drug Administration (FDA) approved directions for use.

Veterinarian-client-patient relationship (VCPR)—A VCPR is the basis for interaction among veterinarians, their clients, and patients. According to the FDA,* a valid VCPR includes the following elements:

1. A veterinarian has assumed the responsibility for making medical judgments regarding the health of an animal(s) and its need for medical treatment, and the client (the owner of the animal(s) or other caretaker) has agreed to follow the veterinarian's instructions.

2. The veterinarian has sufficient knowledge of the animal(s) to initiate at least a general or preliminary diagnosis of the medical condition.

3. The veterinarian is readily available for follow-up in case of adverse reactions or failure of the therapy regimen. Such a relationship can exist only when the veterinarian is personally acquainted with the care and keeping of the animal(s) by virtue of examination and/or by medically appropriate and timely visits.

Weaned steer, heifer, or bull—A young steer, heifer, or bull no longer nursing a cow, i.e., no longer consuming milk. Weaning normally occurs when calves are 4 to 8 months old.

* Available at: https://www.ecfr.gov/cgi-bin/text-idx?SID=99550a83c97103df1503d4e34b99b 26b&mc=true&node=pt21.6.530&rgn=div5#se21.6.530_13

Section I: Population Estimates

Where applicable, column or row totals are shown as 100.0 to aid in interpretation; however, estimates may not always sum to 100.0 due to rounding. Unless otherwise noted, estimates in this report refer to calendar year 2017. Where noted, estimates might refer to the previous 12 months from when the study questionnaire was administered, which occurred from January through May of 2018.

A. Herd Management and Sales Practices

1. Marketing

As expected, a high percentage of operations (93.1 percent) sold beef cattle or weaned calves in 2017.

A.1.a. Percentage of operations that sold any beef cattle or weaned calves in 2017, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
91.7	(3.8)	96.6	(3.4)	100.0	(—)	93.1	(2.9)

There was no regional difference in the percentage of operations that sold beef cattle or weaned calves during 2017.

A.1.b. Percentage of operations that sold any beef cattle or weaned calves in 2017, by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
91.4	(5.8)	93.8	(4.4)	94.5	(3.9)

2. Cattle classes sold

Most beef cow-calf operations sell at least some cattle each year. For many commercial beef cow-calf operations, weaned calves are the main product they sell. Weaned calves from commercial operations might go to a stocker/backgrounder operation or to a feedlot. A cow-calf operation might also operate as a stocker/backgrounder operation or a feedlot. Seedstock operations primarily sell heifers and bulls to be used for breeding, but they often have some weaned calves that go to a stocker/backgrounder operation or feedlot.

A higher percentage of large operations (97.5 percent) sold at least one cull cow during 2017 compared with medium and small operations (74.5 and 53.6 percent, respectively). A higher percentage of large operations (70.6 percent) sold at least one cull bull during 2017 compared with small operations (28.6 percent). There were no other herd size differences in the percentages of operations that sold at least one of any of the other classes of beef cattle listed in the following table. A higher percentage of operations sold steers (79.3 percent) compared with other cattle classes.

A.2.a. Percentage of operations that sold the following classes of beef cattle and weaned calves in 2017, by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Cattle class	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Steers (weaned or older)	77.4	(5.5)	83.7	(5.5)	89.4	(7.5)	79.3	(4.3)
Heifers for breeding stock (weaned or older)	35.6	(6.3)	36.2	(6.4)	28.4	(6.0)	35.4	(4.9)
Other heifers, weaned or older, for purposes other than breeding (e.g., for backgrounding, feeding, or slaughter)	52.1	(6.7)	64.9	(7.5)	81.4	(8.6)	56.1	(5.3)
Cows for breeding stock	17.3	(4.7)	8.7	(2.9)	22.1	(4.4)	15.8	(3.6)

Table cont'd →

A.2.a. (cont'd) Percentage of operations that sold the following classes of beef cattle and weaned calves in 2017, by herd size:

	Percent Operations							
	Herd Size (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Cattle class	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Other cows for purposes other than breeding (e.g., culls, whether for feeding or slaughter)	53.6	(6.3)	74.5	(7.3)	97.5	(1.2)	60.0	(5.0)
Bulls for breeding stock (weaned and under 2 yr old)	10.0	(3.2)	11.7	(4.2)	17.3	(5.1)	10.7	(2.5)
Other bulls, weaned and under 2 yr old, for purposes other than breeding (e.g., for backgrounding, feeding, or slaughter)	19.1	(4.6)	18.1	(5.0)	32.8	(13.5)	19.6	(3.7)
Breeding bulls (2 yr or older; e.g. culls, whether for breeding at another operation, feeding, or slaughter)	28.6	(5.6)	39.7	(6.6)	70.6	(11.8)	32.9	(4.4)

A higher percentage of operations in the West region (28.4 percent) sold at least one cow for breeding stock compared with operations in the Central region (6.2 percent). There were no other regional differences in the percentages of operations by class of beef cattle sold during 2017.

A.2.b. Percentage of operations that sold the following classes of beef cattle and weaned calves in 2017, by region:

	Percent Operations					
	Region					
	West		Central		East	
Cattle class	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Steers (weaned or older)	78.6	(7.9)	84.7	(5.7)	76.0	(7.4)
Heifers for breeding stock (weaned or older)	38.0	(9.2)	44.4	(8.4)	25.4	(6.9)
Other heifers, weaned or older, for purposes other than breeding (e.g., for backgrounding, feeding, or slaughter)	45.7	(9.9)	57.9	(8.7)	67.1	(7.5)
Cows for breeding stock	28.4	(8.0)	6.2	(2.6)	8.1	(4.4)
Other cows for purposes other than breeding (e.g., culls, whether for feeding or slaughter)	56.9	(9.5)	61.4	(6.4)	62.7	(8.0)
Bulls for breeding stock (weaned and under 2 yr old)	7.2	(3.0)	6.5	(3.4)	18.0	(6.0)
Other bulls, weaned and under 2 yr old, for purposes other than breeding (e.g., for backgrounding, feeding, or slaughter)	13.6	(5.9)	13.5	(5.2)	31.3	(7.4)
Breeding bulls, 2 yr or older (e.g. culls, whether for breeding at another operation, feeding, or slaughter)	35.3	(8.7)	41.9	(6.6)	23.3	(6.0)

Large operations sold a higher percentage of cull cows (13.8 percent) than medium and small operations (9.1 and 8.0 percent, respectively). There were no other differences by herd size in the percentages of cattle classes sold during 2017. As expected, of cattle and calves sold during 2017, the highest percentages were steers (44.2 percent) and heifers (24.2 percent) intended for backgrounding, feeding, and slaughter.

A.2.c. Percentage of beef cattle or weaned calves sold in 2017, by cattle class and by herd size:

Percent Beef Cattle or Weaned Calves Sold

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Cattle class	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Steers (weaned or older)	42.0	(3.1)	47.6	(2.6)	42.9	(1.9)	44.2	(1.5)
Heifers for breeding stock (weaned or older)	13.3	(3.0)	13.3	(2.5)	6.5	(1.6)	11.2	(1.5)
Other heifers, weaned or older, for purposes other than breeding (e.g., for backgrounding, feeding, or slaughter)	23.6	(2.9)	22.4	(2.6)	26.9	(1.7)	24.2	(1.5)
Cows for breeding stock	2.6	(0.9)	1.5	(0.7)	3.2	(1.0)	2.4	(0.5)
Other cows for purposes other than breeding (e.g., culls, whether for feeding or slaughter)	8.0	(1.2)	9.1	(0.9)	13.8	(1.3)	10.2	(0.7)
Bulls for breeding stock (weaned and under 2 yr old)	1.2	(0.6)	2.7	(1.3)	2.5	(1.1)	2.1	(0.6)
Other bulls, weaned and under 2 yr old, for purposes other than breeding (e.g., for backgrounding, feeding, or slaughter)	7.5	(1.9)	2.4	(1.0)	2.9	(2.4)	4.3	(1.0)
Breeding bulls (2 yr or older; e.g. culls, whether for breeding at another operation, feeding, or slaughter)	1.8	(0.4)	1.0	(0.2)	1.2	(0.2)	1.3	(0.2)
Total	100.0		100.0		100.0		100.0	

Operations in the Central region sold a slightly higher percentage of cull cows (13.9 percent) than operations in the West and East regions (8.7 and 8.3 percent, respectively). There were no other substantial differences by region in the percentages of any other classes of beef cattle sold during 2017.

A.2.d. Percentage of beef cattle or weaned calves sold in 2017, by cattle class and by region:

	Percent Beef Cattle or Weaned Calves Sold					
	Region					
	West		Central		East	
Cattle class	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Steers (weaned or older)	45.0	(2.9)	45.9	(2.0)	41.4	(2.7)
Heifers for breeding stock (weaned or older)	13.9	(2.9)	13.1	(2.5)	5.6	(1.2)
Other heifers, weaned or older, for purposes other than breeding (e.g., for backgrounding, feeding, or slaughter)	22.2	(2.8)	20.3	(2.2)	31.1	(1.8)
Cows for breeding stock	3.4	(0.9)	1.8	(0.6)	1.6	(0.9)
Other cows for purposes other than breeding (e.g., culls, whether for feeding or slaughter)	8.7	(1.0)	13.9	(1.4)	8.3	(0.8)
Bulls for breeding stock (weaned and under 2 yr old)	3.2	(1.3)	1.1	(0.5)	1.8	(0.8)
Other bulls, weaned and under 2 yr old, for purposes other than breeding (e.g., for backgrounding, feeding, or slaughter)	2.4	(1.2)	2.3	(1.0)	9.0	(2.8)
Breeding bulls, 2 yr or older (e.g. culls, whether for breeding at another operation, feeding, or slaughter)	1.2	(0.3)	1.7	(0.3)	1.1	(0.3)
Total	100.0		100.0		100.0	

3. Primary method of sale

For each class of beef cattle sold during 2017, producers were asked about the primary method of sale. The options are briefly described below:

Auction—Refers to an auction market or sale barn where cattle are sold to the highest bidder. Typically, bidders are physically present during this type of auction, unlike online or video auctions. In addition, many seedstock operations sell cattle by conducting auctions at their farms or ranches.

Direct video/internet auction—A selling method by which a producer's cattle are shown by video or photographs on the Internet and buyers bid on the cattle without being physically present.

Direct private treaty—In this case, potential buyers negotiate directly with sellers. Typically, buyers visit the operation to view the cattle and at the same time assess the operation's facilities.

Forward contract—A selling method by which cattle are sold for a price agreed upon in a contract and delivered at a future date, at a certain weight. For example, a producer might have 650-pound steers that he or she intends to grow to 800 pounds. A forward contract allows the producer to sell the cattle as 800-pound steers (even though they still weigh 650 pounds) with a delivery date 2 months in the future (when the cattle are expected to reach 800 pounds). A producer might enter into a forward contract if he or she believes that cattle prices might decline before the cattle are ready for sale.

Carcass basis—A selling method in which cattle are priced according to how they are graded after slaughter. Cattle are graded on meat quality (e.g., prime, choice, select) and yield (grades 1-5, with 1 being the highest yielding carcass and 5 the lowest). Yield grade identifies the difference in yield of lean red meat compared to fat, with 1 being most desirable. Cattle sold on a carcass basis are usually market-weight cattle. Typically, cow-calf producers would only sell cattle on a carcass basis if they either retained ownership of their cattle at the feedlot or if they operated a feedlot of their own. Selling cattle on a carcass basis is also known as "selling on the grid," which is usually done when producers have an idea of how their cattle will perform on quality and yield. When used for a group of cattle, the "grid" is a matrix-based pricing system that typically consists of a base price along with various bonuses or discounts, which primarily depend on how each carcass in the group performs on quality and yield.

For weaned steers, other weaned heifers (for feeding or backgrounding), cull cows, cull bulls, and other bulls for feeding or backgrounding that were sold during 2017, the most common method of sale was by auction.

A.3. Percentage of operations by primary method of sale for the following cattle classes in 2017:

Percent Operations

Cattle Class

	Weaned steers		**Weaned heifers for breeding**		**Other weaned heifers**		**Cows for breeding stock**		**Other cows** (culls)		**Weaned to 2 yr old bulls for breeding**		**Other bulls weaned to 2 yr old** (for feeding/ backgrounding)		**Breeding bulls 2 yr or older** (culls)	
Primary method of sale	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Auction	61.7	(5.2)	21.7	(4.1)	47.9	(5.3)	9.4	(3.0)	49.4	(5.1)	1.6	(1.3)	18.0	(3.5)	30.1	(4.3)
Direct–video/ internet auction	1.4	(0.4)	0.4	(0.2)	0.9	(0.3)	0.0	(0.0)	0.0	(0.0)	0.0	(—)	0.0	(0.0)	0.0	(—)
Direct–private treaty	13.1	(3.6)	12.0	(3.3)	5.1	(1.6)	6.3	(2.8)	4.6	(2.4)	8.1	(2.3)	1.4	(1.3)	0.9	(0.5)
Forward contract	0.4	(0.4)	0.1	(0.1)	0.4	(0.4)	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)
Carcass basis	0.9	(0.5)	0.0	(—)	0.7	(0.4)	0.0	(—)	0.7	(0.3)	0.0	(—)	0.1	(0.1)	0.1	(0.0)
Other/ Unknown	1.8	(1.1)	1.2	(1.1)	1.1	(0.6)	0.0	(—)	5.3	(2.4)	1.0	(0.9)	0.0	(—)	1.8	(1.7)
None sold	20.7	(4.3)	64.6	(4.9)	43.9	(5.3)	84.2	(3.6)	40.0	(5.0)	89.3	(2.5)	80.4	(3.7)	67.1	(4.4)
Total	100.0		100.0		100.0		100.0		100.0		100.0		100.0		100.0	

4. Weaned calves sold for purposes other than breeding

As expected, most operations (90.4 percent) sold weaned calves for purposes other than breeding during 2017. There were no differences by herd size in the percentage of operations that sold weaned calves for purposes other than breeding.

A.4.a. Percentage of operations that sold any weaned calves for purposes other than breeding in 2017 (specifically calves destined for feedlot, backgrounder, or stocker operations), by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
88.9	(4.2)	93.9	(3.9)	98.1	(1.3)	90.4	(3.2)

There were no differences by region in the percentage of operations that sold weaned calves for purposes other than breeding.

A.4.b. Percentage of operations that sold any weaned calves for purposes other than breeding in 2017 (specifically calves destined for feedlot, backgrounder, or stocker operations), by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
90.3	(5.8)	93.0	(4.4)	88.3	(5.7)

After weaning, calves were held an average of 32.7 days before leaving the operation. Medium operations held calves for a longer average period (53.8 days) than small operations (25.4 days).

A.4.c. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding (table A.4.a.), average number of days after weaning that calves sold in 2017 were held before leaving the operation, by herd size:

Average Number of Days

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Avg.	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
25.4	(5.3)	53.8	(6.7)	49.4	(10.4)	32.7	(4.2)

There were no regional differences in the average number of days calves were held after weaning and before leaving the operation.

A.4.d. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding (table A.4.a.), average number of days after weaning that calves sold in 2017 were held before leaving the operation, by region:

Average Number of Days

Region

West		**Central**		**East**	
Avg.	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
24.9	(7.9)	40.5	(5.2)	36.5	(6.2)

Preconditioning practices help calves get ready to leave their operation of origin. For example, calves that have undergone preconditioning practices experience less stress when adjusting to a new location, such as a feedlot. Typical preconditioning practices include keeping calves on the operation for at least 45 days after weaning, dehorning (if horned), castration (bulls), administering appropriate vaccines, and deworming. Calves are also introduced to eating from a feed bunk and drinking from a water tank during this period.

Of operations that sold any weaned calves for purposes other than breeding, 70.2 percent held calves fewer than 45 days after weaning, and 43.1 percent weaned and shipped calves off the operation on the same day.

A.4.e. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding in 2017 (table A.4.a.), percentage of operations by average number of days calves were held after weaning and before leaving the operations by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Days held	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0	48.0	(5.3)	26.4	(5.9)	42.6	(11.2)	43.1	(4.1)
1–20	13.0	(4.1)	9.5	(4.8)	1.2	(0.6)	11.6	(3.2)
21–44	17.3	(4.6)	11.1	(3.3)	9.1	(4.7)	15.5	(3.5)
45-60	9.3	(3.2)	21.0	(5.5)	14.0	(4.6)	12.0	(2.6)
61–90	7.0	(2.9)	17.0	(7.0)	15.3	(8.6)	9.5	(2.6)
91 or more	5.4	(3.5)	15.0	(4.5)	17.8	(6.0)	8.1	(2.7)
Total	100.0		100.0		100.0		100.0	

A higher percentage of operations in the West region (65.9 percent) weaned calves on the day they were leaving the operation compared with operations in the Central and East regions (21.6 and 31.0 percent, respectively).

A.4.f. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding in 2017 (table A.4.a.), percentage of operations by average number of days calves were held after weaning and before leaving the operations, by region:

	Percent Operations					
	Region					
	West		Central		East	
Days held	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0	65.9	(6.9)	21.6	(6.7)	31.0	(6.4)
1–20	5.4	(3.2)	19.1	(7.1)	13.8	(6.8)
21–44	9.7	(4.1)	25.2	(7.6)	15.6	(7.2)
45-60	3.1	(1.5)	14.6	(5.7)	21.2	(6.3)
61–90	7.1	(3.5)	10.3	(4.7)	12.0	(5.6)
91 or more	8.8	(5.2)	9.2	(2.9)	6.4	(4.5)
Total	100.0		100.0		100.0	

5. Feeding calves prior to sale

Often calves are introduced to a feed bunk prior to weaning in a “creep pen,” which is a pen or area that, due to the size of its entrance, can only be accessed by calves, not older cattle. Creep pens ensure that older cattle do not have access to the calves’ feed and at the same time help calves get used to eating from a feed bunk prior to weaning.

Of operations that sold any weaned calves for purposes other than breeding in 2017, 32.0 percent fed unweaned calves in a feed bunk. There were no differences by herd size in the percentage of operations that fed unweaned calves in a feed bunk. The study’s questionnaire asked for the number of days that calves were fed in a feed bunk before leaving the operation; for unweaned calves, the specific wording was “before weaning (creep feeding).” Given the wording of the question, most operations would have responded only if they used a creep pen to feed calves. However, if the cows in the herd were fed in a feed bunk, unweaned calves could have been introduced to a feed bunk in the absence of a creep pen.

A.5.a. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), percentage of operations that introduced **unweaned** calves to a feed bunk (creep feeding), by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
31.0	(6.5)	34.7	(7.4)	35.6	(8.6)	32.0	(5.0)

There were no regional differences in the percentage of operations that introduced unweaned calves to a feed bunk before weaning.

A.5.b. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), percentage of operations that introduced **unweaned** calves to a feed bunk (creep feeding), by region:

Percent Operations

Region

West		Central		East	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
24.7	(8.8)	38.4	(8.6)	36.5	(8.2)

On operations that sold any weaned calves for purposes other than breeding in 2017, unweaned calves were fed in a feed bunk (creep feeding) for an average of 21.0 days before weaning. There were no differences by herd size in the number of days that unweaned calves were fed in a feed bunk.

A.5.c. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), average number of days **unweaned** calves were fed in a feed bunk (creep feeding), by herd size:

Average Number of Days

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Avg.	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
17.0	(4.6)	33.6	(8.5)	26.6	(7.5)	21.0	(3.8)

For operations that sold any weaned calves for purposes other than breeding in 2017, there were no regional differences in the average number of days that unweaned calves were fed in a feed bunk (creep-fed).

A.5.d. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), average number of days **unweaned** calves were fed in a feed bunk (creep feeding), by herd size, by region:

Average Number of Days					
Region					
West		Central		East	
Avg.	Std. error	Avg.	Std. error	Avg.	Std. error
8.9	(3.8)	26.2	(6.2)	32.2	(9.2)

Overall, more than over two-thirds of operations (68.0 percent) did not introduce unweaned calves to a feed bunk. For operations that did introduce unweaned calves to a feed bunk (creep feeding), there were no substantial differences in the average number of days calves were creep-fed.

A.5.e. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), percentage of operations by average number of days **unweaned** calves were fed in a feed bunk (creep feeding) before leaving the operation:

Average number days fed	Percent operations	Std. error
0	68.0	(5.0)
1–31	12.3	(4.1)
32–61	7.6	(2.5)
62–92	3.5	(1.4)
93–122	5.9	(2.5)
123 or more	2.8	(1.5)
Total	100.0	

Unweaned calves that are not introduced to a feed bunk in a creep pen can still be acclimated to a feed bunk after they are weaned, which will prepare them for entering a backgrounder or feedlot environment. Of operations that sold any weaned calves for purposes other than breeding in 2017, 48.1 percent fed calves in a feed bunk after weaning and before leaving the operation. There were no differences by herd size in the percentage of operations that fed calves in a feed bunk after weaning.

A.5.f. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), percentage of operations that fed calves in a feed bunk after weaning and before leaving the operation, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
43.7	(4.8)	62.6	(6.2)	52.1	(11.0)	48.1	(3.8)

Of operations that sold any weaned calves for purposes other than breeding in 2017, a lower percentage of operations in the West region (21.9 percent) fed calves in a feed bunk after weaning than operations in the Central and East regions (68.5 and 65.4 percent, respectively).

A.5.g. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), percentage of operations that fed calves in a feed bunk after weaning and before leaving the operation, by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
21.9	(4.5)	68.5	(7.6)	65.4	(6.8)

Of operations that sold any weaned calves for purposes other than breeding in 2017, operations fed calves in a feed bunk after weaning for an average of 25.3 days. Medium operations fed calves in a feed bunk after weaning for a greater average number of days (43.0) compared with small operations (19.1).

A.5.h. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), average number of days calves were fed in a feed bunk after weaning and before leaving the operation, by herd size:

Average Number of Days

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Avg.	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
19.1	(3.4)	43.0	(6.4)	40.9	(9.9)	25.3	(2.9)

Of operations that sold any weaned calves for purposes other than breeding in 2017, operations in the West region fed calves in a feed bunk after weaning for a lower average number of days (13.4) compared with operations in the Central and East regions (34.6 and 33.1 days, respectively).

A.5.i. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), average number of days calves were fed in a feed bunk after weaning and before leaving the operation, by region:

Average Number of Days

Region

West		**Central**		**East**	
Avg.	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
13.4	(3.0)	34.6	(5.1)	33.1	(6.3)

Of operations that sold any weaned calves for purposes other than breeding in 2017, 51.9 percent did not feed calves in a feed bunk after weaning, and 43.1 percent weaned calves on the same day they left the operation (table A.4.e.). Because these percentages are not equal (51.9 and 43.1 percent) some operations must be feeding weaned calves without using a feed bunk, such as feeding hay on the ground or turning the weaned calves out to pasture. For operations that did feed calves in a bunk after weaning, about one-third (34.9 percent) fed calves from 1 to 61 days.

A.5.j. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), percentage of operations by average number of days calves were fed in a feed bunk after weaning and before leaving the operation:

Average days fed	Percent operations	Std. error
0	51.9	(3.8)
1–31	19.8	(3.9)
32–61	15.1	(2.9)
62–92	8.2	(2.6)
93–122	2.8	(1.6)
123 or more	2.2	(0.8)
Total	100.0	

Of operations that sold any weaned calves for purposes other than breeding in 2017, 57.3 percent fed calves in a feed bunk prior to or after weaning. There were no differences by herd size in the percentage of operations that fed calves in a feed bunk prior to or after weaning.

A.5.k. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), percentage of operations that fed calves in a feed bunk prior to or after weaning and before leaving the operation, by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Timing of Feeding	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Before weaning (creep feeding)	31.0	(6.5)	34.7	(7.4)	35.6	(8.6)	32.0	(5.0)
After weaning	43.7	(4.8)	62.6	(6.2)	52.1	(11.0)	48.1	(3.8)
Before or after weaning	54.8	(6.2)	64.3	(6.1)	64.7	(10.8)	57.3	(4.7)

Of operations that sold any weaned calves for purposes other than breeding in 2017, a lower percentage of operations in the West region (36.5 percent) fed calves in a feed bunk before or after weaning compared with operations from the Central and East regions (77.2 and 68.3 percent, respectively).

A.5.I. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), percentage of operations that fed calves in a feed bunk prior to or after weaning and before leaving the operation, by region:

	Percent Operations					
	Region					
	West		Central		East	
Timing of Feeding	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Before weaning (creep feeding)	24.7	(8.8)	38.4	(8.6)	36.5	(8.2)
After weaning	21.9	(4.5)	68.5	(7.6)	65.4	(6.8)
Before or after weaning	36.5	(8.8)	77.2	(7.1)	68.3	(6.6)

6. Treatment of calves for internal or external parasites prior to sale

Typically, calves should be treated for internal and external parasites to help them become ready to leave the operation of origin and reduce their stress when adjusting to a new location, such as a feedlot.

Of operations that sold any weaned calves for purposes other than breeding in 2017, there were no differences by herd size in the percentage of operations that treated calves for internal or external parasites before they left the operation. Overall, 70.6 and 71.5 percent of operations treated calves for internal parasites and external parasites, respectively.

A.6.a. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), percentage of operations that treated weaned calves for internal (worms) or external (flies, lice, ticks, grubs) parasites before they left the operation, by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Parasite type	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Internal (worms)	65.1	(6.8)	84.5	(5.3)	84.4	(9.0)	70.6	(5.1)
External (flies, lice, ticks, grubs)	65.0	(7.0)	87.9	(5.1)	87.1	(8.8)	71.5	(5.2)

Of operations that sold any weaned calves for purposes other than breeding in 2017, a lower percentage of operations in the West region (47.0 percent) treated calves for internal parasites before they left the operation compared with operations in the Central and East regions (82.3 and 86.6 percent, respectively). In addition, a lower percentage of operations in the West region (50.3 percent) treated calves for external parasites before they left the operation compared with operations in the East region (84.5 percent).

A.6.b. For the 90.4 percent of operations that sold any weaned calves for purposes other than breeding during 2017 (table A.4.a.), percentage of operations that treated weaned calves for internal (worms) or external (flies, lice, ticks, grubs) parasites before they left the operation, by region:

	Percent Operations					
	Region					
	West		Central		East	
Parasite type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Internal (worms)	47.0	(10.7)	82.3	(5.5)	86.6	(5.3)
External (flies, ticks, grubs)	50.3	(10.8)	83.8	(6.9)	84.5	(5.5)

7. Average weight of cull cows sold

The average weight of cull cows sold in 2017 did not vary by herd size.

A.7.a. Average weight of cows sold in 2017 for purposes other than breeding (culls), by herd size:

Average Weight (lb)							
Herd Size (number of beef cows)							
Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Avg.	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
1,139	(26)	1,214	(22)	1,197	(25)	1,163	(19)

The average weight of cull cows sold in 2017 did not vary by region.

A.7.b. Average weight of cows sold in 2017 for purposes other than breeding (culls), by region:

Average Weight (lb)					
Region					
West		**Central**		**East**	
Avg.	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
1,178	(33)	1,175	(36)	1,139	(29)

A cow's weight can be affected by many factors, including breed, feeding practices, and disease. For operations that sold any cows for purposes other than breeding (culls) in 2017, the percentage of operations in each average-weight category for cull cows sold in 2017 did not differ by herd size.

A.7.c. For the 60.0 percent of operations that sold any cows for purposes other than breeding (culls) in 2017 (table A.2.a), percentage of operations by average weight (in pounds) of cull cows sold, by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Average weight (lb)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 1,000	19.0	(6.6)	6.7	(2.7)	12.8	(7.2)	15.3	(4.5)
1,000–1,149	30.9	(7.7)	30.3	(6.8)	12.8	(4.3)	29.3	(5.4)
1,150–1,299	21.3	(6.9)	32.0	(6.0)	39.5	(11.7)	25.5	(5.0)
1,300 or more	28.8	(8.3)	31.1	(6.6)	34.9	(7.3)	29.8	(5.8)
Total	100.0		100.0		100.0		100.0	

For operations that sold any cows for purposes other than breeding (culls) in 2017, the percentage of operations in each average-weight category for cull cows sold in 2017 did not differ by region.

A.7.d. For the 60.0 percent of operations that sold any cows for purposes other than breeding (culls) in 2017 (table A.2.a), percentage of operations by average weight (in pounds) of cull cows sold, by region:

	Percent Operations					
	Region					
	West		Central		East	
Average weight (lb)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 1,000	12.3	(8.0)	22.5	(9.0)	12.9	(6.6)
1,000–1,149	27.8	(10.8)	19.5	(8.0)	38.2	(8.3)
1,150–1,299	22.5	(8.2)	22.8	(7.4)	30.5	(9.3)
1,300 or more	37.4	(11.9)	35.3	(8.2)	18.3	(8.1)
Total	100.0		100.0		100.0	

8. Reasons for culling cows

Cows are culled for a variety of reasons. In some cases, culling can be viewed as elective, such as during reductions in herd size or if a cow has a bad temperament. In other cases, culling may not be elective, such as in the case of injury. As cows age past 10 to 12 years, they may begin to lose teeth, which over time can affect their ability to harvest forage. In addition, cows are expected to have a calf every year. If they do not get pregnant or abort their calf, that can also be a reason for culling.

For operations that sold any cows for purposes other than breeding (culls) in 2017, the highest percentages of operations culled cows for age or bad teeth (57.7 percent) and for open or aborted pregnancy status (40.6 percent). A higher percentage of medium operations (64.7 percent) than small operations (28.5 percent) culled cows based on pregnancy status. There were no other substantial differences by herd size in the percentages of operations by reasons for culling cows.

A.8.a. For the 60.0 percent of operations that sold any cows for purposes other than breeding (culls) in 2017 (table A.2.a), percentage of operations by reason(s) for sale and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Reason	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Pregnancy status (open or aborted)	28.5	(7.3)	64.7	(6.2)	65.8	(12.9)	40.6	(5.3)
Other reproductive problems (other than open or aborted)	18.2	(5.8)	11.0	(4.0)	7.3	(3.1)	15.5	(4.0)
Producing poor calves	7.0	(3.7)	10.1	(3.8)	22.5	(9.4)	9.0	(2.8)
Age or bad teeth	56.0	(8.9)	59.6	(6.8)	66.4	(10.7)	57.7	(6.2)
Physical unsoundness (e.g., injury or lameness)	21.1	(6.3)	21.1	(5.3)	21.9	(5.8)	21.1	(4.4)
Bad eyes	0.0	(—)	5.6	(3.2)	6.4	(2.7)	1.9	(0.9)
Digestive problem	0.0	(—)	0.0	(—)	1.0	(1.1)	0.1	(0.1)
Respiratory problem	0.0	(—)	2.0	(1.7)	1.5	(1.1)	0.6	(0.4)
Udder problem	11.0	(5.4)	12.7	(3.5)	10.0	(4.0)	11.3	(3.7)
Temperament	5.6	(4.0)	5.2	(2.5)	25.3	(9.4)	7.1	(2.9)
Economics (drought, herd reduction, market conditions)	2.3	(2.3)	0.6	(0.6)	8.5	(7.6)	2.3	(1.6)
Other factor	6.9	(4.8)	2.3	(1.9)	1.1	(0.8)	5.3	(3.2)

For operations that sold any cows for purposes other than breeding (culls) in 2017, there were no regional differences in the percentages of operations by reason for culling cows.

A.8.b. For the 60.0 percent of operations that sold any cows for purposes other than breeding (culls) in 2017 (table A.2.a), percentage of operations by reason(s) for sale and by region:

	Percent Operations					
	Region					
	West		Central		East	
Reason	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Pregnancy status (open or aborted)	38.6	(9.2)	46.8	(8.3)	38.1	(9.1)
Other reproductive problems (other than open or aborted)	12.1	(7.6)	24.3	(9.2)	12.6	(3.5)
Producing poor calves	5.8	(1.5)	7.9	(3.6)	13.2	(7.0)
Age or bad teeth	62.5	(10.9)	52.0	(10.1)	56.9	(10.6)
Physical unsoundness (e.g., injury or lameness)	21.2	(8.4)	21.5	(7.7)	20.8	(6.5)
Bad eyes	2.6	(1.9)	2.0	(1.1)	1.1	(1.0)
Digestive problem	0.2	(0.2)	0.0	(—)	0.0	(—)
Respiratory problem	0.0	(—)	0.8	(0.5)	1.2	(1.2)
Udder problem	10.9	(7.5)	18.6	(8.2)	6.3	(1.9)
Temperament	1.3	(0.9)	13.4	(6.5)	8.5	(6.3)
Economics (drought, herd reduction, market conditions)	0.0	(—)	8.8	(6.1)	0.0	(—)
Other factor	13.3	(8.3)	0.9	(0.6)	0.0	(—)

Among cows sold in 2017 for purposes other than breeding (culls), the highest percentages were culled for pregnancy status (40.5 percent) and age or bad teeth (35.7 percent).

A.8.c. For the 60.0 percent of operations that sold any cows for purposes other than breeding (culls) in 2017 (table A.2.a), percentage of cows by reason for sale:

Reason	Percent cows	Std. error
Pregnancy status (open or aborted)	40.5	(4.9)
Other reproductive problems (other than open or aborted)	3.4	(1.0)
Producing poor calves	3.1	(0.8)
Age or bad teeth	35.7	(8.0)
Physical unsoundness (e.g., injury or lameness)	5.0	(1.1)
Bad eyes	0.3	(0.1)
Digestive problem	0.0	(0.0)
Respiratory problem	0.1	(0.1)
Udder problem	2.8	(1.0)
Temperament	2.1	(0.7)
Economics (drought, herd reduction, market conditions)	5.9	(4.6)
Other factor	1.2	(0.6)
Total	100.0	

9. Age of cows at culling

For operations that sold any cows for purposes other than breeding (culls) in 2017, there were no herd size differences in the percentage of operations by age range of cull cows sold. A higher percentage of operations sold at least one cull cow aged 10 years or more (71.4 percent) compared with operations that sold at least one cull cow less than 5 years old (38.0 percent).

A.9.a. For the 60.0 percent of operations that sold any cows for purposes other than breeding (culls) in 2017 (table A.2.a), percentage of operations by age of cows at time of sale and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Age (yr)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 5	32.1	(7.9)	51.1	(7.2)	46.6	(10.8)	38.0	(5.7)
5–9	45.4	(8.5)	65.5	(6.7)	64.3	(9.1)	51.9	(5.9)
10 or older	68.5	(8.4)	73.5	(5.6)	88.7	(4.0)	71.4	(5.8)

For operations that sold any cows for purposes other than breeding (culls) in 2017, there were no regional differences in the percentage of operations by age range of cull cows sold.

A.9.b. For the 60.0 percent of operations that sold any cows for purposes other than breeding (culls) in 2017 (table A.2.a), percentage of operations by age of cows at time of sale and by region:

	Percent Operations					
	Region					
	West		Central		East	
Age (yr)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 5	31.0	(8.7)	42.9	(9.6)	41.8	(10.7)
5–9	56.6	(9.3)	66.1	(9.1)	36.1	(10.6)
10 or older	69.6	(10.2)	68.4	(9.1)	75.6	(10.0)

Among cows sold in 2017 for purposes other than breeding (culls), a lower percentage of cows less than 5 years old were culled (16.4 percent) compared with cows aged 5 to 9 or 10 or more years (35.3 and 48.3 percent, respectively). There were no herd size differences in the percentages of cows culled within each age range.

A.9.c. For the 60.0 percent of operations that sold any cows for purposes other than breeding (culls) in 2017 (table A.2.a), percentage of cows by age at time of sale and by herd size:

Percent Cows

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Age (yr)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 5	18.1	(5.0)	18.1	(3.3)	14.1	(3.2)	16.4	(2.1)
5–9	32.3	(5.6)	39.5	(4.5)	34.2	(11.0)	35.3	(5.0)
10 or older	49.6	(6.1)	42.4	(4.2)	51.7	(13.9)	48.3	(6.1)
Total	100.0		100.0		100.0		100.0	

Among cows sold in 2017 for purposes other than breeding (culls), a higher percentage of cows 5 to 9 years old in the Central region (46.2 percent) were culled compared to cows in the East region (17.6 percent). There were no other substantial regional differences in the percentage of cows culled within each age range.

A.9.d. For the 60.0 percent of operations that sold any cows for purposes other than breeding (culls) in 2017 (table A.2.a), percentage of cows by age at time of sale and by region:

	Percent Cows					
	Region					
	West		Central		East	
Age (yr)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 5	17.1	(3.5)	16.6	(3.3)	15.1	(4.5)
5–9	34.3	(4.0)	46.2	(9.4)	17.6	(4.6)
10 or older	48.5	(4.5)	37.2	(11.5)	67.3	(7.1)
Total	100.0		100.0		100.0	

B. Vaccination and BVD Testing Practices

1. General vaccination practices

Vaccines are given to cattle primarily for prevention and control of infectious diseases caused by viruses and bacteria. A higher percentage of medium operations (92.6 percent) vaccinated any beef cattle or calves in 2017 compared with small operations (68.8 percent). Overall, 74.5 percent of operations vaccinated any cattle or calves during 2017.

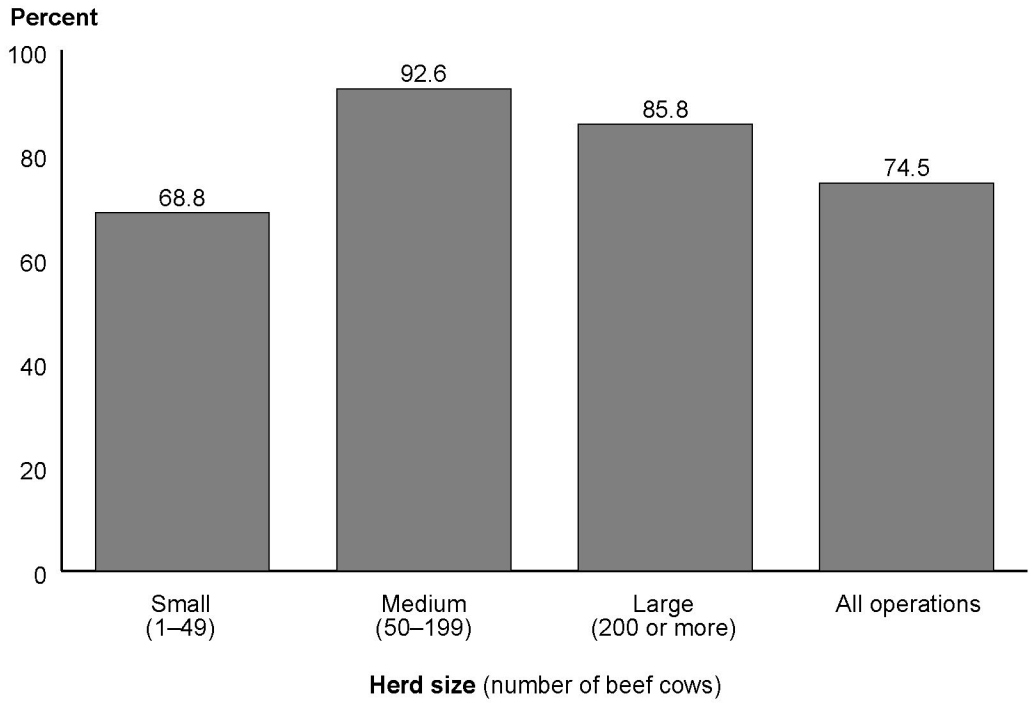
B.1.a. Percentage of operations that vaccinated any beef cattle or calves in 2017, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		Medium (50–199)		Large (200 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
68.8	(6.5)	92.6	(3.6)	85.8	(12.7)	74.5	(5.0)

Percentage of operations that vaccinated any beef cattle or calves in 2017, by herd size



There were no regional differences in the percentage of operations that vaccinated any beef cattle or calves in 2017.

B.1.b. Percentage of operations that vaccinated any beef cattle or calves in 2017, by region:

Percent Operations					
Region					
West		Central		East	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
71.2	(9.3)	82.8	(6.0)	72.0	(8.4)

There are many things to consider when devising a vaccination plan for a beef cow-calf operation. For example, in young calves that receive colostrum from their dam, the antibodies received from the dam (maternal antibodies) may interfere with the antigens in the vaccines, rendering the vaccines ineffective. Some evidence, however, indicates that vaccinating young calves that still have maternal antibodies can be beneficial. If calves do not receive adequate colostrum from their dams, vaccinating them can also be beneficial.

There are two main types of vaccines: modified-live (attenuated) and killed (inactivated). There are often both modified-live and killed vaccines available for viruses. Most vaccines against bacteria are bacterin or bacterin-toxoid products, which are killed vaccines. Modified-live vaccines contain a living organism that has been modified such that it does not cause disease in an animal. Some modified-live vaccines replicate in the animal after administration, and one dose can be sufficient; other modified-live vaccines do not replicate in the animal, and a booster dose is recommended for optimal protection. In killed vaccines, the target organism has been inactivated and is no longer living. All killed vaccines should be given in two doses during initial vaccination. Modified-live vaccines generally offer better and longer-lasting immunity compared with killed vaccines.

The vaccines recommended for use on a cow-calf operation vary based on an operation's disease history/status as well as many other factors. Because there is no universally recommended vaccine program that fits all cattle herds, producers should consult a veterinarian about appropriate vaccines for their herd. In general, and for all classes of cattle, vaccines are commonly recommended for viruses such as infectious bovine rhinotracheitis (IBR), bovine viral diarrhea (BVD), parainfluenza 3 virus (PI3), and bovine respiratory syncytial virus (BRSV). Many combination vaccines contain antigens for IBR, BVD, PI3, and BRSV, meaning a single dose of these vaccines contains antigens against all four of these viruses. Recommended use of other vaccines often varies depending on cattle class, cattle environment, geographic location, and the operation's disease history.

Some cattle classes in the following table are shaded-out (no estimates) for certain vaccines because giving that vaccine to that cattle class is not allowed. For example, vaccines for Johne's disease were only allowed in replacement heifer and bull calves from 1 to 35 days old. While Johne's vaccine was available when this study was conducted, the only vaccine available for Johne's disease in the United States ceased production in 2019. In other cases, administering a vaccine to certain classes of cattle is not appropriate. For example, trichomoniasis vaccines are not appropriate for cattle that will not be used for breeding. *Brucella abortus* vaccines are regulated by USDA:APHIS:VS, and *Brucella abortus* vaccines are typically only given to female cattle from 4 to 12 months old. Exceptions, however, can be granted for adult female cattle that are moved to a State that requires brucellosis vaccination.

About two-thirds of operations (67.6 percent) vaccinated any cattle for *Clostridium* species (not counting *Clostridium perfringens*) during 2017, and 47.9 percent of operations vaccinated any cattle against *Clostridium perfringens*. Over one-half of operations (55.9 to 62.8 percent) vaccinated any cattle against IBR, BVD, PI3, BRSV, and *Leptospira*.

B.1.c. Percentage of operations by vaccine used in 2017, and by cattle class:

	Percent Operations													
	Cattle Class													
	Calves aged 1–21 d		Calves aged 22 d through weaning		Weaned replacement heifers through breeding		Bred replacement heifers through calving		Cows		Bulls		Any Cattle	
Vaccine	Pct.	Std. err.	Pct.	Std. err.	Pct.	Std. err.	Pct.	Std. err.	Pct.	Std. err.	Pct.	Std. err.	Pct.	Std. err.
General (respiratory and/or reproductive)														
Infectious bovine rhinotracheitis, rednose (IBR)	4.6	(1.6)	51.8	(5.0)	39.5	(5.2)	27.0	(4.3)	38.4	(4.6)	30.2	(4.1)	62.8	(5.3)
Histophilus somni	0.7	(0.4)	17.1	(3.0)	11.3	(2.4)	6.3	(1.7)	11.1	(2.4)	7.3	(2.0)	22.2	(3.5)
Respiratory														
Parainfluenza 3 virus (PI3)	4.4	(1.6)	45.9	(5.0)	41.5	(5.2)	29.3	(4.4)	39.5	(4.7)	31.2	(4.2)	58.0	(5.4)
Bovine respiratory syncytial virus (BRSV)	4.8	(1.7)	47.8	(5.1)	41.1	(5.2)	29.0	(4.4)	39.3	(4.7)	31.1	(4.2)	59.5	(5.5)
Pasteurella/ Mannheimia	2.0	(1.1)	20.8	(3.6)	12.4	(3.1)	5.3	(2.1)	9.0	(2.6)	5.2	(2.1)	25.7	(4.0)
Reproductive														
Brucella abortus			3.4	(1.3)	19.3	(4.0)	2.1	(0.8)	2.6	(0.9)			20.0	(3.7)
Leptospira			20.3	(4.0)	38.3	(5.1)	31.5	(4.5)	46.0	(5.0)	32.1	(4.5)	55.9	(5.3)
Campylobacter (vibrio)					21.6	(3.9)	17.4	(3.7)	24.8	(3.7)	18.5	(3.7)	28.4	(3.9)
Tritrichomonas (Trich)					2.0	(0.9)	1.3	(0.6)	4.6	(2.3)	1.1	(0.6)	5.6	(2.5)

Table cont'd →

B.1.c. (cont'd) Percentage of operations by vaccine used in 2017, and by cattle class:

	Percent Operations													
	Cattle Class													
	Calves aged 1–21 d		Calves aged 22 d through weaning		Weaned replacement heifers through breeding		Bred replacement heifers through calving		Cows		Bulls		Any Cattle	
Vaccine	Pct.	Std. err.	Pct.	Std. err.	Pct.	Std. err.	Pct.	Std. err.	Pct.	Std. err.	Pct.	Std. err.	Pct.	Std. err.
Clostridial														
Clostridium chauvoei (blackleg) and/or *Cl. septicum* (malignant edema) and/or *Cl. novyi* and/or *Cl. sordellii* (2- or 4-way)	6.5	(1.8)	47.4	(5.0)	40.8	(5.1)	24.3	(4.5)	31.6	(4.4)	18.7	(3.8)	67.6	(5.3)
Cl. perfringens C and D (enterotoxemia, overeating)	5.5	(1.4)	34.4	(4.5)	29.2	(4.8)	17.3	(3.9)	20.9	(4.1)	13.3	(3.3)	47.9	(5.4)
Cl. tetani (tetanus)	1.8	(0.7)	17.7	(3.6)	9.9	(2.5)	5.4	(2.1)	5.7	(2.2)	3.7	(1.6)	23.8	(4.3)
Digestive														
Rota/corona viruses	0.5	(0.3)	0.1	(0.1)	0.5	(0.3)	4.7	(1.5)	4.4	(1.3)			5.0	(1.3)
E. coli	1.0	(1.0)	1.0	(1.0)	2.1	(1.3)	4.8	(1.6)	4.4	(1.3)			4.6	(1.3)
Salmonella	0.9	(0.9)	0.9	(0.9)	1.1	(1.1)	2.0	(1.3)	1.8	(1.1)	1.0	(1.0)	1.9	(1.1)
Other														
Anthrax	0.0	(—)	0.1	(0.0)	2.1	(1.5)	1.0	(1.0)	1.0	(0.8)	1.1	(0.9)	2.1	(1.3)
Johne's disease	0.0	(0.0)	0.1	(0.1)									0.1	(0.1)
Moraxella bovis (pink eye)	2.6	(1.5)	15.5	(3.2)	13.0	(3.3)	9.4	(2.9)	11.9	(2.8)	9.6	(2.7)	20.8	(3.6)
Wart virus	0.0	(—)	0.0	(0.0)	0.8	(0.5)	0.0	(—)	0.0	(—)	0.3	(0.2)	1.0	(0.5)
Other vaccine	0.0	(0.0)	0.2	(0.1)	0.0	(0.0)	0.6	(0.5)	0.7	(0.5)	1.2	(0.5)	1.2	(0.5)
Any of the above	10.3	(2.0)	62.8	(5.3)	51.4	(5.6)	36.6	(4.5)	58.2	(5.3)	44.3	(4.8)	74.5	(5.0)

2. Calf respiratory disease vaccination

From an economic standpoint, bovine respiratory disease is the most important infectious disease of beef cattle. Vaccination against respiratory disease agents can help prevent economic losses in calves. For the following table, vaccines against bovine viral diarrhea (BVD), bovine respiratory syncytial virus (BRSV), parainfluenza 3 (PI3), infectious bovine rhinotracheitis (IBR), *Pasteurella multocida*, *Mannheimia haemolytica*, *Histophilus somni*, and *Mycoplasma bovis* were considered respiratory disease vaccines.

A higher percentage of small operations (49.9 percent) did not vaccinate calves against respiratory disease compared with medium operations (22.5 percent). Overall, 42.5 percent of operations did not vaccinate calves against respiratory disease.

B.2.a. Percentage of operations by typical number of times calves were vaccinated against respiratory disease from birth to sale, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Number of times vaccinated	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0	49.9	(6.4)	22.5	(5.5)	14.8	(12.8)	42.5	(5.0)
1	28.4	(5.8)	24.6	(6.7)	20.1	(10.0)	27.2	(4.6)
2	18.9	(4.7)	43.5	(6.6)	42.2	(10.7)	25.1	(3.8)
3 or more	2.8	(1.9)	9.4	(3.2)	23.0	(5.6)	5.2	(1.6)
Total	100.0		100.0		100.0		100.0	

There were no regional differences in the percentages of operations by number of times calves were vaccinated against respiratory disease.

B.2.b. Percentage of operations by typical number of times calves vaccinated against respiratory disease from birth to sale, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Number of times vaccinated	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0	52.7	(9.2)	22.3	(6.1)	46.4	(8.3)
1	22.9	(8.1)	38.3	(8.5)	23.7	(7.1)
2	18.8	(5.8)	33.8	(7.4)	25.6	(6.7)
3 or more	5.6	(2.7)	5.6	(2.1)	4.4	(3.1)
Total	100.0		100.0		100.0	

A higher percentage of calves on small operations (48.9 percent) were not vaccinated against respiratory disease compared with calves on medium operations (16.5 percent). Overall, 54.7 percent of calves were vaccinated against respiratory disease two or more times.

B.2.c. Percentage of calves by typical number of times calves were vaccinated against respiratory disease from birth to sale, and by herd size:

	Percent Calves*							
	Herd Size (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Number of times vaccinated	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0	48.9	(7.5)	16.5	(4.4)	15.5	(12.7)	27.2	(4.7)
1	24.8	(6.2)	18.1	(4.9)	11.0	(7.1)	18.2	(3.7)
2	21.0	(5.9)	53.2	(6.6)	47.5	(13.0)	40.6	(5.2)
3 or more	5.3	(3.2)	12.3	(3.9)	25.9	(6.3)	14.1	(2.4)
Total	100.0		100.0		100.0		100.0	

* As a percentage of calves weaned or expected to be weaned in 2017.

A higher percentage of calves were not vaccinated against respiratory disease in the West and East regions (34.2 and 41.5 percent, respectively) than in the Central region (8.3 percent). There were no other regional differences in the percentages of calves by number of times they were vaccinated against respiratory disease.

B.2.d. Percentage of calves by typical number of times calves were vaccinated against respiratory disease from birth to sale, and by region:

	Percent Calves*					
	Region					
	West		Central		East	
Number of times vaccinated	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0	34.2	(6.6)	8.3	(2.8)	41.5	(11.9)
1	14.2	(5.1)	21.9	(7.5)	19.1	(6.7)
2	33.0	(6.4)	57.6	(9.6)	29.3	(8.0)
3 or more	18.6	(4.6)	12.3	(3.5)	10.1	(3.9)
Total	100.0		100.0		100.0	

* As a percentage of calves weaned or expected to be weaned in 2017.

Of operations that vaccinated calves against respiratory disease before sale, the lowest percentage (5.5 percent) administered the vaccinations fewer than 14 days before weaning calves. In addition, a higher percentage of operations vaccinated calves against respiratory disease at weaning (49.1 percent) or from birth to 31 days before weaning (44.4 percent) compared with operations that vaccinated calves 30 to 14 days before weaning (22.2 percent).

B.2.e. For the 57.5 percent of operations that vaccinated calves against respiratory disease before sale (table B.2.a), percentage of operations by timing of vaccination, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Vaccinated…	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
After weaning but before sale	32.3	(8.6)	36.2	(7.6)	35.0	(7.1)	33.5	(6.0)
At weaning	48.3	(8.4)	52.2	(7.8)	45.4	(10.8)	49.1	(6.0)
Less than 14 d prior to weaning	2.2	(1.6)	10.9	(4.5)	15.2	(3.9)	5.5	(1.7)
30 to 14 d prior to weaning	16.6	(5.9)	28.2	(6.9)	49.4	(11.1)	22.2	(4.4)
Birth to 31 days prior to weaning	45.7	(8.5)	38.9	(7.3)	54.0	(11.4)	44.4	(6.0)

Of operations that vaccinated calves against respiratory disease before sale, there were no regional differences in the percentages of operations by timing of vaccination.

B.2.f. For the 57.5 percent of operations that vaccinated calves against respiratory disease before sale (table B.2.a), percentage of operations by timing of vaccination and by region:

	Percent Operations					
	Region					
	West		Central		East	
Vaccinated…	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
After weaning but before sale	24.2	(10.3)	39.3	(9.5)	36.6	(11.2)
At weaning	43.0	(12.6)	39.2	(7.1)	66.3	(10.6)
Less than 14 d prior to weaning	4.0	(2.6)	7.9	(3.4)	4.3	(2.3)
30 to 14 d prior to weaning	18.2	(6.4)	24.6	(7.4)	23.6	(8.7)
Birth to 31 days prior to weaning	59.6	(11.9)	44.2	(8.4)	29.3	(9.4)

3. Bovine viral diarrhea vaccination practices

Cattle infected with bovine viral diarrhea (BVD) virus can show several different clinical signs. The most important effects of BVD infection in a cow-calf herd are associated with reproduction. For example, BVD can cause decreased fertility, abortions, congenital malformations in calves, and the birth of calves persistently infected with BVD. Clinical signs can also include diarrhea and pneumonia in calves. There are two biotypes of BVD: cytopathic (CP) and noncytopathic (NCP). Both biotypes can cause disease. There are also two genotypes of BVD: type 1 and type 2. Both genotypes have been associated with clinical disease.

A pregnant cow infected with BVD rarely shows any signs of disease, but the infection can have negative effects on the fetus. The approximate stage of gestation at the time of BVD infection determines the effect on the fetus. Generally, infection at 0 to 45 days of gestation results in fetal death. Infection at 40 to125 days with the CP biotype can result in fetal death, abortion, or mummification, but these are rare. Infection at 40 to

125 days with the NCP biotype, however, can result in persistent infection in calves. Infection at 100 to 150 days with either biotype can cause congenital defects and abortion. Infection at 125 days to term can result in birth of normal calves, but also abortions and weak calves.

Persistently infected (PI) calves will shed large quantities of the virus throughout their lives in nasal and oral secretions and in feces, and these cattle will never clear the infection. PI calves may or may not have congenital defects. Typically, PI calves are poor performers; however, some will grow relatively well and even make it into the breeding herd and become pregnant. Persistently infected heifers and cows always produce persistently infected calves. Most PI calves are the result of transient BVD infections of their dams during pregnancy.

Normal calves and cows can be infected with BVD following birth. These cattle are known as transiently infected, and they shed relatively low quantities of virus for up to 7 to 14 days, but then clear the infection and stop shedding the virus. Clinical signs of transient infection in calves can include diarrhea or pneumonia. Transient infection often causes no apparent clinical signs in cows other than the effects on the fetus if the cow is pregnant.

Overall, 57.4 percent of operations vaccinated any cattle against BVD in 2017. There were no herd size differences in the percentage of operations that vaccinated cattle against BVD.

B.3.a. Percentage of operations that vaccinated any cattle against BVD in 2017, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
52.6	(6.6)	68.3	(6.9)	84.8	(12.8)	57.4	(5.2)

There were no regional differences in the percentage of operations that vaccinated cattle against BVD.

B.3.b. Percentage of operations that vaccinated any cattle against BVD in 2017, by region:

Percent Operations					
Region					
West		Central		East	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
54.1	(9.6)	66.8	(6.9)	54.1	(8.4)

There are many things to consider when devising a BVD vaccination plan for a beef cow-calf operation. If the herd follows good biosecurity practices, such as not introducing new cattle other than breeding bulls, not having fence-line contact with cattle from other operations, and not taking cattle off the operation (e.g., to fairs) that return to the operation, the risk of BVD introduction will be low. On the other hand, if a herd uses practices such as often introducing replacement heifers or cows with unknown vaccination history, their risk for introduction of BVD can be relatively high. The BVD vaccination strategy must be adapted to each herd while considering disease risks and management practices used on the operation.

Note that one of the cattle classes included in the study questionnaire and used for the following table was “weaned replacement heifers through breeding.” This cattle class should have been worded as “weaned replacement heifers prior to breeding” to account for herds using modified-live vaccines in replacement heifers; these vaccines should not be administered within 28 to 60 days of breeding because they might negatively affect fertility. Because the study questionnaire did not include another cattle class option, it is likely that operations using modified-live BVD vaccines in replacement heifers chose the “weaned replacement heifers through breeding” option, even though they did not give the vaccines through breeding. Killed vaccines do not affect fertility, so operations that used killed vaccines in replacement heifers would not have been affected by the wording in this question.

A higher percentage of large operations (78.9 percent) vaccinated weaned replacement heifers through breeding against BVD compared with small operations (28.7 percent). A higher percentage of operations (45.7 percent) vaccinated calves 22 days old through weaning than bred replacement heifers or cows precalving (25.5 and 22.4 percent, respectively).

B.3.c. Percentage of operations that vaccinated any cattle against BVD in 2017, by cattle class vaccinated and by herd size:

	Percent Operations							
	Herd Size (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Cattle class	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Calves 1 to 21 d	3.3	(1.8)	2.0	(1.6)	5.5	(2.5)	3.2	(1.4)
Calves 22 d through weaning	40.2	(6.5)	60.4	(6.6)	70.0	(13.8)	45.7	(5.1)
Weaned replacement heifers through breeding	28.7	(6.0)	53.1	(6.9)	78.9	(12.5)	36.7	(4.7)
Bred replacement heifers precalving (e.g., at pregnancy check)	21.4	(5.2)	33.0	(6.5)	51.6	(9.9)	25.5	(4.0)
Cows prebreeding	30.3	(5.7)	30.4	(6.5)	58.1	(13.7)	31.6	(4.5)
Cows precalving (e.g., at pregnancy check)	18.4	(4.8)	31.9	(5.9)	47.0	(12.3)	22.4	(3.9)
Bulls	28.8	(5.5)	39.7	(6.9)	56.8	(13.1)	32.5	(4.3)

There were no regional differences by cattle class in the percentages of operations that vaccinated against BVD in 2017.

B.3.d. Percentage of operations that vaccinated any cattle against BVD in 2017, by cattle class vaccinated and by region:

	Percent Operations					
	Region					
	West		Central		East	
Cattle class	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Calves 1 to 21 d	6.7	(3.3)	0.3	(0.2)	1.3	(1.2)
Calves 22 d through weaning	41.0	(9.0)	55.5	(7.0)	43.9	(8.8)
Weaned replacement heifers through breeding	29.1	(7.6)	42.8	(6.9)	40.6	(8.9)
Bred replacement heifers precalving (e.g., at pregnancy check)	23.1	(7.5)	24.1	(5.6)	29.2	(6.9)
Cows prebreeding	26.6	(7.1)	33.1	(8.6)	36.4	(7.8)
Cows precalving (e.g., at pregnancy check)	21.2	(6.9)	22.9	(6.3)	23.7	(6.3)
Bulls	24.1	(6.8)	39.4	(9.0)	38.1	(6.9)

For operations that vaccinated any calves 22 days old through weaning against BVD in 2017, on average these calves were vaccinated against BVD 1.5 times. There were no herd size differences in the average number of times these calves were vaccinated against BVD. Calves 1 to 2 days of age were excluded from tables B.3.e. through B.3.i. because vaccinating this class of calves is not a common practice.

B.3.e. For the 45.7 percent of operations that vaccinated any calves 22 days old through weaning against BVD in 2017 (table B.3.c), average number of times each calf was vaccinated, by herd size:

Average Number of Times

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Avg.	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
1.4	(0.1)	1.7	(0.1)	1.7	(0.1)	1.5	(0.1)

For operations that vaccinated any calves 22 days old through weaning against BVD in 2017, there were no regional differences in the average number of times these calves were vaccinated against BVD.

B.3.f. For the 45.7 percent of operations that vaccinated any calves 22 days old through weaning against BVD in 2017 (table B.3.c), average number of times each of those calves was vaccinated, by region:

Average Number of Times

Region

West		**Central**		**East**	
Avg.	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
1.6	(0.2)	1.5	(0.1)	1.5	(0.1)

For operations that vaccinated any calves 22 days old through weaning against BVD in 2017, there were no herd size differences in the percentages of operations that vaccinated these calves one, two, or three or more times. A higher percentage of operations vaccinated these calves one or two times (53.1 and 41.4 percent, respectively) compared with the percentage of operations that vaccinated these calves three or more times (5.5 percent).

B.3.g. For the 45.7 percent of operations that vaccinated any calves 22 days old through weaning against BVD in 2017 (table B.3.c), percentage of operations by number of times each calf was vaccinated, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Number of times vaccinated	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1	61.9	(11.4)	38.7	(8.5)	34.6	(9.4)	53.1	(7.9)
2	33.9	(11.2)	52.6	(8.9)	61.0	(9.9)	41.4	(7.7)
3 or more	4.2	(4.1)	8.7	(4.9)	4.4	(2.6)	5.5	(3.0)
Total	100.0		100.0		100.0		100.0	

For operations that vaccinated any calves 22 days old through weaning against BVD in 2017, there were no regional differences in the percentage of operations that vaccinated these calves one, two, or three or more times.

B.3.h. For the 45.7 percent of operations that vaccinated any calves 22 days old through weaning against BVD in 2017 (table B.3.c), percentage of operations by number of times each calf was vaccinated, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Number of times vaccinated	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
1	47.9	(16.1)	60.4	(10.4)	51.3	(13.6)
2	42.3	(15.2)	33.6	(9.9)	48.0	(13.6)
3 or more	9.8	(7.7)	5.9	(4.0)	0.7	(0.5)
Total	100.0		100.0		100.0	

As mentioned previously, there are two main types of vaccines for BVD: modified-live (attenuated) and killed (inactivated). Modified-live vaccines contain a living organism that has been modified such that it does not cause disease in an animal. In killed vaccines, the target organism has been inactivated and is no longer living. Modified-live vaccines generally offer better and longer-lasting immunity compared with killed vaccines. All killed vaccines should be given in two doses upon initial vaccination for protection. Modified-live vaccines may provide some protection with a single dose, but typically two or more doses are recommended during initial vaccination. All vaccines need to be properly handled to be effective, meaning that they should be kept away from sunlight and refrigerated prior to use (and preferably stored in a cooler during use).

Of operations that administered killed BVD vaccines in calves 22 days old through weaning, 59.4 percent gave these calves a single dose, which would not likely have provided adequate protection against BVD.

B.3.i. For the 45.7 percent of operations that vaccinated any calves 22 days old through weaning against BVD in 2017 (table B.3.c), percentage of operations by number of times each calf was vaccinated, and by vaccine type:

	Percent Operations			
	Vaccine Type			
	Killed		Modified live	
Number of times vaccinated	Pct.	Std. error	Pct.	Std. error
1	59.4	(11.4)	42.4	(11.0)
2	38.9	(11.3)	47.3	(11.0)
3 or more	1.7	(1.4)	10.2	(6.2)
Total	100.0		100.0	

Killed vaccines are safe to use in any cattle, including pregnant cattle. Some modified-live vaccines are safe to use in pregnant cattle as long as the animal has previously been vaccinated with that vaccine within the past 12 months. If the modified-live vaccine is not labeled for use in pregnant cattle or if the animal has not previously been vaccinated with that vaccine, abortions or birth defects can occur. In addition, many modified-live vaccine product labels state that nursing calves should not be vaccinated with modified-live vaccines unless the dam has also been vaccinated with that vaccine.

There are two genotypes of BVD—type 1 and type 2. Most BVD vaccines provide protection against both genotypes, although some older BVD vaccines might only provide protection against genotype 1.

For operations that vaccinated any cattle against BVD in 2017, 51.3 percent used only killed vaccines. In other words, any animal that received a BVD vaccine on these operations received only killed vaccines. Just 4.9 percent of operations administered BVD vaccines that only protected animals against genotype 1.

B.3.j. For the 57.4 percent of operations that vaccinated any cattle against BVD in 2017 (table B.3.a), percentage of operations by vaccine type used, virus genotype targeted by vaccine, and herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
	Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Vaccine type								
Killed only	57.6	(9.2)	39.8	(7.9)	33.4	(7.4)	51.3	(6.7)
Modified live only	38.5	(9.2)	36.5	(7.8)	40.6	(10.9)	38.1	(6.5)
Both killed and modified live	3.9	(2.6)	23.7	(6.9)	26.0	(11.4)	10.6	(2.8)
Total	100.0		100.0		100.0		100.0	
Virus genotype								
Type 1 only	6.5	(4.2)	1.6	(1.4)	2.7	(2.4)	4.9	(2.9)
Type 1 and 2	88.5	(6.4)	90.8	(4.0)	87.9	(6.5)	89.0	(4.5)
Both type 1 only and type 1 and 2	5.1	(5.0)	7.6	(3.7)	9.4	(6.2)	6.1	(3.5)
Total	100.0		100.0		100.0		100.0	

For operations that vaccinated any cattle against BVD in 2017, there were no regional differences in the percentages of operations by type of vaccine administered (killed or modified-live) or by virus genotype targeted.

B.3.k. For the 57.4 percent of operations that vaccinated any cattle against BVD in 2017 (table B.3.a), percentage of operations by vaccine type used, virus genotype targeted by vaccine, and region:

	Percent Operations					
	Region					
	West		Central		East	
	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Vaccine type						
Killed only	48.1	(13.9)	37.4	(8.8)	68.3	(11.6)
Modified live only	39.2	(13.6)	48.2	(8.6)	27.1	(11.4)
Both killed and modified live	12.7	(5.8)	14.4	(5.4)	4.6	(2.6)
Total	100.0		100.0		100.0	
Virus genotype						
Type 1 only	6.9	(5.6)	6.8	(6.4)	1.2	(1.1)
Types 1 and 2	82.2	(11.2)	89.3	(6.5)	95.4	(2.7)
Both type 1 only and types 1 and 2	10.9	(10.1)	3.9	(2.0)	3.4	(2.5)
Total	100.0		100.0		100.0	

Modified-live vaccines come in two bottles, one with a dried active ingredient and one with a sterile diluent. The diluent must be mixed with the dried ingredient (rehydrated) prior to use. Since rehydrated modified-live vaccines are sensitive to temperature variations and sunlight, they should be used in a matter of hours, kept cool, and any leftover vaccine should be discarded.

Killed vaccines are ready to use out of the bottle and require no rehydration. Remaining vaccine could be refrigerated and used later, although there is the risk that the vaccine was contaminated when needles were inserted into it during vaccination. Killed vaccines are more convenient to use than modified-live vaccines because they require no mixing. For killed vaccines, two doses at intervals as stated on the product label are needed for initial vaccination, and annual boosters are recommended.

Ideally, replacement heifers should receive two to three doses of a BVD modified-live vaccine, with the last dose given 28 to 60 days prior to breeding, because modified-live vaccines can negatively affect fertility. After an initial course of modified-live BVD vaccine, annual booster vaccinations are recommended for breeding cattle, either with a modified-live or killed vaccine.

Of operations that vaccinated the cattle classes listed in the following table against BVD in 2017, over 85 percent used vaccines targeted against BVD genotypes 1 and 2 for all cattle classes. A higher percentage of operations used killed BVD vaccines in weaned replacement heifers through breeding, bred replacement heifers precalving, cows precalving, and bulls compared with operations that used modified-live vaccines in these cattle classes.

B.3.I. For operations that vaccinated the following cattle classes against BVD in 2017, percentage of operations by vaccine type used and virus genotype targeted by vaccine:

	Percent Operations								
	Vaccine Type					Virus Genotype			
	Killed		Modified live			Type 1 only		Types 1 and 2		
Cattle class	Pct.	Std. error	Pct.	Std. error	Total	Pct.	Std. error	Pct.	Std. error	Total
Calves 1 to 21 days old	(D)		(D)		100.0	(D)		(D)		100.0
Calves 22 days old through weaning	49.5	(6.8)	50.5	(6.8)	100.0	3.3	(2.5)	96.7	(2.5)	100.0
Weaned replacement heifers through breeding	68.8	(6.2)	31.2	(6.2)	100.0	11.8	(6.2)	88.2	(6.2)	100.0
Bred replacement heifers precalving (e.g., at pregnancy check)	80.1	(7.5)	19.9	(7.5)	100.0	12.0	(7.6)	88.0	(7.6)	100.0
Cows prebreeding	66.6	(8.8)	33.4	(8.8)	100.0	12.0	(7.1)	88.0	(7.1)	100.0
Cows precalving (e.g., at pregnancy check)	86.2	(4.6)	13.8	(4.6)	100.0	12.8	(7.8)	87.2	(7.8)	100.0
Bulls	75.2	(7.5)	24.8	(7.5)	100.0	13.3	(6.9)	86.7	(6.9)	100.0

(D) Too few to report.

Of operations that used BVD modified-live vaccines for the cattle classes listed in the following table in 2017, 100.0 percent used vaccines that targeted BVD types 1 and 2 for all cattle classes, with the exception of calves 22 days old through weaning.

B.3.m. For operations that vaccinated the following cattle classes against BVD in 2017, percentage of operations by cattle class vaccinated, vaccine type used, and virus genotype targeted by vaccine:

	Percent Operations									
	Killed					Modified Live				
	Type 1 only		Types 1 and 2			Type 1 only		Types 1 and 2		
Cattle class	Pct.	Std. error	Pct.	Std. error	Total	Pct.	Std. error	Pct.	Std. error	Total
Calves 1 to 21 days old	(D)		(D)			(D)		(D)		100.0
Calves 22 days old through weaning	1.6	(1.1)	98.4	(1.1)	100.0	5.0	(4.8)	95.0	(4.8)	100.0
Weaned replacement heifers through breeding	17.1	(8.7)	82.9	(8.7)	100.0	0.0	(—)	100.0	(—)	100.0
Bred replacement heifers precalving (e.g., at pregnancy check)	14.9	(9.3)	85.1	(9.3)	100.0	0.0	(—)	100.0	(—)	100.0
Cows prebreeding	18.1	(9.8)	81.9	(9.8)	100.0	0.0	(—)	100.0	(—)	100.0
Cows precalving (e.g., at pregnancy check)	14.9	(9.0)	85.1	(9.0)	100.0	0.0	(—)	100.0	(—)	100.0
Bulls	17.7	(9.0)	82.3	(9.0)	100.0	0.0	(—)	100.0	(—)	100.0

(D) Too few to report.

4. BVD testing practices

There are several different options for testing a calf for BVD. One involves removing a notch from a calf's ear, and another involves drawing blood. There are kits available that allow producers to test BVD ear notches on the operation. A calf that tests positive for BVD can indicate either a transient or persistent infection. A calf that tests positive again 3 or more weeks after the first test indicates that the calf is persistently infected with BVD (BVD-PI).

Producers were asked if removing BVD-PI calves affects the value of the remaining calves known to be PI-negative. There were no herd size differences in the percentage of operations in which producers thought the value of the remaining calves would increase. No producers thought that the value of their remaining calves would decrease. Producers on 69.8 percent of operations either did not know if the value of remaining calves would be affected, or they thought that the value would be affected, but by an unknown amount.

B.4.a. Percentage of operations by how, according to producers, removing calves that tested positive for persistent infection with BVD affected the value of calves remaining in the herd, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Effect on value of remaining calves	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Increases value	10.0	(3.3)	21.5	(5.6)	37.0	(13.3)	13.7	(2.8)
Decreases value	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)
Has no effect	15.4	(4.8)	20.2	(5.3)	18.1	(6.8)	16.5	(3.7)
Does not know	48.1	(6.6)	25.3	(6.5)	6.0	(1.8)	41.4	(5.1)
Affects value, but amount unknown	26.5	(5.5)	32.9	(5.9)	38.9	(11.1)	28.4	(4.3)
Total	100.0		100.0		100.0		100.0	

Producers on a higher percentage of operations in the Central region (30.9 percent) thought the value of their remaining calves would increase after removing BVD-PI calves compared with producers on operations in the West or East regions (8.0 and 7.3 percent, respectively).

B.4.b. Percentage of operations by how, according to producers, removing calves that tested positive for persistent infection with BVD affected the value of calves remaining in the herd, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Effect on value of remaining calves	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Increases value	8.0	(3.5)	30.9	(7.5)	7.3	(3.4)
Decreases value	0.0	(—)	0.0	(—)	0.0	(—)
Has no effect	24.2	(7.7)	5.8	(2.0)	15.6	(5.8)
Does not know	44.7	(9.2)	40.5	(8.3)	38.1	(8.4)
Affects value, but amount unknown	23.1	(7.3)	22.8	(7.3)	39.0	(7.6)
Total	100.0		100.0		100.0	

For operations in which the producer believed that removing BVD-PI calves increased the value of their remaining calves, the perceived average value increase was $56.50 per head.

B.4.c. For the 13.7 percent of operations in which the producer believed that removing calves that tested positive for persistent infection with BVD increased the value of calves remaining in the herd (table B.4.a), average perceived increase in value:

Average increase ($ per head)	**Std. error**
$56.50	(5.8)

Only 2.0 percent of operations marketed calves as BVD-PI negative. There were no differences by herd size in the percentage of operations that marketed calves as BVD-PI negative.

B.4.d. Percentage of operations that marketed calves as negative for persistent infection with BVD, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1.7	(1.3)	2.0	(1.4)	6.3	(2.9)	2.0	(1.0)

There were no regional differences in the percentage of operations that marketed calves as BVD-PI negative.

B.4.e. Percentage of operations that marketed calves as negative for persistent infection with BVD, by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
2.3	(2.3)	0.7	(0.6)	2.6	(1.4)

Overall, producers on 59.6 percent operations thought that removing BVD-PI calves affected the health of their remaining cattle, while 33.6 percent did not know one way or the other, and 6.8 percent thought it did not.

B.4.f. Percentage of operations by whether, according to producers, removing calves that tested positive for persistent infection with BVD affected the health of remaining cattle, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Affects health	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Yes	56.0	(6.5)	69.4	(5.9)	74.0	(10.7)	59.6	(5.0)
No	7.9	(3.5)	2.6	(1.9)	6.3	(4.1)	6.8	(2.7)
Don’t know	36.0	(6.1)	28.0	(5.9)	19.7	(9.9)	33.6	(4.8)
Total	100.0		100.0		100.0		100.0	

There were no regional differences in the percentage of operations in which the producer believed that removing BVD-PI calves affected the health of remaining cattle.

B.4.g. Percentage of operations by whether, according to producers, removing calves that tested positive for persistent infection with BVD affected the health of the remaining cattle, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Affects health	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Yes	54.8	(8.7)	63.2	(8.6)	62.6	(8.4)
No	7.4	(4.7)	5.5	(3.8)	7.0	(4.9)
Don’t know	37.8	(8.3)	31.3	(8.4)	30.4	(7.8)
Total	100.0		100.0		100.0	

Of operations in which the producer believed that removing BVD-PI calves affected the health of remaining cattle, almost all expected doing so would improve reproductive efficiency, reduced sickness and treatment costs, and reduced death loss (91.9, 99.0, and 98.7 percent of operations, respectively).

B.4.h. For the 59.6 percent of operations in which the producer believed that removing calves positive for persistent infection with BVD affected the health of remaining cattle (table B.4.f), percentage of operations by expected health effect, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Expected health effect	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Improved reproductive efficiency (fewer abortions, stillbirths)	89.8	(5.8)	96.5	(2.7)	98.8	(0.9)	91.9	(4.1)
Reduced sickness and/or treatment costs	99.2	(0.8)	98.4	(1.2)	100.0	(—)	99.0	(0.7)
Reduced death loss	99.2	(0.8)	96.9	(1.9)	100.0	(0.0)	98.7	(0.7)
Other	0.0	(—)	3.5	(2.8)	2.6	(1.5)	1.0	(0.7)

There were no regional differences in the percentages of operations by expected health effects the producer believed would result by removing BVD-PI calves.

B.4.i. For the 59.6 percent of operations in which the producer believed that removing calves positive for persistent infection with BVD affected the health of remaining cattle (table B.4.f), percentage of operations by expected health effect, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Expected health effect	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Improved reproductive efficiency (fewer abortions, stillbirths)	92.0	(7.7)	97.5	(2.4)	87.9	(7.6)
Reduced sickness and/or treatment costs	98.1	(1.6)	100.0	(—)	99.3	(0.7)
Reduced death loss	98.1	(1.6)	100.0	(0.0)	98.4	(1.2)
Other	0.3	(0.2)	2.6	(2.5)	0.6	(0.5)

A low percentage of operations (3.7 percent) tested any beef cattle for persistent infection with BVD during the previous 3 years. There were no differences by herd size in the percentage of operations that tested any beef cattle for persistent infection with BVD.

B.4.j. Percentage of operations that tested any beef cattle for persistent infection with BVD during the previous 3 years, by herd size:

Percent Operations							
Herd Size (number of beef cows)							
Small (1–49)		Medium (50–199)		Large (200 or more)		All operations	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
2.9	(2.1)	5.2	(2.4)	9.7	(3.8)	3.7	(1.6)

There were no regional differences in the percentage of operations that tested any beef cattle for persistent infection with BVD during the previous 3 years.

B.4.k. Percentage of operations that tested any beef cattle for persistent infection with BVD during the previous 3 years, by region:

Percent Operations					
Region					
West		Central		East	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
3.2	(2.6)	7.9	(4.8)	1.1	(0.8)

C. Illnesses and Deaths

1. Illnesses

Producers were asked if any unweaned calves, replacement heifers, or cows were affected in 2017 with the diseases or disorders in the following table. A lower percentage of operations (12.7 percent) had at least one replacement heifer affected with any of the listed diseases or disorders than had at least one preweaned calf (40.3 percent) or cow (33.5 percent) affected. For many of listed diseases or disorders below, a higher percentage of large operations had at least one animal affected with the disease or disorder compared with small operations. This finding is understandable since large operations have more cattle that can become affected.

C.1.a. Percentage of operations by disease or disorder affecting at least one unweaned calf, replacement heifer, or cow in 2017, and by herd size:

	Percent Operations							
	Herd Size (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Disease or disorder in…	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Unweaned calves								
Respiratory	11.7	(3.8)	35.5	(6.6)	49.6	(10.1)	18.4	(3.1)
Diarrhea/scours or other digestive	13.3	(4.3)	30.9	(5.5)	54.9	(11.9)	18.9	(3.5)
Pinkeye	9.8	(3.2)	27.2	(6.4)	12.3	(3.9)	13.4	(2.7)
Navel infection	2.4	(2.3)	2.8	(1.6)	16.5	(8.3)	3.1	(1.8)
Other	5.1	(2.7)	3.1	(2.4)	12.6	(8.1)	5.1	(2.1)
Any	32.7	(6.1)	61.8	(6.1)	66.7	(11.1)	40.3	(4.8)
Replacement heifers (weaned but not yet calved)*								
Respiratory	1.5	(1.5)	9.1	(3.9)	22.2	(9.1)	4.4	(1.5)
Diarrhea/scours or other digestive	0.0	(—)	1.5	(1.5)	18.8	(13.1)	1.4	(0.9)
Pinkeye	7.2	(3.8)	9.9	(3.9)	21.1	(9.1)	8.6	(2.9)
Lameness/footrot	1.5	(1.5)	2.5	(1.7)	20.8	(9.0)	2.9	(1.3)
Other	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)
Any	7.2	(3.8)	18.1	(5.1)	61.3	(10.0)	12.7	(3.1)

Table cont'd →

C.1.a. (cont'd) Percentage of operations by disease or disorder affecting at least one unweaned calf, replacement heifer, or cow in 2017, and by herd size:

	Percent Operations							
	Herd Size (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Disease or disorder in…	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Cows								
Respiratory	3.3	(2.0)	11.4	(5.5)	22.2	(9.0)	5.9	(1.9)
Diarrhea/scours or other digestive	4.5	(2.3)	6.8	(3.0)	28.9	(13.7)	6.2	(2.0)
Pinkeye	9.5	(3.3)	15.3	(4.6)	18.6	(8.6)	11.1	(2.7)
Reproductive (retained placenta/uterine infection)	3.2	(2.2)	2.2	(1.5)	19.5	(8.5)	3.8	(1.7)
Mastitis	2.8	(2.4)	2.2	(1.8)	7.1	(3.1)	2.9	(1.8)
Abortion	2.3	(2.3)	2.2	(1.7)	1.9	(1.2)	2.3	(1.8)
Lameness/footrot	10.2	(3.6)	34.8	(6.7)	51.3	(12.4)	17.2	(3.1)
Other	1.8	(1.8)	3.8	(2.4)	0.7	(0.7)	2.1	(1.4)
Any	26.5	(5.4)	54.0	(7.5)	54.0	(12.2)	33.5	(4.4)

* For operations with replacement heifers

There were no substantial regional differences in the percentages of operations by disease or disorder affecting at least one animal in 2017.

C.1.b. Percentage of operations by disease or disorder affecting at least one unweaned calf, replacement heifer, or cow in 2017, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Disease or disorder in…	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Unweaned calves						
Respiratory	19.3	(5.2)	27.5	(6.9)	10.3	(4.2)
Diarrhea/scours or other digestive	15.2	(5.4)	23.8	(5.7)	19.7	(6.9)
Pinkeye	8.8	(3.4)	21.7	(6.0)	12.6	(5.3)
Navel infection	5.3	(4.3)	3.6	(1.8)	0.3	(0.3)
Other	4.3	(2.5)	5.8	(4.5)	5.3	(4.1)
Any	38.1	(7.9)	46.9	(7.4)	37.8	(8.7)
Replacement heifers (weaned but not yet calved)*						
Respiratory	4.2	(1.9)	8.1	(4.7)	2.0	(1.3)
Diarrhea/scours or other digestive	1.5	(1.0)	0.0	(0.0)	2.3	(2.2)
Pinkeye	13.4	(6.7)	9.9	(5.0)	3.1	(2.5)
Lameness/footrot	2.1	(0.7)	6.4	(4.6)	1.2	(0.9)
Other	0.0	(—)	0.0	(—)	0.0	(—)
Any	17.9	(6.9)	13.0	(4.8)	7.6	(3.5)

Table cont'd →

C.1.b. (cont'd) Percentage of operations by disease or disorder affecting at least one unweaned calf, replacement heifer, or cow in 2017, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Disease or disorder in…	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Cows						
Respiratory	6.8	(3.4)	10.6	(5.1)	1.1	(0.8)
Diarrhea/scours or other digestive	3.1	(1.4)	13.4	(5.9)	4.3	(3.0)
Pinkeye	8.2	(3.5)	18.4	(6.0)	9.1	(4.8)
Reproductive (retained placenta/ uterine infection)	1.6	(0.6)	6.6	(3.9)	4.2	(3.9)
Mastitis	5.8	(4.4)	1.7	(1.4)	0.4	(0.3)
Abortion	5.5	(4.4)	0.2	(0.2)	0.1	(0.1)
Lameness/footrot	14.4	(4.1)	21.9	(6.8)	16.9	(5.8)
Other	1.0	(1.0)	0.6	(0.5)	4.7	(3.9)
Any	28.6	(7.1)	43.3	(8.0)	31.7	(7.3)

*For operations with replacement heifers.

There were no substantial differences by herd size in 2017 in the percentage of cattle affected with the diseases or disorders listed in the following table.

C.1.c. Percentage of unweaned calves, replacement heifers, and cows affected with the following diseases or disorders in 2017, by herd size:

	Percent Cattle **Herd Size** (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All Operations**	
Disease or disorder in…	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**
Unweaned calves[1]								
Respiratory	1.5	(0.6)	3.8	(2.0)	4.9	(2.7)	3.3	(1.1)
Diarrhea/scours or other digestive	1.4	(0.5)	3.8	(2.0)	2.6	(0.9)	2.6	(0.8)
Pinkeye	1.7	(0.7)	1.4	(0.4)	0.4	(0.1)	1.2	(0.3)
Navel infection	0.1	(0.1)	0.1	(0.0)	0.3	(0.2)	0.2	(0.1)
Other	0.2	(0.1)	0.2	(0.2)	0.1	(0.1)	0.2	(0.1)
Replacement heifers (weaned but not yet calved)[2,3]								
Respiratory	0.9	(0.9)	1.0	(0.6)	3.6	(1.4)	1.6	(0.6)
Diarrhea/scours or other digestive	0.0	(—)	0.5	(0.5)	2.2	(1.5)	0.7	(0.4)
Pinkeye	3.2	(1.9)	1.4	(0.6)	2.0	(1.5)	2.4	(1.0)
Lameness/footrot	0.2	(0.2)	0.2	(0.1)	0.9	(0.3)	0.4	(0.1)
Other	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)
Cows[2]								
Respiratory	0.7	(0.5)	0.2	(0.1)	0.2	(0.1)	0.4	(0.2)
Diarrhea/scours or other digestive	0.2	(0.1)	0.1	(0.0)	0.2	(0.1)	0.1	(0.0)

Table cont'd →

C.1.c. (cont'd) Percentage of unweaned calves, replacement heifers, and cows affected with the following diseases or disorders in 2017, by herd size:

	Percent Cattle							
	Herd Size (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All Operations**	
Disease or disorder in…	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**
Pinkeye	0.7	(0.3)	0.5	(0.2)	0.2	(0.1)	0.5	(0.1)
Reproductive (retained placenta/uterine infection)	0.2	(0.1)	0.0	(0.0)	0.3	(0.2)	0.2	(0.1)
Mastitis	0.1	(0.1)	0.0	(0.0)	0.0	(0.0)	0.1	(0.0)
Abortion	0.1	(0.1)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Lameness/footrot	0.7	(0.3)	1.1	(0.2)	0.6	(0.1)	0.8	(0.1)
Other	0.1	(0.1)	0.1	(0.1)	0.0	(0.0)	0.1	(0.0)

[1] Affected unweaned calves as a percentage of calves born alive in 2017.
[2] Affected animals of the given class as a percentage of animals of that class on the operation on October 1, 2017.
[3] For operations with replacement heifers.

There were no substantial regional differences in the percentages of cattle affected with the listed diseases or disorders in 2017.

C.1.d. Percentage of unweaned calves, replacement heifers, and cows affected by the following diseases or disorders in 2017, by region:

	Percent Cattle					
	Region					
	West		Central		East	
Disease or disorder in…	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**
Unweaned calves[1]						
Respiratory	2.1	(0.6)	7.1	(3.1)	0.5	(0.2)
Diarrhea/scours or other digestive	1.7	(0.4)	4.8	(2.2)	1.2	(0.4)
Pinkeye	0.9	(0.6)	1.6	(0.5)	1.2	(0.4)
Navel infection	0.2	(0.1)	0.3	(0.2)	0.0	(0.0)
Other	0.3	(0.2)	0.2	(0.1)	0.1	(0.1)
Replacement heifers (weaned but not yet calved)[2,3]						
Respiratory	1.3	(0.6)	3.2	(1.7)	0.5	(0.2)
Diarrhea/scours or other digestive	0.9	(0.6)	0.0	(0.0)	1.1	(1.1)
Pinkeye	2.5	(1.7)	3.6	(2.0)	0.8	(0.5)
Lameness/footrot	0.4	(0.1)	0.6	(0.3)	0.1	(0.1)
Other	0.0	(—)	0.0	(—)	0.0	(—)
Cows[2]						
Respiratory	0.5	(0.4)	0.4	(0.2)	0.1	(0.0)
Diarrhea/scours or other digestive	0.1	(0.0)	0.3	(0.1)	0.1	(0.1)
Pinkeye	0.2	(0.1)	1.1	(0.3)	0.3	(0.1)

Table cont'd →

C.1.d. (cont'd) Percentage of unweaned calves, replacement heifers, and cows affected by the following diseases or disorders in 2017, by region:

	Percent Cattle					
	Region					
	West		Central		East	
Disease or disorder in…	Pct.	Std. err	Pct.	Std. err	Pct.	Std. err
Reproductive (retained placenta/uterine infection)	0.1	(0.0)	0.4	(0.2)	0.1	(0.1)
Mastitis	0.1	(0.1)	0.0	(0.0)	0.0	(0.0)
Abortion	0.1	(0.1)	0.0	(0.0)	0.0	(0.0)
Lameness/footrot	0.7	(0.2)	0.8	(0.3)	0.9	(0.3)
Other	0.0	(0.0)	0.0	(0.0)	0.1	(0.1)

[1]Affected unweaned calves as a percentage of calves born alive in 2017.
[2]Affected animals of the given class as a percentage of animals of that class on the operation on October 1, 2017.
[3] For operations with replacement heifers.

2. Cattle and calf death loss

In 2017, the majority of operations (51.2 percent) had at least one beef calf that was born alive but died or was lost prior to weaning. Being lost refers to instances such as stolen calves or cases in which calves are killed by a predator and remains are never found. A higher percentage of large and medium operations had at least one calf that died or was lost prior to weaning compared with small operations.

C.2.a. Percentage of operations in which any **beef calves*** died or were lost (from any cause) prior to weaning in 2017, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
42.8	(6.3)	72.7	(5.5)	91.1	(5.3)	51.2	(4.9)

*Calves born alive in 2017.

There were no regional differences in the percentage of operations in which any beef calves died or were lost in 2017 (from all causes) prior to weaning

C.2.b. Percentage of operations in which any of the **beef calves*** died or were lost (from all causes) prior to weaning in 2017, by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
57.6	(9.2)	54.3	(7.1)	41.3	(8.0)

*Calves born alive in 2017.

There were no herd size differences in the percentage of calves that died or were lost (from all causes) prior to weaning in 2017. Overall, 3.3 percent of calves died or were lost prior to weaning.

C.2.c. Percentage of **beef calves**[1] that died or were lost (from all causes) prior to weaning in 2017, by herd size:

Percent Calves[2]							
Herd Size (number of beef cows)							
Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
3.4	(0.6)	3.3	(0.4)	3.2	(0.5)	3.3	(0.3)

[1]Calves born alive in 2017.
[2]Number of calves that died as a percentage of number born alive in 2017.

There were no regional differences in the percentage of calves that died or were lost (from all causes) prior to weaning in 2017.

C.2.d. Percentage of **beef calves**[1] that died or were lost (from all causes) prior to weaning in 2017, by region:

Percent Calves[2]					
Region					
West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
3.8	(0.5)	3.2	(0.5)	2.8	(0.6)

[1]Calves born alive in 2017.
[2]Number of calves that died as a percentage of number born alive in 2017.

Overall, 45.3 percent of operations had at least one weaned or older beef breeding animal that died or was lost in 2017. Being lost refers to instances such as stolen cattle or cases in which cattle are killed by a predator and remains are never found. The percentage of operations that had at least one beef breeding animal die or become lost in 2017 increased as herd size increased. This finding is understandable since large operations have more cattle that may die or become lost.

C.2.e. Percentage of operations in which any **beef breeding cattle*** (weaned or older) died or were lost in 2017 (from all causes), by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
36.1	(6.0)	68.1	(6.0)	92.2	(2.9)	45.3	(4.8)

*Replacement heifers, cows, or bulls.

There were no regional differences in the percentage of operations in which any beef breeding cattle (weaned or older) died or were lost in 2017.

C.2.f. Percentage of operations in which any **beef breeding cattle*** weaned or older died or were lost in 2017 (from all causes), by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
40.5	(8.5)	43.1	(7.5)	52.6	(7.8)

*Replacement heifers, cows, or bulls.

There were no herd size differences in the percentage of beef breeding cattle (weaned or older) that died or were lost in 2017. Overall, 1.3 percent of beef breeding cattle died or were lost in 2017.

C.2.g. Percentage of **beef breeding cattle**[1] (weaned or older) that died or were lost in 2017 (from all causes), by herd size:

Percent Cattle[2]							
Herd Size (number of beef cows)							
Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1.4	(0.2)	1.3	(0.2)	1.1	(0.1)	1.3	(0.1)

[1]Replacement heifers, cows, or bulls.
[2]Number of beef breeding cattle that died as a percentage of the October 1, 2017, inventory of cows, replacement heifers, and bulls.

There were no regional differences in the percentage of beef breeding cattle (weaned or older) that died or were lost in 2017.

C.2.h. Percentage of **beef breeding cattle**[1] weaned or older that died or were lost in 2017 (from all causes), by region:

Percent Cattle[2]					
Region					
West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1.1	(0.2)	1.3	(0.2)	1.5	(0.2)

[1]Replacement heifers, cows, or bulls.
[2]Number of beef breeding cattle that died as a percentage of the October 1, 2017, inventory of cows, replacement heifers, and bulls.

A higher percentage of operations (29.2 percent) had at least one calf 3 weeks of age or older die of respiratory problems compared with operations that had at least one beef breeding animal (3.0 percent) die of respiratory problems. In addition, a higher percentage of operations had at least one calf less than 3 weeks of age die from predators (23.9 percent) compared with operations that had at least one beef breeding animal (0.4 percent) die from predators.

C.2.i. For operations that had any deaths or losses in calves or cattle in 2017 (from all causes), percentage of operations that lost calves less than 3 weeks old, calves 3 weeks and older, and beef breeding cattle, by cause of death:

Percent Operations

Cattle Class

	Less than 3 wk old		3 wk and older		Beef breeding cattle		Any	
Cause of death	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Digestive problems (bloat, scours, parasites, enterotoxemia, acidosis, etc.)	14.4	(4.0)	9.6	(3.7)	13.0	(4.0)	16.3	(3.2)
Respiratory problems (pneumonia, shipping fever, etc.)	12.0	(3.4)	29.2	(7.8)	3.0	(1.8)	17.6	(4.3)
Metabolic problems (milk fever, grass tetany, etc.)	0.0	(—)	0.0	(—)	0.5	(0.3)	0.3	(0.2)
Mastitis (cows only)					0.1	(0.1)	0.1	(0.1)
Lameness or injury	5.4	(3.9)	5.0	(4.1)	20.8	(5.2)	18.3	(4.1)
Calving-related/birth-related problems	34.9	(8.2)	0.2	(0.2)	26.1	(6.1)	27.6	(5.0)
Other known diseases	0.3	(0.3)	10.0	(6.6)	7.0	(3.1)	9.7	(3.9)
Weather-related causes (lightning, drowning, chilling, etc.)	19.1	(7.0)	8.3	(3.7)	7.9	(4.0)	16.9	(4.2)

Table cont'd →

C.2.i. (cont'd) For operations that had any deaths or losses in calves or cattle in 2017 (from all causes), percentage of operations that lost calves less than 3 weeks old, calves 3 weeks and older, and beef breeding cattle, by cause of death:

	Percent Operations							
	Cattle Class							
	Less than 3 wk old		3 wk and older		Beef breeding cattle		Any	
Cause of death	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Poisoning (nitrates, noxious feeds, noxious weeks, etc.)	0.0	(—)	3.0	(2.8)	1.6	(1.0)	2.4	(1.5)
Predators (known or unknown)	23.9	(7.8)	7.0	(3.1)	0.4	(0.2)	13.2	(4.0)
Theft (stolen)	0.0	(—)	1.1	(1.1)	0.6	(0.6)	0.9	(0.7)
Other known causes (old age, etc.	11.6	(5.7)	4.9	(2.9)	29.1	(5.9)	25.0	(4.5)
Unknown causes	39.7	(8.1)	35.7	(8.6)	27.3	(6.3)	42.8	(6.3)

A higher percentage of calves 3 weeks of age and older (29.0 percent) died of respiratory disease in 2017 than calves less than 3 weeks of age (8.1 percent) or beef breeding cattle (2.5 percent). A higher percentage of calves (regardless of age) than beef breeding cattle died due to predators.

C.2.j. For operations that had any deaths or losses in calves or cattle in 2017 (from all causes), percentage of calves less than 3 weeks old, calves 3 weeks or older, and beef breeding cattle lost, by cause of death:

	Percent Calves and Cattle Lost							
	Cattle Class							
	Calves less than 3 wk old		Calves 3 wk and older		Beef breeding cattle		Any	
Cause of death	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Digestive problems (bloat, scours, parasites, enterotoxemia, acidosis, etc.)	11.9	(3.2)	9.8	(2.7)	9.6	(2.9)	10.6	(1.8)
Respiratory problems (pneumonia, shipping fever, etc.)	8.1	(2.3)	29.0	(6.2)	2.5	(1.4)	11.3	(2.2)
Metabolic problems (milk fever, grass tetany, etc.)	0.0	(—)	0.0	(—)	0.4	(0.3)	0.1	(0.1)
Mastitis (cows only)					0.2	(0.2)	0.1	(0.1)
Lameness or injury	1.8	(1.1)	2.5	(2.1)	11.9	(2.7)	5.5	(1.2)
Calving-related/birth-related problems	24.7	(6.1)	0.2	(0.2)	17.0	(3.9)	16.0	(2.6)
Other known diseases	0.1	(0.1)	5.6	(3.5)	4.0	(1.6)	2.8	(1.1)
Weather-related causes (lightning, drowning, chilling, etc.)	12.5	(3.3)	6.2	(2.3)	6.1	(2.4)	8.7	(1.7)
Poisoning (nitrates, noxious feeds, noxious weeks, etc.)	0.0	(—)	1.6	(1.4)	1.0	(0.5)	0.8	(0.4)

Table cont'd →

C.2.j. (cont'd) For operations that had any deaths or losses in calves or cattle in 2017 (from all causes), percentage of calves less than 3 weeks old, calves 3 weeks or older, and beef breeding cattle lost, by cause of death:

	Percent Calves and Cattle Lost							
	Cattle Class							
	Calves less than 3 wk old		Calves 3 wk and older		Beef breeding cattle		Any	
Cause of death	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Predators (known or unknown)	13.8	(6.3)	18.3	(9.7)	0.2	(0.2)	10.1	(3.7)
Theft (stolen)	0.0	(—)	1.2	(1.1)	0.5	(0.3)	0.5	(0.3)
Other known causes (old age, etc.)	3.1	(1.6)	2.6	(1.5)	21.0	(4.2)	9.3	(1.7)
Unknown causes	24.0	(5.7)	23.0	(6.2)	25.5	(6.8)	24.3	(3.7)
Total	100.0		100.0		100.0		100.0	

D. Disease Control

1. Use of antibiotics in feed

On January 1, 2017, the U.S. Food and Drug Administration (FDA) implemented policy changes regarding the use of antibiotics in food-producing animals. These changes included eliminating the use of medically important antibiotics for growth promotion purposes in food-producing animals and requiring veterinary oversight for use of medically important antibiotics in animal feed or water. The FDA defines “medically important” antibiotics as those important for therapeutic use in human medicine. Nonmedically important antibiotics, however, can still be used for growth promotion purposes, and the most common nonmedically important antibiotics used in cattle are ionophores. Monensin, lasalocid, and laidlomycin are the three ionophores approved for use in cattle. All three are approved for improving feed efficiency. Monensin and lasalocid are also approved for prevention and control of coccidiosis.

Using antibiotics in a manner not specified on the product label is called extra-label use, which has been prohibited in livestock feed since the 1990s. Most approved indications for using medically important antibiotics in feed on beef cow-calf operations are targeted toward controlling respiratory or digestive disease in unweaned calves, weaned calves, and replacement heifers; tetracycline products (e.g., chlortetracycline, oxytetracycline, or the chlortetracycline/sulfamethazine combination) are the primary products used for these purposes. Ionophores are nonmedically important and are also used on cow-calf operations in unweaned calves, weaned calves, and replacement heifers for growth promotion purposes or for control of coccidiosis. Chlortetracycline is approved for controlling anaplasmosis, and monensin is approved for preventing and controlling coccidiosis and for improving feed efficiency in beef cows receiving supplemental feed. However, monensin is unlikely to be used much in beef cows, at least during the pasture growing season, since supplemental feed is not often given. In addition, coccidiosis is more of a disease of calves than beef cows.

Beef cow-calf herds graze their cattle almost exclusively on pastures during the growing season and do not supplement their cattle with other feed during this period. Other than operations that keep calves for a short period after weaning or that background calves or feed them to market weight, there are few instances in which cow-calf operations need to use medically important antibiotics in cattle feed. If calves or replacement heifers are held on the operation after weaning, a medically important antibiotic such as chlortetracycline might be put in their feed for a short time to control respiratory disease during the stressful period shortly after weaning.

Antibiotic use in feed was limited on cow-calf operations in 2017, with only 15.3 percent of operations using any antibiotics in feed. The use of medically important antibiotics in feed was not common on cow-calf operations, with only 9.5 percent of operations using these antibiotics in 2017.

D.1.a. Percentage of operations that used any antibiotics in feed in 2017 to treat, control, or prevent disease and/or for growth promotion, by antibiotic type used and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Antibiotic type	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Any medically important antibiotic	7.2	(3.0)	15.8	(4.9)	19.0	(8.8)	9.5	(2.5)
Only non-medically important antibiotics	1.8	(1.8)	1.8	(0.9)	8.8	(3.9)	2.1	(1.4)
Only other/unknown antibiotics	4.2	(2.1)	2.3	(1.8)	1.3	(0.8)	3.6	(1.6)
Any antibiotic	13.1	(3.9)	19.9	(5.2)	29.0	(9.5)	15.3	(3.1)

A higher percentage of operations in the Central region used a medically important antibiotic (26.3 percent) or any antibiotic (34.1 percent) in cattle feed in 2017 compared with operations in the West region (1.4 and 2.9 percent, respectively).

D.1.b. Percentage of operations that used any antibiotics in feed in 2017 to treat, control, or prevent disease and/or for growth promotion, by antibiotic type used and by region:

	Percent Operations					
	Region					
	West		Central		East	
Antibiotic type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Any medically important antibiotics	1.4	(0.7)	26.3	(7.9)	6.2	(3.4)
Only non-medically important antibiotics	0.5	(0.3)	2.0	(0.8)	4.2	(3.9)
Other/unknown antibiotics	1.0	(0.9)	5.8	(3.9)	5.1	(3.4)
Any antibiotic	2.9	(1.2)	34.1	(8.4)	15.5	(6.2)

A higher percentage of operations used any antibiotics in feed for calves weaned but not yet shipped (13.3 percent) than used antibiotics in feed for unweaned calves (3.5 percent).

D.1.c. Percentage of operations by primary purpose for using antibiotics in feed for the following cattle classes in 2017:

	Percent Operations	
Primary purpose for…	**Pct.**	**Std. error**
Unweaned calves		
Prevention, control, or treatment of respiratory disease	1.9	(1.2)
Other	1.7	(0.7)
Any	3.5	(1.4)
Replacement heifers weaned but not calved[1]		
Prevention, control, or treatment of respiratory disease	8.4	(2.6)
Promote growth	3.1	(1.2)
Other	0.9	(0.5)
Any	10.7	(2.7)
Other calves weaned but not yet shipped for feeding or sold as breeding stock[2]		
Prevention, control, or treatment of respiratory disease	10.0	(2.9)
Promote growth	4.5	(2.0)
Other	0.5	(0.3)
Any	13.3	(3.4)
Unweaned calves, replacement heifers, or other calves weaned but not yet shipped[3]		
Prevention, control, or treatment of respiratory disease	10.3	(2.6)
Promote growth	4.7	(1.8)
Other	2.1	(0.7)
Any	13.5	(3.0)

[1]For operations with replacement heifers.
[2]For operations with other calves.
[3]For operations with one or more of the following cattle classes: unweaned calves, replacement heifers, or other calves weaned but not yet shipped.

For operations that used antibiotics in feed in for unweaned calves, replacement heifers, or other calves weaned but not yet shipped in 2017, a higher percentage of operations (44.2 percent) cited local veterinary practitioners as the primary influence when making decisions regarding what antibiotics to use compared with trade journals (1.5 percent), other producers (8.4 percent), second-opinion veterinarians (0.7 percent), or other sources (3.3 percent).

D.1.d. For the 13.5 percent of operations that used any antibiotics in feed to treat, control, or prevent respiratory disease and/or to promote growth in unweaned calves, replacement heifers, or other calves weaned but not yet shipped in 2017 (table D.1.c), percentage of operations by primary influence regarding what antibiotics to use, and by primary purpose for using antibiotics:

	Percent Operations					
	Primary purpose					
	Prevention, control, or treatment of respiratory disease		Growth promotion		All operations	
Primary influence	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Trade journals	2.0	(1.8)	4.6	(4.2)	1.5	(1.3)
Other producers	9.6	(6.8)	0.0	(—)	8.4	(5.2)
Local veterinary practitioner	45.8	(13.5)	36.7	(17.8)	44.2	(11.2)
Consulting or second-opinion veterinarian	0.9	(0.8)	0.0	(—)	0.7	(0.6)
Nutritionist	1.5	(1.3)	42.0	(21.3)	14.4	(9.3)
Supplier of antibiotics other than veterinarian	24.4	(10.9)	14.0	(12.1)	17.9	(8.2)
Other	2.5	(2.6)	4.5	(4.7)	3.3	(2.4)
No other influence	13.2	(10.7)	2.7	(2.4)	9.8	(8.1)

Producers were asked what antibiotics were used to prevent, control, or treat respiratory disease and/or promote growth in unweaned calves, weaned replacement heifers, and other weaned calves. Of the antibiotics listed in the following table, chlortetracycline, oxytetracycline, and chlortetracycline/sulfamethazine are approved for treating or controlling respiratory disease in calves and replacement heifers. Ionophores are approved for growth promotion/increased feed efficiency in calves and replacement heifers.

For operations that used antibiotics in feed for unweaned calves, replacement heifers, or other calves weaned but not yet shipped in 2017, chlortetracycline, oxytetracycline, or the chlortetracycline/sulfamethazine combination were the specific primary antibiotics used by the highest percentages of operations to prevent, control, or treat respiratory disease. As expected, ionophores were used by the highest percentage of operations for growth promotion.

D.1.e. For the 13.5 percent of operations that used any antibiotics in feed to treat, control, or prevent respiratory disease and/or to promote growth in unweaned calves, replacement heifers, or other calves weaned but not yet shipped in 2017 (table D.1.c), percentage of operations by primary antibiotic used, and by primary purpose of using antibiotics.

	Percent Operations			
	Primary purpose			
	Prevention, control, or treatment of respiratory disease		Growth promotion	
Primary antibiotic	Pct.	Std. error	Pct.	Std. error
Chlortetracycline or Oxytetracycline	59.5	(12.8)	1.3	(1.4)
Chlortetracycline/Sulfamethazine	23.7	(11.2)	0.0	—
Other	0.0	—	0.4	(0.5)
Ionophore	0.0	—	81.7	(14.9)
Fed, but unknown type	16.8	(9.3)	16.6	(14.9)

For operations that used antibiotics in feed for unweaned calves, replacement heifers, or other calves weaned but not yet shipped in 2017, a higher percentage of operations used chlortetracycline or oxytetracycline in feed for unweaned calves than any other antibiotics listed in the following table.

D.1.f. For the 13.5 percent of operations that used any antibiotics in feed to treat, control, or prevent respiratory disease and/or to promote growth in unweaned calves, replacement heifers, or other calves weaned but not yet shipped in 2017 (table D.1.c), percentage of operations by primary antibiotic used, and by cattle class:

	Percent Operations					
	Cattle class					
	Unweaned calves		Replacement heifers (weaned but not yet calved)		Other weaned calves	
Primary antibiotic	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Chlortetracycline or Oxytetracycline	78.7	(12.2)	40.0	(13.1)	37.4	(12.6)
Chlortetracycline/ Sulfamethazine	11.9	(10.8)	26.8	(12.3)	22.8	(10.9)
Other	0.0	(—)	0.0	(—)	0.2	(0.2)
Ionophore	13.9	(8.0)	19.5	(7.9)	26.5	(11.3)
Fed but unknown type	0.9	(0.9)	19.5	(10.4)	16.2	(9.0)

As shown in table D.1.e, chlortetracycline, oxytetracycline, or chlortetracycline/sulfamethazine are used to prevent, control, or treat respiratory disease, and ionophores are used to promote/improve growth and feed efficiency. Chlortetracycline/sulfamethazine can be administered to cattle for 28 days to prevent, control, or treat respiratory disease. The approved period for feeding chlortetracycline or oxytetracycline to cattle to prevent, control, or treat respiratory disease depends on the dose. For example, there is no limit on how long chlortetracycline doses of 350 mg/head/day can be fed to weaned replacement heifers. Chlortetracycline doses of 10 mg/lb/day, however, are limited to 5 days of use. Oxytetracycline doses of 500-2000 mg/head/day can be fed 3 to 5 days before cattle are placed in a feedlot, while doses of 10 mg/lb/day can be fed for 7 to 14 days. Ionophores can be fed to replacement heifers or calves indefinitely.

For operations that used antibiotics in feed for unweaned calves, replacement heifers, or other calves weaned but not yet shipped in 2017, antibiotics for growth promotion were fed for an average of 56.6 days, while antibiotics to prevent, control, or treat respiratory disease were fed for an average 23.2 days.

D.1.g. For the 13.5 percent of operations that used any antibiotics in feed to treat, control, or prevent respiratory disease and/or to promote growth in unweaned calves, replacement heifers, or other calves weaned but not yet shipped in 2017 (table D.1.c), average number of days antibiotics were fed, by primary reason for using antibiotics:

Average Number of Days

Primary purpose

Prevention, control, or treatment of respiratory disease		Growth promotion	
Days	**Std. error**	**Days**	**Std. error**
23.2	(4.9)	56.6	(13.1)

2. Use of oral or injectable antibiotics to treat disease

As shown in table D.1.a., few beef cow-calf operations use antibiotics in cattle feed. Rather, individual animal treatments on cow-calf operations for a disease or disorder are often given with injectable antibiotics, but they can also be given by bolus (pill), or drench (e.g., liquid products given orally via a large syringe, dosing gun, or stomach tube). Treatments can also be administered to one or multiple animals via drinking water. While the latter practice is common in poultry and swine operations, antibiotics are not commonly added to drinking water of cattle. Since January 1, 2017, the use of medically important antibiotics in livestock drinking water requires a veterinary prescription. Antibiotics used in a drench are generally the same ones used in drinking water. Some medically important injectable or bolus-dosed antibiotics require a prescription, but some do not and are available over-the-counter.

A higher percentage of medium and large operations (79.8 and 82.9 percent, respectively) used oral (via bolus, drench, or drinking water) or injectable antibiotics to treat disease in 2017 compared with small operations (42.1 percent). Overall, 51.8 percent of operations used oral (via bolus, drench, or drinking water) or injectable antibiotics to treat disease in 2017.

D.2.a. Percentage of operations that used oral (via bolus, drench, or drinking water) or injectable antibiotics to treat disease in 2017, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
42.1	(6.2)	79.8	(5.2)	82.9	(6.7)	51.8	(4.9)

There were no regional differences in the percentage of operations that used oral (via bolus, drench, or drinking water) or injectable antibiotics to treat disease in 2017.

D.2.b. Percentage of operations that used oral (via bolus, drench, or drinking water) or injectable antibiotics to treat disease in 2017, by region:

Percent Operations					
Region					
West		Central		East	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
53.2	(8.7)	58.1	(7.4)	45.3	(8.1)

A lower percentage of operations used oral (via bolus, drench, or drinking water) or injectable antibiotics at least once for weaned replacement heifers (15.0 percent) in 2017 compared with operations that used oral or injectable antibiotics at least once for unweaned calves (38.9 percent) or for cows (30.6 percent).

D.2.c. Percentage of operations that gave oral (via bolus, drench, or drinking water) or injectable antibiotics at least once to the following cattle classes 2017 to treat or control any disease or disorder, by herd size:

	Percent Operations							
	Herd Size (number of beef cows)							
	Small (1–49)		Medium (50–199)		Large (200 or more)		All operations	
Cattle class	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Unweaned calves	30.7	(6.1)	60.5	(6.4)	72.8	(10.6)	38.9	(4.7)
Replacement heifers (weaned but not calved)*	10.0	(4.1)	18.0	(4.9)	65.6	(9.6)	15.0	(3.3)
Cows	23.9	(5.4)	47.1	(7.0)	63.8	(11.0)	30.6	(4.4)

*For operations with replacement heifers.

There were no regional differences in the percentages of operations that used oral (via bolus, drench, or drinking water) or injectable antibiotics at least once in unweaned calves, weaned replacement heifers, or cows in 2017.

D.2.d. Percentage of operations that gave oral (via bolus, drench, or drinking water) or injectable antibiotics at least once to the following cattle classes in 2017 to treat or control any disease or disorder, by region:

	Percent Operations					
	Region					
	West		Central		East	
Cattle class	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Unweaned calves	38.4	(7.9)	40.1	(7.4)	38.5	(8.7)
Replacement heifers (weaned but not calved)*	21.0	(7.2)	18.5	(6.0)	6.8	(3.4)
Cows	28.0	(7.1)	44.5	(8.1)	23.0	(7.1)

*For operations with replacement heifers.

A higher percentage of unweaned calves (6.2 percent) were given oral or injectable antibiotics at least once in 2017 compared with cows (1.9 percent). There were no herd size differences in the percentages of unweaned calves, weaned replacement heifers, or cows that were given oral or injectable antibiotics in 2017.

D.2.e. Percentage of cattle and calves given oral (via bolus, drench, or drinking water) or injectable antibiotics at least once in 2017 to treat or control any disease or disorder, by cattle class and by herd size:

	Percent Cattle[1]							
	Herd Size (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Cattle class	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Unweaned calves	4.6	(1.5)	6.9	(2.2)	7.2	(3.0)	6.2	(1.3)
Replacement heifers (weaned but not calved)[2]	4.6	(2.6)	2.9	(1.0)	8.3	(2.3)	5.0	(1.3)
Cows	2.3	(0.8)	1.8	(0.4)	1.6	(0.4)	1.9	(0.3)

[1]Number of animals treated divided by inventory on October 1, 2017, for heifers and cows. For unweaned calves, the number treated divided by the number of calves born alive in 2017.
[2]For operations with replacement heifers.

There were no regional differences in the percentages of unweaned calves, weaned replacement heifers, or cows given oral or injectable antibiotics in 2017.

D.2.f. Percentage of cattle and calves given oral (via bolus, drench, or drinking water) or injectable antibiotics at least once in 2017 to treat or control any disease or disorder, by cattle class and by region:

	Percent Cattle[1]					
	Region					
	West		Central		East	
Cattle class	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Unweaned calves	4.9	(1.2)	10.4	(3.3)	3.0	(0.7)
Replacement heifers (weaned but not calved)[2]	4.6	(1.9)	8.3	(3.3)	2.4	(1.3)
Cows	1.7	(0.5)	2.9	(0.8)	1.3	(0.3)

[1]Number of animals treated divided by inventory on October 1, 2017, for heifers and cows. For unweaned calves, the number treated divided by the number of calves born alive in 2017.
[2]For operations with replacement heifers.

For tables D.2.g. through D.2.j., the term “oral” use refers only to antibiotics given by bolus or drench, not by drinking water. Since there was no use of antibiotics in drinking water (tables D.2.g. through D.2.j.), it is likely that the only oral use of antibiotics represented in previous tables D.2.a. and D.2.f. was via bolus or drench and not drinking water.

Of operations with unweaned calves, replacement heifers, or cows affected by respiratory disease, over 90 percent used oral or injectable antibiotics to treat or control respiratory disease in these cattle. Of operations with unweaned calves, replacement heifers, or cows affected by pinkeye, 89.7, 98.1, and 93.4 percent used oral or injectable antibiotics to treat or control pinkeye in unweaned calves, replacement heifers, and cows, respectively.

D.2.g. Percentage of operations with at least one unweaned calf, replacement heifer, or cow affected/sick with any of the listed diseases or disorders (from table C.1.a.), and percentage of operations that treated any of these cattle with any oral (via bolus or drench) or injectable antibiotics in 2017, by cattle class and by route of administration:

			Percent Operations					
			Route of Administration[2]					
	Percent operations with cattle/calves affected/sick[1]		Oral (bolus or drench)		Injection		Any oral or injection route	
Disease or disorder in…	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Unweaned calves								
Respiratory	18.4	(3.1)	7.1	(4.3)	93.2	(4.3)	97.7	(1.3)
Diarrhea/scours or other digestive	18.9	(3.5)	59.2	(9.1)	36.0	(8.4)	88.0	(5.7)
Pinkeye	13.4	(2.7)	14.4	(9.4)	75.3	(10.8)	89.7	(6.8)
Navel infection	3.1	(1.8)	0.7	(0.8)	99.3	(0.8)	99.3	(0.8)
Other	5.1	(2.1)	0.0	(—)	100.0	(—)	100.0	(—)
Any	40.3	(4.8)	33.3	(7.1)	77.0	(6.6)	94.3	(2.7)
Replacement heifers (weaned but not yet calved)[3]								
Respiratory	4.4	(1.5)	0.0	(—)	91.7	(8.0)	91.7	(8.0)
Diarrhea/scours or other digestive	1.4	(0.9)	(D)	(D)	(D)	(D)	70.0	(25.0)
Pinkeye	8.6	(2.9)	5.1	(5.2)	93.0	(5.5)	98.1	(1.6)
Lameness/footrot	2.9	(1.3)	6.1	(5.9)	100.0	(—)	100.0	(—)
Other	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)
Any	12.7	(3.1)	5.7	(4.0)	89.4	(5.6)	92.9	(4.1)

Table cont'd →

D.2.g. (cont'd) Percentage of operations with at least one unweaned calf, replacement heifer, or cow affected/sick with any of the listed diseases or disorders (from table C.1.a.), and percentage of operations that treated any of these cattle with any oral (via bolus or drench) or injectable antibiotics in 2017, by cattle class and by route of administration:

			Percent Operations Route of Administration[2]					
	Percent operations with cattle/calves affected/sick[1]		Oral (bolus or drench)		Injection		Any oral or injection route	
Disease or disorder in…	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Cows								
Respiratory	5.9	(1.9)	0.0	(—)	98.1	(1.2)	98.1	(1.2)
Diarrhea/scours or other digestive	6.2	(2.0)	18.7	(16.0)	50.3	(16.1)	50.3	(16.1)
Pinkeye	11.1	(2.7)	0.0	(—)	93.4	(4.2)	93.4	(4.2)
Reproductive (retained placenta/ uterine infection)	3.8	(1.7)	11.8	(8.8)	56.9	(23.4)	64.9	(24.7)
Mastitis	2.9	(1.8)	(D)	(D)	(D)	(D)	95.1	(4.7)
Abortion	2.3	(1.8)	(D)	(D)	(D)	(D)	15.4	(17.4)
Lameness/footrot	17.2	(3.1)	13.2	(7.2)	68.9	(9.2)	79.7	(7.9)
Other	2.1	(1.4)	(D)	(D)	(D)	(D)	86.7	(13.4)
Any	33.5	(4.4)	18.3	(6.8)	74.5	(6.4)	86.2	(5.2)

(D) Too few to report.
[1]Operations with affected animals of the given class out of all respondents with cattle of that class.
[2] Operations that treated affected animals by the given route, out of operations with animals of the given class affected by the given disease/disorder.
[3] For operations with replacement heifers.

Of unweaned calves, replacement heifers, and cows affected with respiratory disease in 2017, over 90 percent were treated for respiratory disease with injectable antibiotics. Of unweaned calves and cows affected with digestive disease in 2017, there was no difference in the percentage of these cattle treated with oral (bolus or drench) versus injectable antibiotics.

D.2.h. Percentage of cattle and calves affected/sick with any of the listed diseases or disorders (from table C.1.c.), and percentage of these cattle and calves treated with any oral (via bolus, drench, or drinking water) or injectable antibiotics in 2017, by cattle class and by route of administration:

			Percent Cattle Calves Route of Administration[1]			
	Percent affected/sick cattle/calves		Bolus or drench		Injection	
Disease or disorder	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Unweaned calves[2]						
Respiratory	3.3	(1.1)	7.5	(6.0)	93.0	(5.8)
Diarrhea/scours or other digestive	2.6	(0.8)	60.7	(13.2)	25.9	(8.6)
Pinkeye	1.2	(0.3)	19.7	(14.8)	73.9	(14.2)
Navel infection	0.2	(0.1)	0.8	(0.9)	99.2	(0.9)
Other	0.2	(0.1)	0.0	(—)	100.0	(—)
Replacement heifers (weaned but not yet calved)[3, 4]						
Respiratory	1.6	(0.6)	0.0	(—)	98.4	(1.7)
Diarrhea/scours or other digestive	0.7	(0.4)	(D)	(D)	(D)	(D)
Pinkeye	2.4	(1.0)	13.2	(12.5)	84.5	(12.7)
Lameness/footrot	0.4	(0.1)	17.0	(14.1)	99.6	(0.5)
Other	0.0	(—)	0.0	(—)	0.0	(—)

Table cont'd →

D.2.h. (cont'd) Percentage of cattle and calves affected/sick with any of the listed diseases or disorders (from table C.1.c.), and percentage of these cattle and calves treated with any oral (via bolus, drench, or drinking water) or injectable antibiotics in 2017, by cattle class and by route of administration:

			Percent Cattle Calves Route of Administration[1]			
	Percent affected/sick cattle/calves		Bolus or drench		Injection	
Disease or disorder	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Cows[3]						
Respiratory	0.4	(0.2)	0.0	(—)	99.0	(0.8)
Diarrhea/scours or other digestive	0.2	(0.0)	14.0	(12.6)	54.6	(14.8)
Pinkeye	0.5	(0.1)	0.0	(—)	95.2	(2.6)
Reproductive (retained placenta/ uterine infection)	0.2	(0.1)	14.6	(9.1)	78.7	(13.4)
Mastitis	0.1	(0.0)	(D)	(D)	(D)	(D)
Abortion	0.0	(0.0)	(D)	(D)	(D)	(D)
Lameness/footrot	0.8	(0.1)	7.9	(3.5)	78.8	(6.0)
Other	0.1	(0.0)	(D)	(D)	(D)	(D)

(D) Too few to report.
[1]Treated animals of the given class as a percentage of affected animals of that class.
[2]Affected unweaned calves as a percentage of calves born alive in 2017.
[3]Affected animals of the given class as a percentage of animals of that class on the operation on October 1, 2017.
[4] For operations with replacement heifers.

Antibiotics administered by bolus or drench can be used in an extra-label fashion (e.g., for an indication not appearing on the product label) when directed by a veterinarian. Antibiotics in the table below are listed by antibiotic class. For example, chlortetracycline, oxytetracycline, and tetracycline are products within the tetracycline class that are available for administration by the oral route. The specific oral antibiotics included in each class can be found in Appendix III. However, Appendix III only includes antibiotics that operations specifically indicated they used in 2017. For example, within the tetracycline class, operations indicated they only used oxytetracycline via the oral route, so chlortetracycline and tetracycline do not appear in Appendix III.

Overall, there was very little use of antibiotics by bolus or drench in unweaned calves, replacement heifers, or cows to treat or control the diseases or disorders listed in the following table.

D.2.i. Percentage of operations by primary antibiotic class administered by the oral route (bolus or drench) in 2017, by cattle class and by disease or disorder treated or controlled:

Percent Operations

Primary Antibiotic Class

	Tetracyclines		Sulfonamides		Amino-glycosides		Other/ Unknown		None (No cattle affected or no cattle treated for this disease)		Total
Disease or disorder	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**
Unweaned calves											
Respiratory	0.0	(—)	0.5	(0.3)	0.0	(—)	0.8	(0.8)	98.7	(0.8)	100.0
Diarrhea/scours or other digestive	3.8	(2.0)	5.6	(2.2)	0.1	(0.1)	1.7	(0.9)	88.8	(3.1)	100.0
Pinkeye	0.0	(—)	1.2	(1.2)	0.0	(—)	0.8	(0.8)	98.1	(1.4)	100.0
Navel infection	0.0	(—)	0.0	(0.0)	0.0	(—)	0.0	(—)	100.0	(0.0)	100.0
Other	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)	100.0	(—)	100.0
Any	3.8	(2.0)	7.1	(2.4)	0.1	(0.1)	2.5	(1.2)			

Table cont'd →

D.2.i. (cont'd) Percentage of operations by primary antibiotic class administered by the oral route (bolus or drench) in 2017, by cattle class and by disease or disorder treated or controlled:

	Percent Operations										
	Primary Antibiotic Class										
	Tetracyclines		Sulfonamides		Amino-glycosides		Other/ Unknown		**None** (No cattle affected or no cattle treated for this disease)		Total
Disease or disorder	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.
Replacement heifers (weaned but not yet calved)[1]											
Respiratory	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)	100.0	(—)	100.0
Diarrhea/scours or other digestive	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	100.0
Pinkeye	0.0	(—)	0.4	(0.4)	0.0	(—)	0.0	(—)	99.6	(0.4)	100.0
Lameness/footrot	0.0	(—)	0.2	(0.2)	0.0	(—)	0.0	(—)	99.8	(0.2)	100.0
Other	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)	100.0	(—)	100.0
Any	0.0	(—)	0.7	(0.5)	0.0	(—)	0.0	(—)			
Cows											
Respiratory	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)	100.0	(—)	100.0
Diarrhea/scours or other digestive	0.0	(—)	1.2	(1.1)	0.0	(—)	0.0	(—)	98.8	(1.1)	100.0
Pinkeye	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)	100.0	(—)	100.0
Reproductive (retained placenta/ uterine infection)	0.0	(—)	0.2	(0.1)	0.0	(—)	0.3	(0.3)	99.6	(0.3)	100.0
Mastitis	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	100.0
Abortion	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	100.0
Lameness/footrot	0.7	(0.7)	1.6	(1.2)	0.0	(—)	0.0	(0.0)	97.7	(1.4)	100.0
Other	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	100.0
Any	0.7	(0.7)	3.0	(1.6)	0.0	(—)	2.5	(1.8)			

(D) Too few to report.
[1] For operations with replacement heifers.

When directed by a veterinarian, antibiotics administered by injection can be given in an extra-label fashion (e.g., for an indication not appearing on the product label), as long as the extra-label use is not specifically prohibited by the FDA.

Antibiotics listed in the following table are presented by antibiotic class. For example, the phenicol class includes florfenicol (Nuflor,® Norfenicol®) and florfenicol with flunixin meglumine (Resflor Gold®). The injectable products used in each class can be found in Appendix IV.

A higher percentage of operations used tetracyclines in unweaned calves (17.5 percent) than any other antibiotics. In addition, a higher percentage of operations used tetracyclines in cows (18.4 percent) than any other antibiotics.

D.2.j. Percentage of operations by primary antibiotic class administered by injection in 2017, by disease or disorder treated or controlled:

Percent Operations

Primary Antibiotic Class

	Tetracyclines		Macrolides		Cephalo-sporins		Non cephal-osporin Beta-lactams		Phenicols		Fluoro-quinolones		Other/ Unknown		None (No cattle affected or no cattle treated for this disease)		Total
Disease or disorder	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**
Unweaned calves																	
Respiratory	7.0	(2.4)	4.5	(1.4)	0.9	(0.5)	1.4	(0.9)	2.6	(1.2)	0.7	(0.4)	0.2	(0.1)	82.7	(3.0)	100.0
Diarrhea/ scours or other digestive	2.6	(1.2)	1.7	(1.0)	0.6	(0.4)	0.2	(0.2)	0.9	(0.4)	0.6	(0.4)	0.3	(0.2)	93.1	(1.7)	100.0
Pinkeye	8.3	(2.3)	1.0	(0.5)	0.0	(—)	0.4	(0.3)	0.4	(0.4)	0.1	(0.1)	0.4	(0.3)	89.5	(2.4)	100.0
Navel infection	0.2	(0.1)	0.3	(0.2)	0.4	(0.4)	2.0	(1.8)	0.3	(0.2)	0.0	(0.0)	0.0	(0.0)	96.9	(1.8)	100.0
Other	3.5	(1.7)	0.4	(0.4)	0.0	(0.0)	1.2	(1.1)	0.0	(—)	0.0	(—)	0.0	(—)	94.9	(2.1)	100.0
Any	17.5	(3.5)	6.5	(1.7)	1.6	(0.7)	5.1	(2.3)	3.6	(1.3)	0.9	(0.4)	0.7	(0.4)			
Replacement heifers (weaned but not yet calved)[1]																	
Respiratory	2.3	(1.3)	1.3	(0.6)	0.0	(0.0)	0.0	(0.0)	0.4	(0.3)	0.0	(0.0)	0.0	(0.0)	95.8	(1.4)	100.0
Diarrhea/ scours or other digestive	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	100.0

Table cont'd →

D.2.j. (cont'd) Percentage of operations by primary antibiotic class administered by injection in 2017, by disease or disorder treated or controlled:

Percent Operations

Primary Antibiotic Class

	Tetracyclines		Macrolides		Cephalo-sporins		Non cephal-osporin Beta-lactams		Phenicols		Fluoro-quinolones		Other/ Unknown		None (No cattle affected or no cattle treated for this disease)		Total
Disease or disorder	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**	**Std. err**	**Pct.**
Pinkeye	5.6	(2.0)	3.3	(2.3)	0.0	(0.0)	0.1	(0.1)	0.0	(0.0)	0.0	(—)	0.1	(0.1)	90.9	(3.0)	100.0
Lameness/ footrot	1.7	(1.1)	0.7	(0.4)	0.0	(—)	0.0	(0.0)	0.4	(0.4)	0.0	(—)	0.1	(0.1)	97.1	(1.3)	100.0
Other	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)	100.0	(—)	100.0
Any	7.2	(2.2)	4.9	(2.4)	0.0	(0.0)	0.2	(0.2)	0.9	(0.5)	0.0	(0.0)	0.1	(0.1)			
Cows																	
Respiratory	4.1	(1.7)	0.7	(0.4)	0.0	(—)	0.0	(—)	0.9	(0.7)	0.0	(0.0)	0.0	(—)	94.2	(1.9)	100.0
Diarrhea/ scours or other digestive	0.7	(0.7)	0.0	(—)	1.2	(1.1)	0.0	(—)	0.0	(—)	0.0	(—)	1.3	(1.0)	96.9	(1.6)	100.0
Pinkeye	7.8	(2.2)	2.1	(1.2)	0.0	(—)	0.6	(0.5)	0.4	(0.4)	0.0	(—)	0.8	(0.8)	88.3	(2.7)	100.0
Reproductive (retained placenta/ uterine infection)	1.2	(0.9)	0.1	(0.1)	0.4	(0.4)	0.5	(0.2)	0.0	(0.0)	0.0	(—)	0.0	(0.0)	97.8	(1.0)	100.0
Mastitis	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	100.0
Abortion	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	100.0
Lameness/ footrot	8.4	(1.9)	2.1	(1.0)	0.0	(0.0)	0.1	(0.1)	0.8	(0.5)	0.0	(—)	0.9	(0.9)	87.7	(2.4)	100.0
Other	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	100.0
Any	18.4	(3.2)	3.7	(1.3)	1.6	(1.2)	1.8	(0.7)	2.1	(0.9)	0.0	(0.0)	3.0	(1.5)			

(D) Too few to report.
[1] For operations with replacement heifers.

Diarrhea (scours) is a common problem in unweaned calves. Table D.2.j. shows that 18.9 percent of operations had at least one unweaned calf affected by diarrhea/scours in 2017. Calf scours can be caused by infectious (e.g., *Salmonella,* rotavirus, coccidia) or noninfectious (e.g., nutritional) causes.

Antibiotics can be used to treat scours in unweaned calves, but there are also several management practices that can be beneficial for calf scours prevention and control. For example, a dry, clean environment and an effective vaccination program can help prevent or control scours. In addition, other management practices, such as the Sandhills Calving System, can help prevent or control calf scours. In this system, cows yet to calve are moved to a new pasture on a regular basis, such as once a week or every two weeks, leaving behind cow-calf pairs that calved in the past week or two. One of the basic principles of this Sandhills Calving System is to keep calves of the same age together. In this system, older calves cannot transmit diseases, such as those that cause scours, to younger calves.

Overall, 42.9 percent of operations treated calves 7 days or older with antibiotics for diarrhea (scours) as a general practice. There were no differences by herd size in the percentage of operations that generally treated calves 7 days or older with antibiotics for diarrhea.

D.2.k. Percentage of operations that generally treated calves 7 days or older with antibiotics for diarrhea (scours), by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
39.9	(6.1)	47.7	(7.1)	69.7	(8.8)	42.9	(4.8)

There were no differences by region in the percentage of operations that treated calves 7 days or older with antibiotics for diarrhea (scours) as a general practice.

D.2.l. Percentage of operations that generally treated calves 7 days or older with antibiotics for diarrhea (scours), by region:

Percent Operations					
Region					
West		Central		East	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
32.0	(8.6)	58.1	(7.0)	44.2	(8.3)

3. Use of antibiotics to control anaplasmosis

Anaplasmosis in cattle is caused by *Anaplasma marginale*, a rickettsial pathogen that invades red blood cells and can cause anemia, jaundice, and fever. Anaplasmosis is spread by the transfer of blood by biological means, e.g., ticks and biting insects or by mechanical means, e.g., needles not changed between cattle). Cattle of all ages can be infected, but clinical signs of disease are more severe in cattle 2 years or older. Infected cattle less than 2 years old rarely show clinical signs of disease. Mortality rates can be high in older, untreated cattle with no previous disease exposure. Anaplasmosis was historically thought to be a disease of cattle in the southern United States, but the disease has become more widespread and is no longer limited to the South.

Anaplasmosis control is complicated. In areas where anaplasmosis is endemic, eradication is unlikely. In areas where anaplasmosis disease is infrequent, eradication may be possible through vaccination or antibiotics. Using chlortetracycline (CTC) in feed, mineral mixes, or mineral blocks is approved in the United States for controlling anaplasmosis. There are, however, no injectable forms of chlortetracycline available in the United States. Injectable forms of oxytetracycline can be used as an alternative, but oxytetracycline by injection should be used under the guidance of a veterinarian because it is not approved for treating or controlling anaplasmosis. Recently, a new product, Baytril® 100-CA1 (enrofloxacin), has been conditionally approved for treating anaplasmosis, but this product was not available when this study was conducted.

Overall, 4.4 percent of operations used chlortetracycline in feed, mineral mixes, or mineral blocks to control anaplasmosis on the operation in 2017. A higher percentage of medium operations (15.2 percent) used chlortetracycline to control anaplasmosis compared with small operations (1.4 percent).

D.3.a. Percentage of operations that used chlortetracycline (CTC, Aureomycin®) in feed, mineral mixes, or mineral blocks in 2017 to control anaplasmosis on the operation, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1.4	(1.2)	15.2	(3.8)	3.8	(2.4)	4.4	(1.2)

A higher percentage of operations in the Central region (11.1 percent) used chlortetracycline to control anaplasmosis on the operation in 2017 compared with operations in the West region (0.8 percent).

D.3.b. Percentage of operations that used chlortetracycline (CTC, Aureomycin) in feed, mineral mixes, or mineral blocks in 2017 to control anaplasmosis on the operation in 2017, by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0.8	(0.8)	11.1	(4.3)	3.3	(1.0)

Of operations that used chlortetracycline to control anaplasmosis in 2017, a higher percentage used chlortetracycline in free-choice loose minerals (70.8 percent) compared with operations that used chlortetracycline in mineral blocks (11.2 percent).

D.3.c. For the 4.4 percent of operations that used chlortetracycline (CTC, Aureomycin) in 2017 to control anaplasmosis on the operation (table D.3.c), percentage of operations by method used to administer CTC:

	Percent Operations	
Method of administration	**Pct.**	**Std. error**
Free choice loose mineral	70.8	(16.7)
Medicated mineral block	11.2	(8.1)
Mixed in feed	23.5	(16.5)
In cattle drinking water	0.0	(—)
Other	0.1	(0.1)

Of operations that used CTC to control anaplasmosis in 2017, there was no primary reason for using CTC for this purpose.

D.3.d. For the 4.4 percent of operations that used chlortetracycline (CTC, Aureomycin) to control anaplasmosis on the operation (table D.3.c), percentage of operations by primary reason for using CTC to control anaplasmosis:

	Percent Operations	
Primary reason	**Pct.**	**Std. error**
Recommended by veterinarian	41.3	(14.4)
Recommended by nutritionist	9.8	(7.4)
Anaplasmosis has been diagnosed in the past in cattle on this operation (by lab testing or examination by veterinarian)	23.7	(11.0)
Anaplasmosis has been diagnosed in the past in other herds in the area	25.1	(16.6)
Recommended by supplier of antibiotics other than veterinarian (e.g., feed salesman)	0.0	(—)
Other	0.0	(—)
Total	100.0	

4. Use of veterinarians

A veterinarian-client-patient relationship (VCPR) is the basis of interactions among veterinarians, their clients, and their patients. The FDA's requirements of a VCPR are in the Terms section of this report. A VCPR is required before a veterinarian can write a prescription for injectable or water antibiotics that require a prescription, for a veterinarian to instruct a producer to use an injectable, water, or bolus antibiotic in an extra-label fashion, or before a veterinarian can write a veterinary feed directive (VFD) for use of medically important antibiotics in feed. Antibiotics in feed cannot be used in an extra-label fashion.

Producers on over two-thirds of operations in 2017 (68.3 percent) had at least a basic familiarity of a VCPR.

D.4.a. Percentage of operations by producer's level of familiarity with a VCPR, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Level of familiarity with VCPR	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Have at least a basic understanding of what it means	65.6	(6.1)	77.7	(5.3)	70.4	(14.1)	68.3	(4.8)
Heard the name but do not know what it means	8.9	(3.0)	12.9	(3.8)	2.2	(1.6)	9.4	(2.3)
Never heard of it	25.5	(5.8)	9.4	(3.9)	27.4	(14.3)	22.3	(4.5)
Total	100.0		100.0		100.0		100.0	

There was no regional differences in 2017 in the percentage of operations in which the producer had at least a basic understanding of a VCPR.

D.4.b. Percentage of operations by producer's level of familiarity with a VCPR, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Level of familiarity with VCPR	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Have at least a basic understanding of what it means	63.8	(8.9)	62.4	(8.4)	78.2	(6.3)
Heard the name but do not know what it means	6.2	(2.7)	19.6	(6.4)	5.4	(3.4)
Never heard of it	30.0	(8.8)	17.9	(7.0)	16.4	(5.9)
Total	100.0		100.0		100.0	

Overall, 80.7 percent of operations used the services of a veterinarian for their cattle in 2017. A higher percentage of large operations (98.4 percent) used the services of a veterinarian for cattle compared with medium and small operations (80.2 and 79.7 percent, respectively).

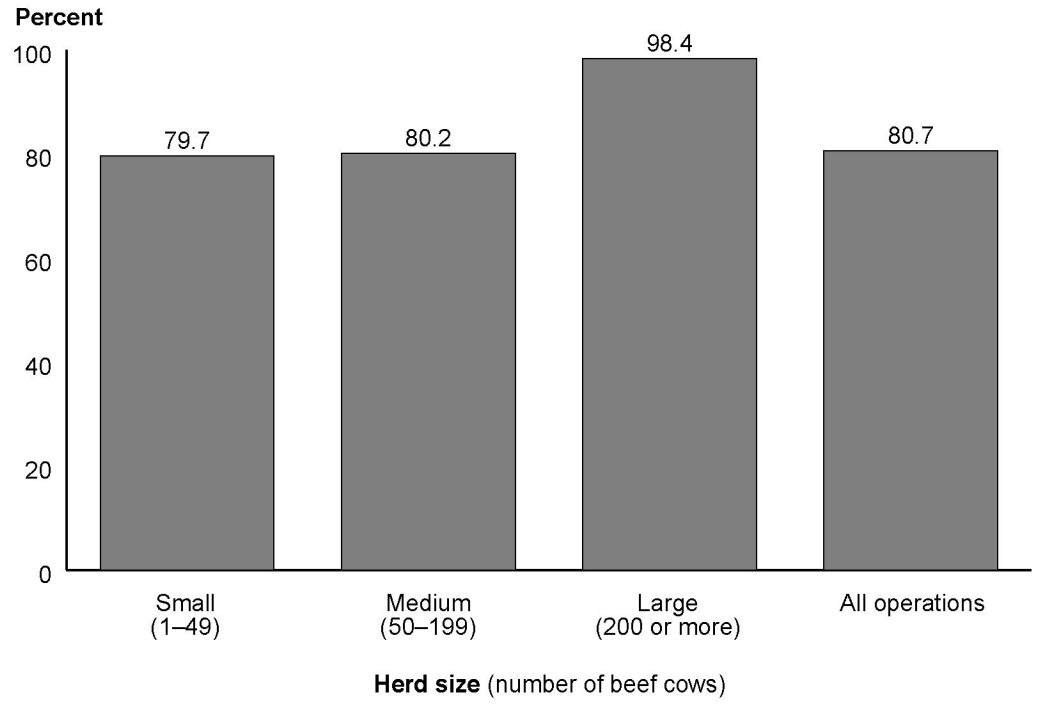
D.4.c. Percentage of operations that used the services of a veterinarian for cattle on the operation in 2017, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
79.7	(5.4)	80.2	(5.1)	98.4	(1.4)	80.7	(4.1)

Percentage of operations that used the services of a veterinarian for cattle on the operation in 2017, by herd size



There were no regional differences in the percentage of operations that used the services of a veterinarian for their cattle on the operation in 2017.

D.4.d. Percentage of operations that used the services of a veterinarian for cattle on the operation in 2017, by region:

Percent Operations					
Region					
West		Central		East	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
75.2	(8.5)	91.1	(4.1)	79.4	(5.9)

For operations that did not use the services of a veterinarian for cattle on the operation in 2017, the vast majority (90.7 percent) reported not needing a veterinarian during this period.

D.4.e. For the 19.3 percent of operations that **did not** use the services of a veterinarian for cattle on the operation in 2017 (table D.4.c), percentage of operations by primary reason for not using a veterinarian:

	Percent Operations	
Primary reason	Pct.	Std. error
Veterinarian was available in the local area but not knowledgeable about beef cattle	0.0	(—)
Veterinarian was not available in the local area	1.3	(1.3)
Too expensive	8.0	(5.5)
Not needed on this operation	90.7	(5.6)
Other	0.0	(—)
Total	100.0	

Of operations that used the services of a veterinarian for cattle on the operation in 2017, the highest percentage (84.8 percent) used a private veterinarian who was called as needed.

D.4.f. For the 80.7 percent of operations that used the services of a veterinarian for cattle on the operation in 2017 (table D.4.c), percentage of operations by type of veterinarian used, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Type of veterinarian	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Full-time veterinarian on staff (includes owner if a veterinarian)	5.2	(3.1)	5.4	(4.3)	2.5	(2.2)	5.0	(2.4)
Private veterinarian who made regular or routine visits	8.8	(4.1)	14.8	(7.1)	10.2	(4.0)	10.1	(3.3)
Private veterinarian called as needed	86.0	(5.0)	79.8	(7.9)	87.3	(4.6)	84.8	(4.0)
Total	100.0		100.0		100.0		100.0	

For operations that used the services of a veterinarian for cattle on the operation in 2017, there were no regional differences in the percentage of operations that used a private veterinarian who was called as needed.

D.4.g. For the 80.7 percent of operations that used the services of a veterinarian for cattle on the operation in 2017 (table D.4.c), percentage of operations by type of veterinarian used, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Type of veterinarian	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Full-time veterinarian on staff (includes owner if a veterinarian)	0.0	(—)	10.9	(5.8)	5.6	(5.1)
Private veterinarian who made regular or routine visits	18.1	(7.9)	1.7	(0.9)	8.6	(3.8)
Private veterinarian called as needed	81.9	(7.9)	87.4	(5.8)	85.8	(6.2)
Total	100.0		100.0		100.0	

There were no differences by herd size in the percentage of operations that reported having a VCPR. Overall, 73.1 percent of operations had a VCPR. This finding is similar to the 80.7 percent of operations that used the services of a veterinarian in 2017 (table D.4.c.).

D.4.h. Percentage of operations that had a VCPR, by herd size:

	Percent Operations							
	Herd Size (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Had VCPR	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Yes	71.4	(6.0)	77.4	(5.1)	80.7	(12.0)	73.1	(4.7)
Didn't know	11.5	(4.3)	5.4	(2.6)	1.3	(0.8)	9.8	(3.2)
No	17.1	(4.6)	17.2	(4.6)	18.0	(12.1)	17.2	(3.6)
Total	100.0		100.0		100.0		100.0	

There were no regional differences in the percentage of operations that had a VCPR.

D.4.i. Percentage of operations that had a VCPR, by region:

	Percent Operations					
	Region					
	West		**Central**		**East**	
Had VCPR	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Yes	77.1	(8.3)	71.8	(7.1)	69.3	(8.0)
Didn't know	12.1	(6.2)	11.5	(5.8)	5.8	(4.0)
No	10.8	(5.9)	16.8	(5.5)	24.9	(7.0)
Total	100.0		100.0		100.0	

For operations that had a VCPR, most operations' VCPR (94.7 percent) was based on a verbal agreement or on the relationship with the veterinarian. Only 5.3 percent of operations had a written VCPR with their veterinarian.

D.4.j. For the 73.1 percent of operations that had a VCPR (table D.4.h), percentage of operations by description of the VCPR, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
VCPR description	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
A written document signed by veterinarian and producer	6.2	(3.6)	2.8	(2.0)	4.1	(2.4)	5.3	(2.6)
A verbal agreement between my veterinarian and producer	24.9	(6.4)	36.6	(7.4)	52.7	(11.5)	29.0	(5.1)
No formal VCPR, but considered to have VCPR based on relationship with veterinarian	68.9	(7.1)	60.6	(7.5)	43.2	(11.6)	65.7	(5.5)
Total	100.0		100.0		100.0		100.0	

For operations that had a VCPR, there were no regional differences by description of the VCPR.

D.4.k. For the 73.1 percent of operations that had a VCPR (table D.4.h), percentage of operations by description of the VCPR, and by region:

	Percent Operations					
	Region					
	West		Central		East	
VCPR description	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
A written document signed by veterinarian and producer	0.4	(0.3)	1.0	(0.7)	15.1	(7.7)
A verbal agreement between my veterinarian and producer	34.2	(9.1)	27.5	(8.9)	23.7	(7.8)
No formal VCPR, but considered to have VCPR based on relationship with veterinarian	65.4	(9.1)	71.5	(8.9)	61.2	(10.0)
Total	100.0		100.0		100.0	

5. Deworming practices

Internal parasites can reduce the reproductive performance of a cow herd; reduce weaning weights of calves; negatively impact animal health by causing signs such as anemia or diarrhea; and cause immunosuppression, which makes animals more susceptible to other types of infections.

Many beef producers routinely deworm cattle at a set time every year, such as during the fall when cows are checked for pregnancy. Using the same dewormer year after year can allow parasites to become resistant to that dewormer. Overdosing or underdosing a dewormer can also contribute to parasitic resistance. Evaluating parasite burden in fecal samples can determine if a dewormer is needed, which can, in turn, prolong the effectiveness of dewormers.

Overall, 16.5 percent of operations tested fecal matter to evaluate parasite burden during the previous 3 years. There were no herd size differences in the percentage of operations that tested fecal matter to evaluate parasite burden.

D.5.a. Percentage of operations that tested any fecal matter to evaluate parasite burden during the previous 3 years, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
16.3	(5.1)	15.3	(4.4)	25.5	(10.1)	16.5	(3.9)

There were no regional differences in the percentage of operations that tested any fecal matter to evaluate parasite burden during the previous 3 years.

D.5.b. Percentage of operations that tested any fecal matter testing to evaluate parasite burden during the previous 3 years, by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
20.0	(7.3)	12.2	(5.6)	15.7	(6.3)

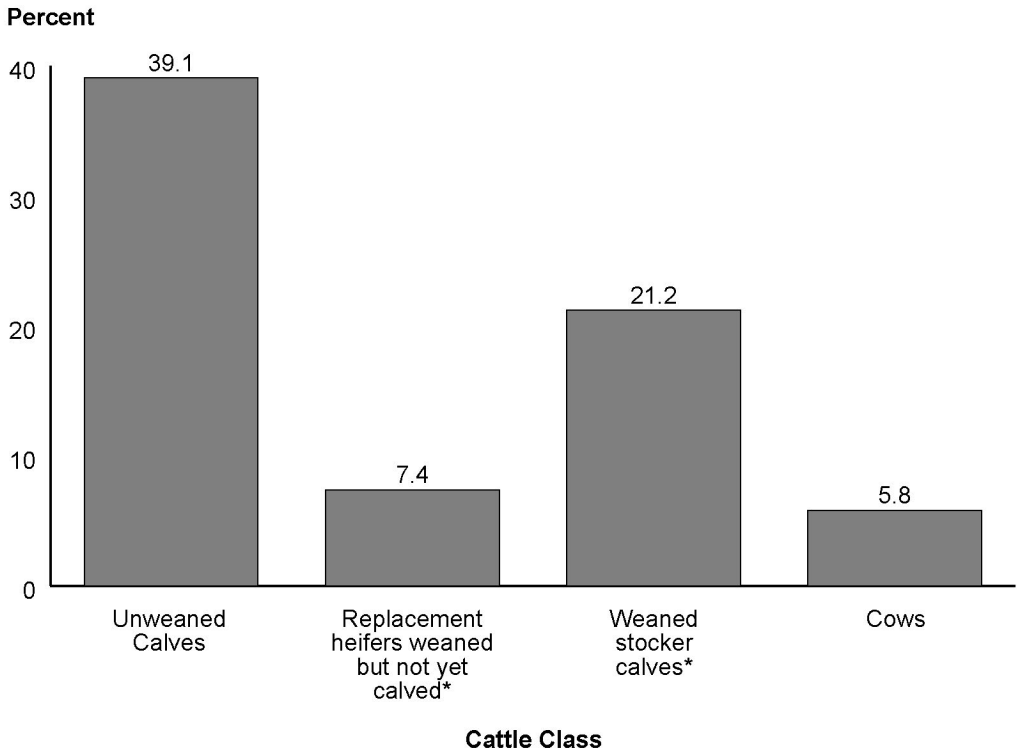
In each cattle class listed in the following table, over one-half of operations dewormed cattle at least once per year. Overall, 78.4 percent of cows and 51.8 percent of unweaned calves were dewormed at least once per year.

D.5.c. Percentage of operations by frequency cattle were dewormed, by cattle class:

	Percent Operations												
	Frequency of Deworming												
	Never		**Infrequently** (less than every 3 years)		**Occasionally** (less than once a year but at least every 3 years)		**Once a year**		**More than once a year**		**Dewormed, but unknown frequency**		
Cattle class	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Total**
Unweaned calves	39.1	(4.9)	5.5	(2.5)	2.1	(1.8)	28.3	(4.4)	23.5	(4.4)	1.5	(1.0)	100.0
Replacement heifers weaned but not yet calved*	7.4	(3.1)	3.9	(2.3)	4.0	(2.2)	34.8	(5.3)	48.8	(5.5)	1.0	(0.5)	100.0
Weaned stocker calves*	21.2	(5.2)	4.3	(1.7)	2.0	(1.4)	36.0	(6.0)	35.2	(5.6)	1.3	(0.6)	100.0
Cows	5.8	(1.9)	7.6	(3.1)	6.5	(2.7)	32.8	(4.7)	45.6	(5.1)	1.8	(1.0)	100.0

*For operations that had this class of cattle.

Percentage of operations that never dewormed the following classes of cattle



*For operations that had this class of cattle.

There were no herd size differences by cattle class in the percentages of operations that at least occasionally dewormed the classes of cattle listed in the following table. A lower percentage of operations dewormed unweaned calves (53.9 percent) at least occasionally than dewormed replacement heifers or cows occasionally (87.7 and 84.8 percent, respectively). Overall, 90.0 percent of operations dewormed any cattle or calves at least occasionally.

D.5.d. Percentage of operations that dewormed cattle of the given class at least occasionally, by herd size:

	Percent Operations							
	Herd Size (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Cattle class	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Unweaned calves	54.8	(6.6)	49.5	(6.7)	59.0	(6.3)	53.9	(5.1)
Replacement heifers weaned but not yet calved*	86.7	(4.7)	89.9	(3.2)	93.2	(2.6)	87.7	(3.6)
Weaned stocker calves*	69.8	(7.5)	80.7	(5.3)	85.2	(3.8)	73.2	(5.5)
Cows	82.3	(4.8)	91.7	(3.0)	93.4	(2.5)	84.8	(3.7)
Any	87.5	(4.2)	97.5	(1.3)	98.0	(1.1)	90.0	(3.2)

*For operations that had this class of cattle.

A lower percentage of operations in the West region (78.5 percent) dewormed replacement heifers at least occasionally compared with operations in the East region (98.1 percent).

D.5.e. Percentage of operations that dewormed cattle of the given class at least occasionally, by region:

	Percent Operations					
	Region					
	West		Central		East	
Cattle class	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Unweaned calves	48.9	(9.3)	46.7	(8.6)	65.3	(8.1)
Replacement heifers weaned but not yet calved*	78.5	(8.2)	88.7	(4.5)	98.1	(1.1)
Weaned stocker calves*	73.0	(10.2)	64.8	(8.8)	79.4	(8.6)
Cows	81.7	(7.2)	84.5	(5.5)	88.7	(5.1)
Any	85.7	(7.0)	88.3	(4.3)	96.3	(3.3)

*For operations that had this class of cattle.

Of the operations that dewormed cattle at least occasionally, the highest percentage (89.0 percent) did so on a regular schedule. A higher percentage of large operations (99.6 percent) dewormed cattle on a regular schedule compared with medium and small operations (83.4 and 89.9 percent, respectively).

D.5.f. For the 90.0 percent of operations that dewormed any cattle at least occasionally (table D.5.d.), percentage of operations by primary factor used to determine when to treat cattle for internal parasites (worms), and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Primary factor	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
When the cattle look rough	10.1	(4.4)	11.7	(7.0)	0.0	(0.0)	9.9	(3.6)
Fecal consistency (diarrhea)	0.0	(—)	0.5	(0.5)	0.0	(—)	0.1	(0.1)
On a regular schedule	89.9	(4.4)	83.4	(7.2)	99.6	(0.3)	89.0	(3.6)
Based on fecal tests	0.0	(—)	2.0	(1.9)	0.4	(0.3)	0.4	(0.4)
Other	0.0	(—)	2.4	(2.4)	0.0	(—)	0.5	(0.5)
Total	100.0		100.0		100.0		100.0	

For operations that dewormed any cattle at least occasionally, there were no regional differences in the percentage of operations by primary factor used to determine when to deworm cattle.

D.5.g. For the 90.0 percent of operations that dewormed any cattle at least occasionally (table D.5.d.), percentage of operations by primary factor used to determine when to treat cattle for internal parasites (worms), and by region:

	Percent Operations					
	Region					
	West		Central		East	
Primary factor	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
When the cattle look rough	16.0	(7.9)	6.9	(4.9)	5.5	(3.5)
Fecal consistency (diarrhea)	0.0	(—)	0.4	(0.4)	0.0	(—)
On a regular schedule	84.0	(7.9)	91.0	(5.0)	93.1	(3.7)
Based on fecal tests	0.0	(0.0)	1.7	(1.7)	0.0	(—)
Other	0.0	(—)	0.0	(—)	1.4	(1.4)
Total	100.0		100.0		100.0	

There are several classes of anthelmintic products (drugs that destroy parasitic worms). For operations that dewormed any cattle at least occasionally, the highest percentage (95.4 percent) used avermectin products. A higher percentage of medium operations (33.4 percent) used benzimidazoles compared with small operations (9.1 percent).

D.5.h. For the 90.0 percent of operations that dewormed any cattle at least occasionally (table D.5.d.), percentage of operations by product(s) used during the previous 3 years to treat cattle for internal parasites, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Product	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Avermectins (Ivomec–ivermectin, Cydectin®–moxidectin)	94.5	(3.0)	97.3	(2.2)	100.0	(—)	95.4	(2.3)
Benzimidazoles (Valbazen®–albendazole, Panacur®–fenbendazole)	9.1	(3.2)	33.4	(7.0)	34.1	(11.9)	15.5	(2.9)
Imidazothiazoles (Levasole®–levamisole)	4.7	(3.3)	7.1	(3.3)	2.9	(1.4)	5.1	(2.6)
Benzenesulphonamides (Curatrem®–clorsulon, Ivomec Plus®–clorsulon)	12.4	(4.8)	9.6	(3.5)	9.0	(5.7)	11.6	(3.7)
Tetrahydropyrimidines (Rumatel®–morantel)	0.0	(—)	0.0	(—)	0.0	(—)	0.0	(—)
Other	2.7	(2.6)	0.0	(—)	0.0	(—)	2.0	(1.9)

For operations that dewormed any cattle at least occasionally during the previous 3 years, there were no regional differences in product used.

D.5.i. For the 90.0 percent of operations that dewormed any cattle at least occasionally (table D.5.d.), percentage of operations by product(s) use during the previous 3 years to treat cattle for internal parasites, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Product	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Avermectins (Ivomec–ivermectin, Cydectin–moxidectin)	93.3	(5.0)	93.6	(4.4)	98.9	(1.1)
Benzimidazoles (Valbazen–albendazole, Panacur–fenbendazole)	7.5	(2.3)	25.2	(7.4)	17.1	(5.4)
Imidazothiazoles (Levasole–levamisole)	6.9	(5.3)	2.3	(1.7)	5.2	(4.2)
Benzenesulphonamides (Curatrem–clorsulon, Ivomec Plus–clorsulon)	13.5	(6.8)	2.4	(0.9)	16.2	(7.1)
Tetrahydropyrimidines (Rumatel–morantel)	0.0	(—)	0.0	(—)	0.0	(—)
Other	5.2	(5.0)	0.0	(—)	0.0	(—)

For operations that dewormed any cattle at least occasionally, the highest percentage (43.2 percent) considered a veterinarian as a very important source for deworming information.

D.5.j. For the 90.0 percent of operations that dewormed any cattle at least occasionally (table D.5.d.), percentage of operations by level of importance of deworming information sources:

	Percent Operations								
	Level of Importance								
	Not important		Slightly important		Important		Very important		
Information source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Veterinarian	20.5	(4.6)	9.0	(2.8)	27.3	(4.5)	43.2	(5.5)	100.0
Other producers	32.6	(4.6)	36.8	(4.8)	24.1	(4.2)	6.4	(2.6)	100.0
Sales representative	57.3	(5.5)	24.6	(5.0)	13.5	(3.5)	4.7	(1.9)	100.0
Extension/university personnel	47.3	(5.5)	14.9	(3.3)	24.5	(4.7)	13.3	(3.9)	100.0
Magazines/journals (articles and/or ads)	46.0	(5.5)	33.2	(5.4)	13.8	(3.3)	7.0	(2.9)	100.0
Internet	68.2	(5.4)	19.5	(4.4)	5.7	(2.3)	6.5	(2.9)	100.0
Other	98.0	(1.3)	0.1	(0.1)	0.5	(0.5)	1.4	(1.2)	100.0

For operations that dewormed any cattle at least occasionally, the highest percentage (70.5 percent) considered a veterinarian as an important or very important source for deworming information.

D.5.k. For the 90.0 percent of operations that dewormed any cattle at least occasionally (table D.5.d.), percentage of operations that considered the following deworming information sources very important or important, by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Information source	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Veterinarian	71.6	(6.6)	67.9	(6.6)	66.2	(13.3)	70.5	(5.1)
Other producers	28.0	(5.9)	39.2	(6.7)	30.4	(10.3)	30.5	(4.6)
Sales representative	14.7	(4.4)	25.2	(6.8)	36.6	(12.0)	18.2	(3.7)
Extension/university personnel	36.0	(6.6)	46.2	(7.6)	28.4	(8.5)	37.8	(5.2)
Magazines/journals (articles and/or ads)	22.2	(5.6)	17.3	(5.0)	16.7	(5.4)	20.8	(4.2)
Internet	14.1	(4.8)	6.6	(2.8)	9.6	(4.0)	12.2	(3.6)
Other	1.7	(1.7)	3.1	(2.5)	0.0	(—)	1.9	(1.3)

For operations that dewormed any cattle at least occasionally, there were no regional differences in the percentage of operations by importance of deworming information sources.

D.5.l. For the 90.0 percent of operations that dewormed any cattle at least occasionally (table D.5.d.), percentage of operations that considered the following deworming information sources very important or important, by region:

	Percent Operations					
	Region					
	West		Central		East	
Information source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Veterinarian	69.8	(9.6)	78.9	(6.5)	65.3	(8.4)
Other producers	33.4	(8.3)	34.6	(8.6)	24.5	(7.0)
Sales representative	15.4	(6.2)	15.7	(6.0)	22.9	(6.4)
Extension/university personnel	43.1	(10.6)	29.4	(7.3)	38.1	(7.3)
Magazines/journals (articles and/or ads)	18.5	(7.3)	21.7	(6.4)	22.7	(7.6)
Internet	13.7	(6.9)	7.1	(3.8)	14.4	(6.2)
Other	0.0	(—)	0.5	(0.5)	4.9	(3.6)

Parasite resistance to dewormers is increasing. After an animal is treated with an antiparasitic drug, the susceptible parasites die and the resistant parasites survive to pass on their resistance genes to their offspring. If the balance of resistant and susceptible parasites in the environment and in animals leans toward resistant parasites, eventually all parasites on the operation might become resistant, which occurs when there is a lack of refugia. Refugia is the proportion of the total parasite population that is not selected for antiparasitic drug treatment; in other words, these parasites are in “refuge” from the drugs. It is now considered important to maintain refugia in the environment and in the animals in order to maintain the effectiveness of dewormers. Refugia maintains a proportion of susceptible parasites on the operation. Examples of refugia include parasites left in untreated animals, e.g., if some percentage of cattle are not dewormed; eggs and larvae on the pasture before animals are treated (these are still viable and not affected by the dewormer); and life stages of the parasites, such as larval stages not affected by dewormer.

Producers were asked about the strategies they used to maintain the effectiveness of dewormers. A brief description of these practices follow:

Rotating dewormers—Operations rotate the type of dewormers they use on a regular basis. For example, they might use one product in fall and a different product in spring.

Monitoring effectiveness by laboratory testing—Operations send fecal samples to a laboratory to test for parasites before and after deworming animals. Based on the results of testing done prior to deworming, the producer might decide not to deworm if the parasite burden is not high enough to warrant deworming.

Deworming more often—Operations deworm 100 percent of cattle more than once or twice a year. This practice, however, is likely to lead to parasite resistance to dewormers because it eliminates susceptible parasites from all cattle at once, increasing the proportion of resistant parasites in the population. This practice may lead to the lack of refugia on the operation and is not considered an effective practice for maintaining the effectiveness of dewormers.

Deworming less often—Most operations deworm once or twice a year. If an operation deworms cattle less often, it may be to prolong or improve the efficacy of dewormers.

Targeted deworming of certain cattle classes (weight/age)—Young cattle or lighter weight cattle might have a higher parasite burden than older or heavier cattle, so some operations deworm only certain classes of cattle.

Although not asked about in the study questionnaire, deworming less than 100 percent of cattle is also an effective way to maintain susceptible parasites in the population, which helps maintain the effectiveness of dewormers. Producers also use pasture management practices to control parasites and decrease reliance on dewormers. Examples include dragging or harrowing pastures to break up manure piles, reducing stocking density so that cattle are not forced to graze near manure piles, and keeping grass sufficiently tall so that cattle do not need to graze close to the ground; most parasite larvae stay within one inch from the ground.

For operations that dewormed any cattle at least occasionally, the highest percentage (43.5 percent) rotated dewormer type to prolong or improve the efficacy of dewormers. There were no substantial differences by herd size in percentages of operations by methods used to prolong or improve the efficacy of dewormers.

D.5.m. For the 90.0 percent of operations that dewormed any cattle at least occasionally (table D.5.d.), percentage of operations by method(s) used to prolong or improve the efficacy of dewormers, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Rotating dewormer type	39.4	(6.1)	51.3	(7.4)	67.6	(9.6)	43.5	(4.8)
Monitoring effectiveness by laboratory testing	3.9	(2.8)	9.4	(3.4)	15.8	(9.7)	5.7	(2.2)
Deworming more often	16.9	(4.9)	18.4	(5.2)	12.9	(4.1)	17.0	(3.7)
Deworming less often	4.2	(3.1)	3.8	(2.3)	0.9	(0.7)	3.9	(2.3)
Targeted deworming of certain classes of cattle (weight/age)	17.0	(5.0)	31.3	(6.5)	24.8	(8.1)	20.5	(4.0)
Other	0.0	(—)	1.7	(1.3)	0.0	(—)	0.4	(0.3)
Any method*	50.0	(6.9)	61.3	(7.6)	78.1	(9.2)	54.0	(5.3)

*"Any method" does not include "deworming more often" because this is not an effective method for prolonging the efficacy of dewormers.

For operations that dewormed any cattle at least occasionally, there were no regional differences in percentages of operations by methods used to prolong or improve the efficacy of dewormers.

D.5.n. For the 90.0 percent of operations that dewormed any cattle at least occasionally (table D.5.d.), percentage of operations by method(s) used to prolong or improve the efficacy of dewormers, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Rotating dewormer type	34.9	(8.9)	36.1	(8.0)	57.2	(7.3)
Monitoring effectiveness by laboratory testing	3.2	(1.7)	7.5	(5.3)	7.1	(4.3)
Deworming more often	15.6	(6.5)	12.1	(3.9)	21.9	(7.2)
Deworming less often	5.5	(5.4)	7.0	(4.4)	0.2	(0.2)
Targeted deworming of certain classes of cattle (weight/age)	13.0	(6.0)	25.1	(7.4)	24.8	(7.0)
Other	0.3	(0.3)	1.0	(1.0)	0.0	(—)
Any method*	43.3	(9.6)	53.6	(9.3)	64.9	(8.2)

*"Any method" does not include "deworming more often" because this is not an effective method for prolonging the efficacy of dewormers.

6. Fly and lice control

A higher percentage of large operations (96.4 percent) used a pour-on product to control flies and/or lice in 2017 compared with medium and small operations (80.3 and 76.0 percent, respectively)

D.6.a. Percentage of operations that used a pour-on product to control flies and/or lice in 2017, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
76.0	(5.1)	80.3	(5.1)	96.4	(1.3)	77.9	(4.0)

There were no regional differences in the percentages of operations that used a pour-on product to control flies and/or lice in 2017.

D.6.b. Percentage of operations that used a pour-on product to control flies and/or lice in 2017, by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
83.1	(6.7)	85.6	(5.3)	66.5	(7.2)

7. Movement

Cattle are brought onto operations for various reasons. For example, new bulls might be brought onto the operation to replace bulls that were culled due to low fertility or to prevent inbreeding. Some cows are culled each year for various reasons, and in order to maintain the same herd size, these cows need to be replaced. Many operations raise their own heifers to replace culled cows, while some operations buy replacement heifers. Introducing new cattle to the operation presents the potential of introducing disease to the operations.

Overall, 64.7 percent of operations brought new cattle onto the operation during the previous 3 years. There were no herd size differences in the percentage of operations that brought new cattle onto the operation during the previous 3 years.

D.7.a. Percentage of operations that brought any new cattle onto the operation during the previous 3 years, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
63.2	(6.1)	72.9	(6.0)	53.8	(10.6)	64.7	(4.8)

There were no regional differences in the percentage of operations that brought new cattle onto the operation during the previous 3 years

D.7.b. Percentage of operations that brought any new cattle onto the operation during the previous 3 years, by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
62.4	(8.9)	72.8	(6.0)	61.3	(8.1)

For operations that brought any new cattle onto the operation during the previous 3 years, 15.8 to 31.8 percent required that cattle be vaccinated against trichomoniasis, brucellosis, BVD, IBR, or leptospirosis before arriving at the operation.

D.7.c. For the 64.7 percent of operations that brought any new cattle onto the operation during the previous 3 years (table D.7.a), percentage of operations that normally required new cattle be vaccinated against the following diseases before arriving at the operation, by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Disease	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Brucellosis*	20.9	(8.2)	42.6	(10.0)	51.4	(12.5)	26.8	(6.5)
BVD (bovine viral diarrhea)	28.2	(7.5)	36.5	(7.0)	43.0	(10.4)	30.7	(5.7)
IBR (infectious bovine rhinotracheitis)	29.5	(7.4)	36.5	(7.0)	42.2	(10.5)	31.6	(5.7)
Leptospirosis	30.0	(7.5)	36.4	(7.0)	39.9	(10.0)	31.8	(5.7)
Trichomoniasis (trich)	14.4	(5.3)	20.0	(5.4)	19.1	(6.7)	15.8	(4.1)
Other	4.5	(2.7)	1.2	(1.0)	0.7	(0.7)	3.6	(2.0)

*Excludes operations that only brought on bulls.

For operations that brought any new cattle onto the operation during the previous 3 years, there were no regional differences in the percentage of operations that required that cattle be vaccinated against trichomoniasis, brucellosis, BVD, IBR, or leptospirosis before arriving at the operation.

D.7.d. For the 64.7 percent of operations that brought any new cattle onto the operation during the previous 3 years (table D.7.a), percentage of operations that normally required that new cattle be vaccinated against the following diseases before arriving at the operation, by region:

	Percent Operations					
	Region					
	West		Central		East	
Disease	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Brucellosis*	27.3	(11.2)	33.7	(10.0)	17.7	(11.9)
BVD (bovine viral diarrhea)	24.8	(9.7)	33.8	(9.2)	34.9	(10.2)
IBR (infectious bovine rhinotracheitis)	24.8	(9.7)	30.8	(9.0)	40.4	(10.0)
Leptospirosis	24.7	(9.7)	28.2	(8.6)	43.6	(10.5)
Trichomoniasis (trich)	11.5	(6.9)	13.8	(6.6)	22.8	(7.5)
Other	3.4	(3.3)	3.9	(3.2)	3.7	(3.6)

*Excludes operations that only brought on bulls.

For operations that brought any new cattle onto the operation during the previous 3 years, a higher percentage required testing for trichomoniasis (21.4 percent) before bringing on new cattle than required testing for Johne's disease, BVD, or tuberculosis (1.8, 4.3, and 6.2 percent, respectively).

D.7.e. For the 64.7 percent of operations that brought any new cattle onto the operation during the previous 3 years (table D.7.a), percentage of operations that normally required that new cattle be tested for the following diseases before arriving at the operation, by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Disease	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Brucellosis for animals 2 years of age or older*	5.6	(3.4)	10.8	(3.6)	25.0	(8.0)	7.5	(2.7)
Johne's disease	1.6	(1.6)	1.9	(1.7)	4.5	(3.2)	1.8	(1.2)
BVD (bovine viral diarrhea; persistently infected)	2.8	(2.0)	7.7	(3.8)	14.0	(6.4)	4.3	(1.7)
TB (bovine tuberculosis)	5.4	(3.1)	7.1	(3.3)	14.8	(7.0)	6.2	(2.4)
Trichomoniasis (trich)	15.0	(6.0)	39.0	(7.9)	36.4	(9.2)	21.4	(4.8)
Other	1.2	(1.2)	1.2	(1.1)	0.8	(0.8)	1.2	(0.9)

*Excludes operations that only brought on cattle less than 2 years old.

For operations that brought any new cattle onto the operation during the previous 3 years, there were no regional differences in the percentage of operations that required testing for brucellosis, trichomoniasis, Johne's disease, BVD, or tuberculosis prior to bringing new cattle onto the operation. Trichomoniasis is a reportable disease in many Western States, which usually means that any positive cases need to be reported to the State Veterinarian. In the past, trichomoniasis was found mostly in Western States, but recently it has spread to States where it was not normally found.

D.7.f. For the 64.7 percent of operations that brought any new cattle onto the operation during the previous 3 years (table D.7.a), percentage of operations that normally required that new cattle be tested for the following diseases before arriving at the operation, by region:

	Percent Operations					
	Region					
	West		Central		East	
Disease	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Brucellosis for animals 2 years of age or older*	4.0	(2.0)	2.0	(1.0)	15.8	(7.2)
Johne's disease	0.3	(0.3)	0.1	(0.1)	5.1	(3.8)
BVD (bovine viral diarrhea; persistently infected)	1.3	(0.7)	4.8	(3.4)	7.6	(4.2)
TB (bovine tuberculosis)	2.3	(1.2)	9.7	(6.4)	7.7	(4.2)
Trichomoniasis (trich)	33.0	(10.9)	15.0	(5.7)	13.1	(4.7)
Other	0.8	(0.7)	3.0	(3.0)	0.0	(—)

*Excludes operations that only brought on cattle less than 2 years old.

For operations that brought any new weaned calves or cows onto the operation during the previous 3 years, 25.3 percent required that weaned calves be treated for internal parasites before arriving at the operation.

D.7.g. For operations that brought new weaned calves or cows onto the operation during the previous 3 years, percentage of operations that normally required that new weaned calves or cows be **tested or treated** for internal parasites before arriving at the operation, by cattle class:

	Percent Operations	
Cattle class	**Pct.**	**Std. error**
Weaned calves[1]		
Tested	6.9	(5.0)
Treated	25.3	(7.3)
Cows[2]		
Tested	1.5	(1.4)
Treated	12.5	(4.2)
Any[3]		
Tested	4.2	(3.1)
Treated	18.2	(4.9)

[1]For operations that brought on weaned calves
[2]For operations that brought on cows
[3]For operations that brought on either weaned calves or cows

E. Nutrition Management

1. Feed analysis

A cow's nutritional requirements vary based on their stage of gestation. For example, cows in the middle third of pregnancy have lower protein requirements compared with cows nursing calves in the first 3 to 4 months after calving. Nutritional requirements are readily available in beef cattle nutrition publications. Ideally, balanced rations are based on both the animals' requirements for their stage of production as well as the quality of feedstuffs available. One method of estimating forage quality is to use "book values" (e.g., from beef cattle nutrition publications) that are based on the type of forage and the stage of maturity when it was harvested. The most accurate method of estimating forage quality, however, is to submit forage samples to a laboratory for testing.

There were no differences by herd size in the percentage of operations that usually calculated a balanced ration using either published feed values ("book values") or results of feed analysis.

E.1.a. Percentage of operations that usually calculated a balanced ration using either published feed values ("book values") or the results of a feed analysis, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
12.2	(3.7)	31.1	(6.1)	33.8	(9.7)	17.1	(3.1)

There were no regional differences in the percentage of operations that usually calculated a balanced ration using either published feed values (“book values”) or the results of a feed analysis.

E.1.b. Percentage of operations that usually calculated a balanced ration using either published feed values (“book values”) or the results of a feed analysis, by region:

Percent Operations					
Region					
West		Central		East	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
9.0	(4.6)	29.4	(7.7)	17.4	(3.9)

For operations that usually calculated a balanced ration using either published feed values (“book values”) or the results of a feed analysis, 94.1 percent balanced the ration by considering both the animals’ requirements and the quality of available feed.

E.1.c. For the 17.1 percent of operations that usually calculated a balanced ration using either published feed values (“book values”) or the results of a feed analysis (table E.1.a.), percentage of operations that balanced the ration based by considering both the animals’ requirements and the quality of available feed:

Percent Operations	
Pct.	Std. error
94.1	(6.1)

A lower percentage of small operations (9.2 percent) than medium and large operations (29.0 and 61.7 percent, respectively) had submitted any feed samples (including forage or hay samples) to a laboratory for nutritional analysis during the previous 5 years. Overall, 15.8 percent of operations submitted any feed samples to a laboratory for nutritional analysis during the previous 5 years.

E.1.d. Percentage of operations that submitted any feed samples to a laboratory for nutritional analysis during the previous 5 years, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
9.2	(3.6)	29.0	(5.3)	61.7	(11.1)	15.8	(3.0)

There were no regional differences in the percentage of operations that submitted any feed samples to a laboratory for nutritional analysis during the previous 5 years.

E.1.e. Percentage of operations that submitted any feed samples to a laboratory for nutritional analysis during the previous 5 years, by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
14.7	(4.8)	22.8	(6.3)	11.9	(4.4)

2. Mineral supplements

Beef cows generally require mineral supplements because their forage is deficient in at least one or more minerals. Mineral deficiency in forage often depends on what part of the country the forage was raised. Minerals are described as either macrominerals or microminerals. The general distinction between the two is that cattle need macrominerals in higher quantities (measured in grams or ounces) than microminerals (measured in milligrams or parts per million). Macrominerals include calcium, phosphorus, sodium, chloride, magnesium, potassium, and sulfur. Microminerals, also referred to as trace minerals, include cobalt, copper, iodine, iron, manganese, selenium, and zinc.

Salt (plain or iodized)—Salt only (i.e., sodium chloride).

Trace mineral salt—Salt and common trace minerals (microminerals).

Complete mineral—An appropriate mix of both macrominerals and microminerals, including salt.

High magnesium mineral—A complete mineral with extra magnesium, generally used to prevent grass tetany in spring.

Almost all operations (96.5 percent) fed a mineral or salt supplement to cows in fall/winter. There were no differences by herd size in the percentages of operations that fed salt, trace mineral salt, or high magnesium mineral in fall or winter. A lower percentage of small operations (45.3 percent) fed complete mineral in fall/winter compared with medium and large operations (73.2 and 78.2 percent, respectively). Because of the wording of this question, operations could have used more than one of the products listed in the following table.

E.2.a. Percentage of operations that fed mineral and/or salt supplements to cows during the **fall/winter** (October 2017 through March 2018), by supplement type and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Mineral/salt supplement	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Salt (plain or iodized)	51.0	(6.2)	52.7	(6.2)	59.5	(8.7)	51.7	(4.8)
Trace mineral salt	55.9	(6.5)	48.4	(7.3)	41.6	(10.5)	53.6	(5.1)
Complete mineral	45.3	(6.1)	73.2	(5.7)	78.2	(8.5)	52.6	(4.8)
High magnesium mineral	26.9	(4.4)	33.5	(5.0)	47.9	(9.1)	29.3	(3.5)
Any	95.8	(2.9)	99.0	(0.6)	98.1	(1.9)	96.5	(2.2)

There were no regional differences in the percentage of operations that fed salt or trace mineral salt in the fall/winter. A higher percentage of operations in the Central region (72.4 percent) fed complete mineral in the fall/winter compared with operations in the West region (36.6 percent). A higher percentage of operations in the East region (61.3 percent) fed high magnesium mineral in the fall/winter compared with operations in the Central and West regions (24.9 and 4.0 percent, respectively).

E.2.b. Percentage of operations that fed mineral and/or salt supplements to cows during **fall/winter** (October 2017 through March 2018), by supplement type and by region:

	Percent Operations					
	Region					
	West		Central		East	
Mineral/salt supplement	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Salt (plain or iodized)	52.0	(8.3)	65.8	(6.9)	40.7	(8.6)
Trace mineral salt	48.3	(8.8)	58.5	(8.8)	56.3	(8.5)
Complete mineral	36.6	(8.0)	72.4	(7.8)	56.3	(7.8)
High magnesium mineral	4.0	(1.6)	24.9	(7.7)	61.3	(7.2)
Any	91.3	(5.3)	100.0	(—)	100.0	(—)

Mineral and salt supplements can be fed as pressed blocks that cattle lick, or they can be fed in loose (granular) form. For operations that fed mineral and/or salt supplements to cows during the fall/winter, few fed the supplements in both block and loose forms. For operations that fed complete mineral or high magnesium mineral, a higher percentage fed loose forms these supplements in fall/winter than used block forms.

E.2.c. For operations that fed the listed mineral and/or salt supplements to cows during **fall/winter** (October 2017 through March 2018), percentage of operations by form of supplement fed:

	Percent Operations						
	Form of Mineral/Salt Supplement						
	Block		Loose		Both		
Mineral/salt supplement	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Salt (plain or iodized)	55.7	(6.8)	37.1	(7.0)	7.2	(3.1)	100.0
Trace mineral salt	54.4	(6.1)	40.9	(5.9)	4.8	(2.4)	100.0
Complete mineral	23.0	(5.9)	73.3	(5.9)	3.7	(2.0)	100.0
High magnesium mineral	11.5	(5.4)	87.2	(5.4)	1.3	(1.2)	100.0

The percentage of operations that fed a mineral or salt supplement to cows in the spring/summer was almost identical to the corresponding percentage for fall or winter (96.2 versus 96.5 percent, respectively), which is not surprising since mineral or salt supplements are recommended year-round. There were no herd size differences in the percentages of operations that fed cows salt, trace mineral salt, complete mineral, or high magnesium mineral in the spring/summer.

E.2.d. Percentage of operations that fed mineral and/or salt supplements to cows during **spring/summer** (April through September 2017), by supplement fed and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Mineral/salt supplement	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Salt (plain or iodized)	51.9	(6.2)	61.1	(6.4)	57.7	(8.7)	54.1	(4.8)
Trace mineral salt	54.5	(6.5)	45.8	(7.6)	32.5	(6.9)	51.7	(5.1)
Complete mineral	44.0	(5.8)	65.8	(7.2)	70.1	(4.9)	49.7	(4.6)
High magnesium mineral	27.1	(5.1)	40.3	(6.8)	46.6	(10.1)	30.9	(4.1)
Any	95.7	(2.9)	97.5	(1.6)	97.6	(1.9)	96.2	(2.2)

There were no regional differences in the percentages of operations that fed salt or trace mineral salt in the spring/summer. A higher percentage of operations in the Central region (67.6 percent) fed complete mineral in the spring/summer compared with operations in the West region (31.9 percent). A higher percentage of operations in the East (52.8 percent) fed high magnesium mineral in the spring/summer compared with operations in the West region (10.7 percent).

E.2.e. Percentage of operations that fed mineral and/or salt supplements to cows during the **spring/summer** (April through September 2017), by supplement fed and by region:

	Percent Operations					
	Region					
	West		Central		East	
Mineral/salt supplement	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Salt (plain or iodized)	55.2	(8.4)	66.4	(7.1)	43.6	(8.7)
Trace mineral salt	47.4	(8.8)	51.8	(8.7)	56.7	(8.3)
Complete mineral	31.9	(7.3)	67.6	(8.2)	57.3	(7.7)
High magnesium mineral	10.7	(4.2)	32.2	(8.2)	52.8	(8.2)
Any	91.3	(5.3)	100.0	(—)	99.1	(0.9)

For operations that fed mineral and/or salt supplements to cows during the spring/summer, few fed the supplements in both block and loose form. For operations that fed complete mineral or high magnesium mineral, a higher percentage fed these supplements in spring/summer in loose form than in block form.

E.2.f. For operations that fed the listed mineral and/or salt supplements to cows during the **spring/summer** (April through September 2017), percentage of operations by form of supplement fed:

Percent Operations

Form of Mineral/Salt Supplement

	Block		Loose		Both		
Mineral/salt supplement	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Total**
Salt (plain or iodized)	55.4	(6.7)	37.4	(7.0)	7.1	(3.1)	100.0
Trace mineral salt	54.7	(6.3)	40.9	(6.1)	4.4	(2.4)	100.0
Complete mineral	21.9	(5.9)	75.5	(6.0)	2.6	(1.2)	100.0
High magnesium mineral	19.1	(7.2)	79.3	(7.2)	1.6	(1.3)	100.0

Overall, 96.5 percent of operations fed any mineral and/or salt supplements to cows in 2017. There were no differences by herd size in the percentage of operations that fed any mineral and/or salt supplements during 2017.

E.2.g. Percentage of operations that fed any mineral and/or salt supplements to cows in 2017, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
95.8	(2.9)	99.0	(0.6)	98.1	(1.9)	96.5	(2.1)

There were no regional differences in the percentage of operations that fed any mineral and/or salt supplements to cows in 2017.

E.2.h. Percentage of operations that fed any mineral and/or salt supplements to cows in 2017, by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
91.3	(5.3)	100.0	(—)	100.0	(—)

The amount of mineral or salt supplement consumed by cows can vary based on the type of supplement administered and the potential flavoring agents added to complete minerals. Consumption is generally driven by the salt appetite, as most feeds contain enough sodium and chloride to meet requirements. As a rule of thumb, cattle consume 0.005 to 0.010 percent of their body weight as salt daily. For example, a 1,000 lb beef cow would consume 0.05 to 0.10 pounds (0.8 to 1.6 ounces) of salt every day, which equates to approximately 18 to 36 lb of salt per 1,000 lb cow per year for a product such as trace mineral salt. A 1,300 lb beef cow would consume between 0.065 to 0.13 lb/day, which equates to approximately 24 to 47 lb of salt per year. Consumption of complete mineral products should be higher

than trace mineral salt due to the lower salt concentration in the complete mineral (i.e. the cow will eat more to meet her salt appetite). However, the questionnaire only asked for the total amount of mineral or salt fed to the cow herd in 2017 and did not differentiate between the types of salt or mineral products.

Overall, 53.1 pounds of mineral/salt supplement were fed to each cow in 2017. Small operations fed more pounds of supplement per cow in 2017 compared with large operations. However, it's possible that small operations were counting the entire weight of protein tubs or blocks fed to cows. While protein tubs or blocks include minerals, they also include protein and energy supplements.

E.2.i. Average amount of mineral/salt supplement fed per cow in 2017, by herd size:

Average Amount of Supplement (lb) **Per Cow***

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Lb	**Std. error**	**Lb**	**Std. error**	**Lb**	**Std. error**	**Lb**	**Std. error**
67.8	(9.5)	56.7	(5.7)	36.5	(5.5)	53.1	(4.3)

*Pounds of mineral/salt supplement fed to the herd in 2017 divided by the number of beef cows on the operation on October 1, 2017.

There were no regional differences in the average amount of mineral/salt supplement fed per cow in 2017.

E.2.j. Average amount of mineral/salt supplement fed per cow in 2017, by region:

Average Amount of Supplement (lb) **Per Cow***

Region

West		**Central**		**East**	
Lb	**Std. error**	**Lb**	**Std. error**	**Lb**	**Std. error**
42.6	(7.4)	66.7	(6.6)	53.9	(8.0)

* Pounds of mineral/salt supplement fed to the herd in 2017 divided by the number of beef cows on the operation on October 1, 2017.

A higher percentage of small operations (30.7 percent) fed more than 80 lb of mineral/salt supplement per cow in 2017 compared with large operations (6.7 percent). As previously stated, it is possible that small operations counted the entire weight of protein tubs or blocks fed to cows. While protein tubs or blocks include minerals, they also include protein and energy supplements.

E.2.k. For operations that fed any mineral/salt supplement to cows in 2017, percentage of operations by average amount of mineral/salt supplement fed per cow in 2017, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Average amount of supplement (lb) **Per Cow***	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 20	10.3	(3.0)	26.0	(6.9)	40.5	(13.6)	15.7	(2.9)
20–40	27.3	(6.6)	20.7	(5.4)	20.0	(5.3)	25.4	(4.9)
41–60	17.5	(4.7)	23.4	(7.8)	23.3	(9.8)	19.2	(3.9)
61–80	14.1	(5.1)	7.8	(3.6)	9.6	(5.8)	12.4	(3.7)
More than 80	30.7	(6.1)	22.1	(5.2)	6.7	(3.1)	27.3	(4.5)
Total	100.0		100.0		100.0		100.0	

*Pounds of mineral/salt supplement fed to the herd in 2017 divided by the number of beef cows on the operation on October 1, 2017.

There were no regional differences in the percentages of operations by amount of mineral/salt supplement fed per cow in 2017.

E.2.I. Percentage of operations that fed mineral/salt supplement to cows in 2017 by average amount of mineral/salt supplement fed per cow in 2017, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Average amount of supplement (lb) **Per Cow***	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 20	29.5	(7.5)	8.6	(4.0)	8.2	(3.3)
20–40	26.5	(9.3)	17.9	(5.7)	30.0	(8.6)
41–60	28.1	(7.5)	22.4	(7.4)	8.6	(4.6)
61–80	3.7	(3.1)	10.8	(6.0)	21.7	(8.1)
More than 80	12.1	(6.4)	40.4	(8.5)	31.5	(8.1)
Total	100.0		100.0		100.0	

*Pounds of mineral/salt supplement fed to the herd in 2017 divided by the number of beef cows on the operation on October 1, 2017.

Mineral deficiencies can result in disease or reproductive problems in beef cows. For example, copper deficiency can lead to reduced fertility in beef cows.

A higher percentage of large operations (15.3 percent) identified any mineral deficiencies in cows during the last five years compared with small operations (1.6 percent). The method by which the deficiency was identified was not captured in the study questionnaire.

E.2.m. Percentage of operations that identified mineral deficiencies or health or reproductive problems in their herd that were associated with minerals in the last five years, by mineral and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Mineral	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Phosphorus	0.0	(—)	0.7	(0.7)	2.9	(2.0)	0.3	(0.2)
Magnesium	0.0	(—)	3.0	(1.8)	5.2	(2.4)	0.9	(0.4)
Cobalt	0.5	(0.5)	0.0	(—)	1.9	(1.0)	0.5	(0.4)
Copper	1.1	(1.1)	2.3	(1.1)	7.9	(2.4)	1.7	(0.9)
Iodine	0.5	(0.5)	0.4	(0.4)	3.4	(2.1)	0.6	(0.4)
Manganese	0.5	(0.5)	0.0	(—)	2.3	(1.0)	0.5	(0.4)
Selenium	0.5	(0.5)	3.3	(1.9)	9.2	(2.8)	1.5	(0.5)
Zinc	0.0	(—)	0.8	(0.8)	3.3	(1.4)	0.3	(0.2)
Any	1.6	(1.2)	8.7	(2.8)	15.3	(3.8)	3.7	(1.1)

There were no regional differences in the percentages of operations that identified mineral deficiencies in cows during the last five years.

E.2.n. Percentage of operations that identified mineral deficiencies or health or reproductive problems in their herd that were associated with minerals in the last five years, by mineral and by region:

	Percent Operations					
	Region					
	West		Central		East	
Mineral	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Phosphorus	0.2	(0.2)	0.8	(0.6)	0.0	(—)
Magnesium	1.8	(1.0)	0.2	(0.2)	0.4	(0.2)
Cobalt	0.9	(0.9)	0.4	(0.2)	0.0	(—)
Copper	3.5	(2.1)	0.5	(0.2)	0.3	(0.2)
Iodine	1.4	(0.9)	0.2	(0.2)	0.0	(—)
Manganese	1.0	(0.9)	0.3	(0.2)	0.0	(—)
Selenium	2.1	(1.1)	1.0	(0.5)	1.2	(0.8)
Zinc	0.7	(0.4)	0.2	(0.2)	0.0	(—)
Any	6.8	(2.6)	1.8	(0.8)	1.4	(0.8)

A higher percentage of operations (42.2 percent) used mineral mixes to treat or prevent health or reproductive problems associated with minerals in 2017 compared with operations that used supplemental feed or injections (19.0 and 7.1 percent, respectively). A higher percentage of large operations (27.1 percent) used injections to treat or prevent health or reproductive problems associated with minerals in 2017 compared with small operations (5.8 percent). A higher percentage of medium operations (63.2 percent) used mineral mixes to treat or prevent health or reproductive problems associated with minerals in 2017 compared with small operations (35.5 percent).

E.2.o. Percentage of operations by method(s) used to treat or prevent health or reproductive problems associated with minerals in 2017, and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Mineral mix	35.5	(5.6)	63.2	(5.5)	57.2	(11.8)	42.2	(4.4)
Supplemental feed	16.6	(4.6)	27.6	(6.6)	20.7	(5.4)	19.0	(3.7)
Injections	5.8	(2.8)	7.8	(3.3)	27.1	(6.9)	7.1	(2.2)
Any	39.6	(6.0)	66.5	(5.0)	62.2	(12.1)	46.2	(4.6)

There were no regional differences in the percentages of operations by methods used to treat or prevent health or reproductive problems in associated with minerals in 2017.

E.2.p. Percentage of operations by method(s) used to treat or prevent health or reproductive problems associated with minerals in 2017, and by region:

	Percent Operations					
	Region					
	West		Central		East	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Mineral mix	33.0	(7.0)	45.4	(7.4)	50.6	(8.5)
Supplemental feed	20.0	(6.0)	22.8	(7.4)	15.1	(6.1)
Injections	11.9	(4.6)	3.1	(2.3)	4.5	(3.1)
Any	39.7	(7.5)	50.0	(7.8)	51.1	(8.5)

3. Pasture access

Nearly all operations (98.1 percent) gave cows access to pasture in 2017. A higher percentage of operations gave cows access to pasture in May, July, and September compared with January and March. There were no herd size differences by month in the percentages of operations that gave cows access to pasture in 2017.

E.3.a. Percentage of operations that gave cows any access to pasture in 2017, by month of access and by herd size:

	Percent Operations							
	Herd Size (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Month	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
January	83.5	(4.3)	76.6	(5.2)	77.9	(8.5)	81.8	(3.4)
March	84.0	(4.4)	79.3	(3.7)	78.0	(8.5)	82.7	(3.4)
May	96.9	(1.8)	97.8	(1.7)	91.8	(7.4)	96.8	(1.4)
July	97.4	(1.8)	99.8	(0.2)	99.1	(0.9)	97.9	(1.3)
September	97.4	(1.8)	99.8	(0.2)	99.1	(0.9)	97.9	(1.3)
November	92.4	(2.8)	95.9	(2.5)	98.0	(1.1)	93.4	(2.2)
Any	97.5	(1.8)	99.8	(0.2)	100.0	(—)	98.1	(1.3)

There were no regional differences by month in the percentages of operations that gave cows any access to pasture in 2017.

E.3.b. Percentage of operations that gave cows any access to pasture in 2017, by month of access and by region:

	Percent Operations					
	Region					
	West		Central		East	
Month	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
January	83.5	(6.2)	75.3	(4.7)	84.7	(5.9)
March	83.6	(6.3)	72.5	(5.3)	89.6	(5.2)
May	95.7	(2.4)	98.3	(1.4)	96.9	(3.0)
July	97.5	(2.0)	100.0	(—)	96.9	(3.0)
September	97.5	(2.0)	100.0	(—)	96.9	(3.0)
November	95.9	(2.1)	91.0	(5.3)	92.4	(4.4)
Any	97.9	(2.0)	100.0	(—)	96.9	(3.0)

The study questionnaire asked if cows had access to pasture for the following 6 months: January, March, May, July, September, and November in 2017. There were no herd size differences in the percentages of operations by the number of months that cows were given access to pasture. The majority of operations (83.1 percent) gave cows access to pasture for 5 to 6 of the 6 months included in the questionnaire.

E.3.c. Percentage of operations that gave cows any access to pasture in 2017, by number of months (January, March, May, July, September, and November) cows had any access to pasture, by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Number of months	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
0	2.5	(1.8)	0.2	(0.2)	0.0	(—)	1.9	(1.3)
1–2	0.6	(0.5)	0.0	(—)	0.9	(0.9)	0.5	(0.4)
3–4	12.1	(3.9)	21.6	(5.1)	20.1	(8.4)	14.4	(3.1)
5–6	84.7	(4.2)	78.2	(5.1)	79.0	(8.5)	83.1	(3.3)
Total	100.0		100.0		100.0		100.0	

There were no regional differences in the percentages of operations by number of months that cows were given access to pasture in 2017.

E.3.d. Percentage of operations that gave cows any access to pasture in 2017, by the number of months (January, March, May, July, September, and November) cows had any access to pasture, by region:

	Percent Operations					
	Region					
	West		Central		East	
Number of months	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0	2.1	(2.0)	0.0	(—)	3.1	(3.0)
1–2	1.3	(0.9)	0.1	(0.1)	0.0	(—)
3–4	13.6	(6.0)	22.8	(4.5)	9.1	(4.5)
5–6	83.1	(6.2)	77.1	(4.5)	87.8	(5.4)
Total	100.0		100.0		100.0	

On many beef cow-calf operations, pasture is expected to make up the complete diet for cows during the growing season, with the exception of mineral/salt supplements. In drought conditions, however, if pasture cannot meet the nutritional needs of cows, supplemental feed may be required. The study question used to obtain these estimates did not ask for the exact percentages of a cow's complete diet that pasture provided by month. Instead, the question provided the following categories: less than 30 percent, 30-60 percent, and greater than 60 percent. During periods of good growing conditions, it would be expected that in May, July, and September pasture would comprise close to 100 percent of the complete diet of cows.

For operations that gave cows access to pasture in 2017, the majority of operations reported that pasture comprised greater than 60 percent of the cows' complete diet in May, July, and September (87.1, 93.9, and 88.3 percent of operations, respectively).

E.3.e. For the operations that gave cows access to pasture in the months listed below in 2017, percentage of operations by approximate percentage of the complete diet that pasture comprised, by month:

Percent Operations

Percent Complete Diet Pasture Comprised

	Less than 30		30–60		Greater than 60		
Month	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Total**
January	57.9	(5.7)	10.9	(3.9)	31.2	(5.3)	100.0
March	38.5	(5.2)	25.8	(5.1)	35.7	(5.4)	100.0
May	1.8	(0.9)	11.2	(2.9)	87.1	(3.0)	100.0
July	0.8	(0.6)	5.3	(2.1)	93.9	(2.2)	100.0
September	1.4	(0.7)	10.3	(3.3)	88.3	(3.3)	100.0
November	15.2	(3.5)	32.8	(5.3)	51.9	(5.2)	100.0

4. Utilization of crop residue

Crop residue such as cornstalks can be an inexpensive source of nutrition for cattle. Some corn kernels are lost in the field during the harvesting process; some ears on cornstalks are not harvestable due to issues such as wind damage; and some ears of corn drop to the ground prior to or during harvest. Cows eat the kernels or ears of corn before grazing on corn husks, leaves, or stalks.

A higher percentage of large operations (41.2 percent) used crop residue/aftermath as a feed source in 2017 compared with small operations (9.0 percent). Overall, 13.4 percent of operations used crop residue/aftermath as a feed source in 2017.

E.4.a. Percentage of operations that used crop residue/aftermath as a feed source (e.g., allowing cows to feed on cornstalk residue) in 2017, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
9.0	(3.2)	22.8	(4.6)	41.2	(12.4)	13.4	(2.7)

A higher percentage of operations in the Central region (38.7 percent) used crop residue/aftermath as a feed source in 2017 compared with operations in the West and East regions (1.7 and 7.8 percent, respectively). As shown in table E.4.c., of operations that used crop residue/aftermath as a feed source in 2017, 74.0 percent used cornstalk residue. Thus, it is not surprising that a higher percentage of operations in the Central region used crop residue as a feed source because of the amount of corn grown in the Central region.

E.4.b. Percentage of operations that used crop residue/aftermath as a feed source (e.g., allowing cows to feed on cornstalk residue) in 2017, by region:

Percent Operations

Region

West		**Central**		**East**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1.7	(1.0)	38.7	(7.9)	7.8	(4.4)

For operations that used crop residue/aftermath as a feed source in 2017, 74.0 percent used cornstalk residue.

E.4.c. For the 13.4 percent of operations that used crop residue/aftermath as a feed source in 2017 (table E.4.a), percentage of operations by type of residue cows had access to:

Residue type	Percent operations	Std. error
Cornstalks	74.0	(8.5)
Milo stalks	8.6	(5.1)
Cornstalks plus another residue	8.5	(4.8)
Other	9.0	(4.5)
Total	100.0	

5. Supplemental feedstuffs

When grass is not growing, cows will likely be fed hay or other feedstuffs such as silage. To meet cows' nutritional needs, protein or energy supplements might also be fed year-round or at specific times of the year. Protein supplements may consist of plant products high in protein, such as soybean or cottonseed meal, which can also serve as a source of energy. Nonplant sources of protein, such as urea, can also be used as inexpensive options for protein supplementation, but urea must be used carefully, since it is toxic if overfed. In addition, the efficient use of urea requires some readily available carbohydrate, which may be lacking in some rations. Protein supplements can also consist of protein tubs or blocks with plant-based products high in protein or urea. Protein tubs or blocks are fed on a free-choice basis, and daily consumption is generally low. Protein tubs or blocks typically contain energy and mineral supplements as well as salt to control intake. Energy supplements may consist of grain fed to cows, such as corn, or it may consist of tubs or blocks that contain energy supplements. In addition to tubs and blocks, liquid supplements provided through devices such as a lick wheel offer another means of providing protein and energy supplements to beef cows.

Most operations fed hay during January and March (92.4 and 88.8 percent, respectively). A relatively low percentage of operations fed hay during May, July, and September (25.5, 12.3, and 12.9 percent, respectively), which corresponds to the growing season for grass in the northern part the United States. Less than 10 percent of operations fed silage at any time during the year. A higher percentage of operations fed protein supplements during January and March compared with May, July, and September. There were no substantial differences in the percentages of operations by month that energy supplements were fed. Regional differences in the percentages of operations that fed the various feedstuffs by month were not examined.

E.5.a. Percentage of operations by feedstuffs given to cows, and by month fed:

	Percent Operations							
	Feedstuff							
	Hay		Silage		Protein supplement		Energy supplement	
Month	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
January	92.4	(2.8)	6.2	(1.9)	50.8	(5.5)	16.5	(2.7)
March	88.8	(3.1)	6.7	(1.9)	45.0	(5.6)	16.6	(2.7)
May	25.5	(4.1)	3.0	(1.3)	23.4	(4.4)	8.6	(1.9)
July	12.3	(3.8)	1.0	(0.8)	21.7	(4.8)	6.4	(2.4)
September	12.9	(3.7)	1.3	(0.9)	22.4	(4.8)	6.6	(2.4)
November	62.0	(4.5)	2.8	(1.2)	31.5	(5.3)	13.1	(3.1)

For operations that fed protein or energy supplements to cows, there were no differences by month in the average amounts of protein or energy supplement fed to cows per day. For operations that fed silage, there were no differences by month in the amount of silage fed to cows per day. For operations that fed hay, a higher amount of hay was fed per cow, per day during January and March (28.8 and 26.9 lb/d, respectively) compared with July and September (14.4 and 14.7 lb/d, respectively).

E.5.b. For operations that fed the feedstuffs to cows, average amount fed per head, per day, by month:

Average Amount Fed Per Cow Per Day (lb/d)

	Feedstuff							
	Hay		**Silage**		**Protein supplement**		**Energy supplement**	
Month	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
January	28.8	(1.5)	18.8	(1.7)	2.3	(0.3)	2.7	(0.5)
March	26.9	(1.4)	17.1	(1.6)	2.1	(0.2)	2.6	(0.5)
May	20.4	(3.0)	16.3	(2.8)	1.8	(0.3)	2.0	(0.4)
July	14.4	(3.1)	(D)		1.8	(0.4)	1.9	(0.5)
September	14.7	(3.0)	(D)		1.8	(0.4)	1.9	(0.5)
November	22.7	(1.4)	14.0	(1.6)	1.9	(0.3)	2.2	(0.5)

(D) Too few observations.

6. Access to nutritionist and nutrition information

A higher percentage of large operations (38.1 percent) consulted an animal nutritionist during 2017 compared with small operations (6.5 percent). Overall, 10.8 percent of operations consulted an animal nutritionist during 2017.

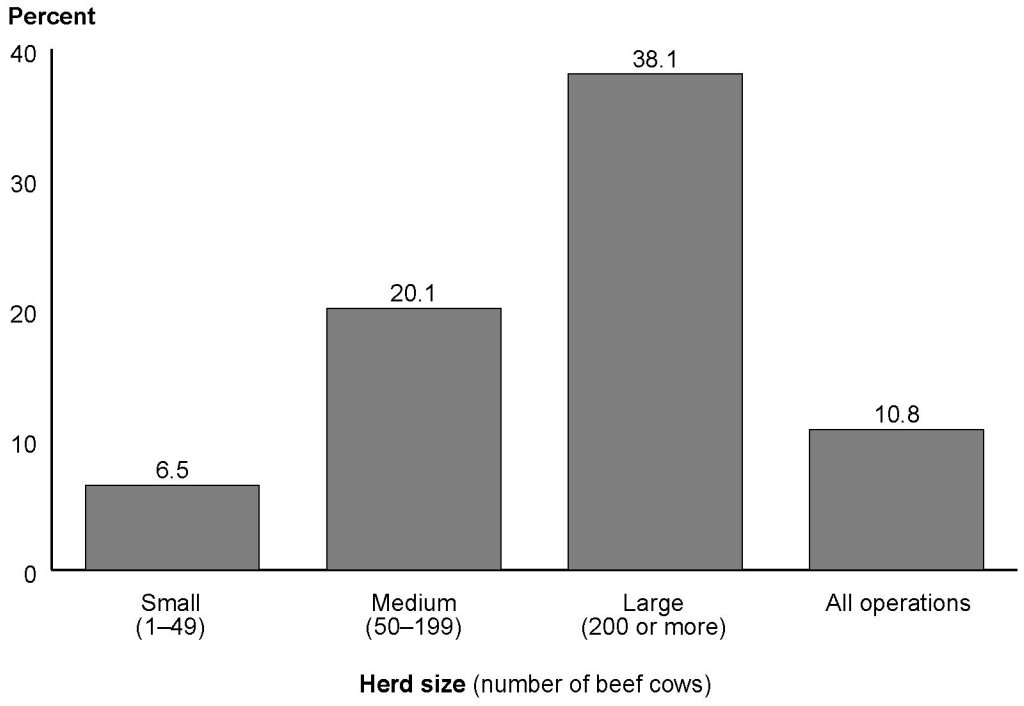
E.6.a. Percentage of operations that consulted an animal nutritionist during 2017, by herd size:

Percent Operations

Herd Size (number of beef cows)

Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
6.5	(2.6)	20.1	(4.8)	38.1	(11.0)	10.8	(2.2)

Percentage of operations that consulted an animal nutritionist during 2017, by herd size



A higher percentage of operations in the Central region (24.0 percent) consulted an animal nutritionist during 2017 compared with operations in the West region (5.2 percent).

E.6.b. Percentage of operations that consulted an animal nutritionist during 2017, by region:

Percent Operations					
Region					
West		Central		East	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
5.2	(1.9)	24.0	(6.4)	7.5	(3.2)

Producers on the highest percentages of operations reported that veterinarians and their own personal knowledge/education (27.2 and 45.4 percent, respectively) were very important sources of nutrition information.

E.6.c. Percentage of operations by source of information about animal nutrition, and level of importance producer placed on these sources:

	Percent Operations								
	Level of Importance								
	Not important		Slightly important		Important		Very important		
Information source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Private nutritionist	77.0	(4.1)	4.6	(2.3)	8.8	(2.3)	9.6	(2.9)	100.0
Feed salesman or feed retailer	33.7	(4.6)	26.5	(4.4)	30.8	(4.8)	8.9	(2.5)	100.0
Beef Quality Assurance (BQA) manual or online modules	67.4	(4.7)	21.6	(4.3)	8.0	(2.8)	3.0	(1.9)	100.0
Extension agent	54.1	(4.8)	15.9	(3.5)	20.1	(4.0)	10.0	(3.4)	100.0
Veterinarian	26.4	(4.7)	15.2	(2.9)	31.3	(4.7)	27.2	(4.7)	100.0
Friend or neighbor or other producers	38.0	(4.7)	29.4	(4.4)	26.5	(4.5)	6.1	(2.3)	100.0
Producer magazine in print or online	60.7	(5.0)	20.9	(3.5)	13.5	(3.5)	4.9	(2.3)	100.0
Personal knowledge/ education	13.4	(3.9)	13.2	(3.8)	28.0	(3.8)	45.4	(4.9)	100.0

There were no substantial differences by herd size in the percentages of operations in which the producer found the following information sources to be important or very important.

E.6.d. Percentage of operations in which the producer found the following sources of information about animal nutrition to be important or very important, by herd size:

	Percent Operations							
	Herd Size (number of beef cows)							
	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Information source	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Private nutritionist	16.5	(4.4)	21.6	(6.3)	34.2	(7.7)	18.4	(3.6)
Feed salesman or feed retailer	41.7	(6.3)	30.1	(6.3)	50.4	(10.5)	39.8	(4.9)
BQA manual or online modules	12.0	(4.4)	7.4	(2.3)	10.7	(4.6)	11.0	(3.4)
Extension agent	32.4	(6.1)	23.7	(5.4)	19.9	(5.4)	30.0	(4.7)
Veterinarian	61.0	(6.5)	47.9	(7.4)	62.7	(13.1)	58.4	(5.1)
Friend or neighbor or other producers	32.9	(6.1)	34.9	(7.3)	18.8	(5.3)	32.6	(4.8)
Producer magazine in print or online	20.4	(5.3)	13.2	(3.5)	9.0	(3.3)	18.4	(4.1)
Personal knowledge/education	70.8	(6.3)	78.5	(7.3)	91.2	(3.2)	73.4	(4.9)

There were no substantial regional differences in the percentages of operations in which the producer found the following sources to be important or very important for information about animal nutrition.

E.6.e. Percentage of operations in which the producer found that the following sources were important or very important for information about nutrition, by region:

	Percent Operations					
	Region					
	West		Central		East	
Information source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Private nutritionist	13.9	(6.1)	25.0	(7.2)	18.6	(5.5)
Feed salesman or feed retailer	35.5	(9.1)	58.7	(7.3)	30.4	(7.8)
BQA manual or online modules	10.1	(6.2)	2.1	(1.0)	18.7	(6.6)
Extension agent	28.9	(8.6)	19.2	(6.1)	39.7	(8.1)
Veterinarian	59.9	(9.3)	64.9	(7.5)	51.7	(8.5)
Friend or neighbor or other producers	35.8	(8.5)	40.3	(8.4)	22.9	(7.6)
Producer magazine in print or online	16.4	(7.4)	17.7	(6.5)	21.2	(6.7)
Personal knowledge/education	66.8	(9.4)	73.4	(7.5)	81.0	(7.2)

F. Opinions on the Significance of Health Problems

1. Economic impact

Producers on a higher percentage of operations strongly agreed that internal parasites, external parasites, and open cows/late calvers had more significant economic impacts than bloat/colic/ulcers, cow asthma, white muscle disease, copper deficiency, and anaplasmosis.

F.1.a. Percentage of operations by producer's level of agreement that the following health problems had a significant economic impact on the operation during 2017:

	Percent Operations										
	Level of Agreement										
	Strongly agree		Agree		Disagree		Strongly disagree		No opinion		
Health problem	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Parasites											
Internal parasites	20.4	(3.9)	27.5	(4.5)	29.9	(4.1)	13.2	(3.8)	9.0	(3.2)	100.0
External parasites (flies, lice, ticks, grubs)	23.0	(4.1)	36.3	(4.7)	23.0	(4.3)	9.4	(3.5)	8.3	(3.2)	100.0
Digestive											
Calf scours	17.6	(3.9)	12.5	(3.0)	43.1	(5.3)	12.6	(3.6)	14.2	(3.4)	100.0
Bloat/colic/ ulcers (abomasal/ stomach)	5.9	(2.6)	13.9	(3.3)	44.9	(5.2)	16.6	(3.6)	18.6	(3.9)	100.0
Coccidiosis	10.1	(3.1)	12.7	(3.2)	41.2	(5.3)	15.2	(3.9)	20.8	(4.1)	100.0
Reproductive											
Open/late calvers	21.1	(4.1)	29.5	(4.4)	31.1	(4.5)	8.9	(3.2)	9.5	(2.9)	100.0
Abortion	11.2	(3.3)	18.0	(3.8)	37.2	(4.8)	18.4	(4.3)	15.2	(3.4)	100.0
Weak calves	10.9	(3.2)	18.5	(3.7)	37.4	(5.0)	18.5	(4.4)	14.8	(3.3)	100.0

Table cont'd →

F.1.a. (cont'd) Percentage of operations by producer's level of agreement that the following health problems had a significant economic impact on the operation during 2017:

	Percent Operations										
	Level of Agreement										
	Strongly agree		Agree		Disagree		Strongly disagree		No opinion		
Health problem	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Respiratory											
Calf pneumonia/ shipping fever	16.3	(3.8)	16.4	(3.3)	36.3	(4.6)	12.9	(3.7)	18.2	(4.0)	100.0
Cow asthma	4.7	(2.5)	7.0	(2.5)	42.6	(5.2)	18.0	(3.8)	27.8	(4.2)	100.0
Plant-related											
Toxicities	7.5	(2.9)	12.4	(3.2)	40.4	(4.7)	20.8	(4.6)	19.0	(3.9)	100.0
Other											
Pinkeye	15.5	(3.6)	24.9	(4.2)	33.8	(4.9)	11.2	(3.2)	14.6	(3.8)	100.0
Footrot	10.3	(3.2)	20.4	(3.6)	40.4	(5.0)	13.0	(3.7)	15.9	(3.6)	100.0
White muscle disease (selenium/ vitamin E deficiency)	1.6	(1.1)	5.9	(1.9)	43.2	(4.9)	17.9	(4.1)	31.5	(3.9)	100.0
Copper deficiency	1.8	(1.0)	9.8	(3.0)	44.1	(4.9)	18.6	(4.3)	25.8	(3.9)	100.0
Anaplasmosis	5.0	(1.7)	7.0	(2.0)	41.8	(5.2)	18.7	(4.2)	27.5	(4.5)	100.0
Grass tetany	3.6	(1.5)	10.3	(2.6)	43.2	(4.9)	18.9	(4.4)	24.0	(4.1)	100.0

Producers on the highest percentage of operations (37.5 percent) strongly agreed that internal parasites are a significant problem for the beef industry. A higher percentage of producers strongly agreed that trichomoniasis, BVD, internal parasites, and resistance to anthelmintics were significant problems for the beef industry than strongly agreed that BLV, *Neospora*, and bluetongue were significant problems.

F.1.b. Percentage of operations by producer's level of agreement that the following health issues are a significant problem for the beef industry:

	Percent Operations										
	Level of Agreement										
	Strongly agree		Agree		Disagree		Strongly disagree		No opinion		
Health issue	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Tuberculosis	11.2	(2.8)	28.0	(4.6)	19.9	(4.1)	2.2	(1.2)	38.7	(5.3)	100.0
Brucellosis	13.3	(3.0)	34.9	(5.0)	23.2	(4.2)	2.7	(1.3)	25.8	(4.8)	100.0
Tritrichomoniasas infection (trich)	18.9	(3.5)	36.7	(4.8)	16.2	(4.0)	1.1	(0.6)	27.1	(4.0)	100.0
Johne's disease (paratuberculosis)	11.7	(2.8)	22.2	(4.1)	11.4	(3.3)	1.4	(0.7)	53.3	(5.2)	100.0
BLV (bovine leucosis virus) infection	6.7	(2.1)	16.1	(3.8)	10.2	(3.0)	1.6	(0.7)	65.3	(4.6)	100.0
BVD (bovine viral diarrhea)	20.0	(3.2)	46.9	(5.0)	9.6	(2.6)	0.5	(0.4)	22.9	(4.2)	100.0
Anaplasmosis	9.5	(2.3)	26.6	(4.2)	19.3	(3.7)	2.3	(1.3)	42.4	(4.8)	100.0
Neospora infection	4.0	(1.5)	12.2	(3.4)	18.4	(3.2)	2.4	(1.2)	63.1	(4.7)	100.0
Bluetongue	4.9	(1.8)	18.8	(3.8)	24.3	(3.7)	1.9	(1.1)	50.0	(5.1)	100.0
Internal parasites (worms)	37.5	(4.9)	52.2	(5.2)	3.6	(1.6)	0.5	(0.4)	6.2	(2.8)	100.0
Resistance to anthelmintics (dewormers)	20.2	(3.6)	46.8	(5.1)	12.5	(3.2)	0.8	(0.5)	19.8	(4.4)	100.0

2. U.S. outbreak preparedness

Overall, producers on 53.3 percent of operations agreed with the statement "The United States is well prepared to handle outbreaks of livestock disease currently not found in this country," (such as foot-and-mouth disease), while producers on 27.5 percent of operations disagreed with the statement and producers on 19.2 percent of operations had no opinion.

F.2.a. Percentage of operations by producer's level of agreement with the statement, "The United States is well prepared to handle outbreaks of livestock disease currently not found in this country, (such as foot-and-mouth disease)," and by herd size:

Percent Operations

Herd Size (number of beef cows)

	Small (1–49)		**Medium** (50–199)		**Large** (200 or more)		**All operations**	
Level of agreement	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Agree	54.3	(6.4)	53.5	(6.7)	37.8	(11.1)	53.3	(5.0)
Disagree	25.8	(6.0)	26.4	(5.5)	57.7	(11.4)	27.5	(4.7)
No opinion	19.9	(5.2)	20.1	(6.3)	4.5	(2.0)	19.2	(4.1)
Total	100.0		100.0		100.0		100.0	

There were no regional differences in the level of agreement with the statement “The United States is well prepared to handle outbreaks of livestock disease currently not found in this country, (such as foot-and-mouth disease”).

F.2.b. Percentage of operations by level of agreement with the statement, “The United States is well prepared to handle outbreaks of livestock disease currently not found in this country, such as foot-and-mouth disease,” and by region:

	Percent Operations					
	Region					
	West		Central		East	
Level of agreement	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Agree	49.1	(9.3)	57.1	(8.7)	55.6	(7.4)
Disagree	31.1	(9.0)	29.6	(8.3)	21.8	(6.1)
No opinion	19.9	(7.6)	13.4	(4.5)	22.7	(7.2)
Total	100.0		100.0		100.0	

Section II: Methodology

A. Needs Assessment

NAHMS develops study objectives by exploring existing literature and contacting industry members about their informational needs and priorities during a needs-assessment phase. A driving force of the needs assessment is the desire of NAHMS to receive as much input as possible from a variety of producers, as well as from industry experts and representatives, veterinarians, extension specialists, university personnel, beef organizations, allied industry groups, and other stakeholders. Information was collected through a needs-assessment survey.

The objective of the needs-assessment survey for the NAHMS Beef 2017 study was to collect information from U.S. beef cow-calf producers, industry leaders, and other stakeholders about what they perceived to be the most important management issues and the top producer incentives to encourage participation in the study. The survey, created in SurveyMonkey,® was available online from February through May 2016. The survey was promoted via industry-related electronic newsletters, magazines, Web sites, and various radio shows. In total, 690 people from 43 States completed the study's needs-assessment survey. The complete results from the needs-assessment survey can be found at the following link: https://www.aphis.usda.gov/animal_health/nahms/beefcowcalf/downloads/beef2017/Beef2017_NeedsAssess_1.pdf.

Respondents to the needs-assessment survey represented the following affiliations:

- Beef producer, 65 percent of respondents
- Veterinarian, 16 percent
- Federal or State government, 6 percent
- University/extension, 6 percent
- Allied industry personnel, 2 percent
- Nutritionist, 1 percent

Using input from the needs assessment, reviews from the scientific literature, and input from government and industry researchers, three primary study objectives were identified:

1. Describe trends in beef cow-calf health and management practices, specifically
    a. Cow health and longevity,
    b. Calf health,
    c. Reproductive efficiency,
    d. Selection methods for herd improvement, and
    e. Biosecurity practices

2. Describe management practices and producer beliefs related to
    a. Animal welfare,
    b. Emergency preparedness,
    c. Environmental stewardship,
    d. Record-keeping, and
    e. Animal identification practices

3. Describe antimicrobial-use practices (stewardship) and determine the prevalence and antimicrobial resistance patterns of potential food-safety pathogens, specifically
    a. Types and reasons for using antimicrobial drugs by animal type,
    b. Antimicrobial stewardship
        i. Use of alternatives for disease control
        ii. Use of Beef Quality Assurance principles
        iii. Veterinarian-client-patient relationship
        iv. Information sources, and
    c. Antimicrobial resistance assessments for *Salmonella*, *E. coli*, and *Enterococcus*.

B. Sampling

1. State selection

The goal for NAHMS national studies is to include States that account for at least 70 percent of the animals and operations being studied. This method helps to ensure that the representation of the sample collected and the statistical inferences made using the sample data can be generalized to the target population, but balances this scientific aim with practical budget constraints.

A total of 24 States were selected for inclusion in the study based upon each State's contribution to the total number of U.S. beef cow-calf operations and the inventory of beef cows, based on population data held by the National Agricultural Statistics Service (NASS). The 24 states were Alabama, Arkansas, California, Colorado, Florida, Georgia, Idaho, Iowa, Kansas, Kentucky, Minnesota, Mississippi, Missouri, Montana, Nebraska, North Dakota, Ohio, Oklahoma, Oregon, South Dakota, Tennessee, Texas, Virginia, and Wyoming. The 24 States represented 86.6 percent of the U.S beef cow inventory and 78.9 percent of all U.S. operations with beef cows (Appendix II).

A memo identifying these 24 States was provided to the USDA–APHIS–VS CEAH Director and, in turn, the VS District Directors. Each District Director sought input from the respective States about being included or excluded from the study.

2. Operation selection

The list frame from which operations with beef cows were sampled was provided by NASS. NASS selected a sample of beef producers in each State when establishing estimates for their January Cattle Report. The sample from the NASS January 2017 survey was used as the screening sample. Thus, all operations in the 24 States that had 1 or more beef cows on January 1, 2017, were eligible to be included in the NAHMS study sample for contact in October 2017.

A stratified random sampling design was planned, and 4,000 operations were selected to be part of the sample. Stratification was based on State and herd size of the operation from the January 2017 survey (where "herd size" is defined as the number of beef cows on the operation — 1 to 49, 50 to 199, and 200 or more). The total sample size was computed to achieve prespecified precision criteria at the 95-percent confidence level, while accounting for the estimated population size, design effect, and expected response rate. The sample size was allocated to strata proportional to size, based upon a weighted average number of beef cow-calf operations, and the total beef cow inventory within the strata. This sampling design allows for logistical efficiencies in administering the survey, prespecified precision for estimates, and oversampling of larger operations.

3. Population Inferences

Inferences cover the population of beef producers with at least 1 beef cow in the study's 24 participating states. These States accounted for 86.6 percent of the 31.7 million total U.S. beef cows and 78.9 percent of the 729,046 total operations with beef cows in the United States in 2017 (See Appendix II for respective data on individual states from the NASS 2017 Census of Agriculture).

SUDAAN software (RTI, version 11.0.1) was used to produce population estimates and their standard errors. The SUDAAN software allows estimation of standard errors for complex sampling designs using Taylor series linearization.

a. Phase I: Beef Management Survey

Estimates for Phase I represent 61.8 percent of U.S. beef cow-calf operations with at least 1 beef cow in the 24 study States, after taking into account the survey design and weighting (see Section II.E.1 for more information on the calculation of the weighted response rate).

Because operations participating in the study were selected from operations that participated in the NASS January 2017 Cattle Survey, there were two weighting phases. In the first weighting phase, the inverse of the probability of selection for the January 2017 Cattle Survey was used as the initial weight and then adjusted for nonresponse and sampling-frame duplication. In the second phase, the inverse of the probability of selection for the Cow-Calf study (with probabilities being approximately proportional to stratum size) was used as the initial weight and then adjusted for coverage and nonresponse. Nonresponse is accounted for using an additional adjustment according to the proportion of nonrespondents within each stratum using a propensity score model.

b. Phase II: VS Visit

Estimates for Phase II represent 30.8 percent of U.S. beef cow-calf operations with at least 1 beef cow in the 24 study States, after taking into account the survey design and weighting (see Section II.E.2 for more information on the calculation of the weighted response rate).

Turnover weights were constructed by adjusting the Phase I response rates for nonresponse of operations turning over consent forms for the opportunity to participate in Phase II of the study. The sampling weights used in Phase II used these turnover weights, adjusted for nonresponse at the second phase of the study using a propensity score model, trimmed for outlying weights, and calibrated to original weight totals as the final weights used for the analysis presented in this report.

C. Data Collection

1. Phase I: Beef Management Survey

From October through November in 2017, NASS enumerators administered the 2017 NAHMS Beef Management Survey via personal interviews. The interview took about 75 minutes to complete.

2. Phase II: VS Visit

Producers who indicated during Phase I that they would like to participate in Phase II of the Beef 2017 study were contacted by VS Veterinary Medical Officers (VMOs) and/or Animal Health Technicians (AHTs) from January through May, 2018. The VMOs/AHTs set up a time that was convenient for the producers to make a face-to-face visit to the operation to administer the Phase II questionnaire and, if the producer elected to do so, perform biological testing. The Phase II questionnaire interview took about 90 minutes to complete.

D. Data Analysis

1. Validation

After completing the Phase II questionnaire, VMOs/AHTs sent the completed questionnaires to their respective NAHMS State Coordinators, who reviewed the questionnaire responses for accuracy. Reviewed questionnaires were then sent to NAHMS headquarters and were reviewed independently by NAHMS staff and entered into a SAS electronic database.

NAHMS staff performed data validation checks on the data set to identify consistency and statistical issues. Consistency issues include logical inconsistencies within a survey and were identified using summary procedures to check for invalid responses (e.g., a response of '3' for a 0/1 response variable); threshold checks (e.g., identifying invalid total sums of beef cow inventory); and, if-then, checks (e.g., if the operation did not sell any cattle or calves during 2017, there should not be any reported methods of sale).

Statistical issues were identified by investigating summary measures of responses for variables, and extreme outliers were investigated by data analysts and subject-matter experts. Inconsistencies were identified using SAS software, and hard copies of questionnaires were reviewed by data analysts and subject-matter experts. Identified inconsistencies were addressed using item-level imputation measures, if appropriate values could be logically deduced or inferred.

2. Estimation

Summarization and estimation for the final report were performed using SUDAAN software, which accounts for the stratified sampling study design. Estimates were generated by one analyst, and numbers and estimation code were reviewed by a second analyst to ensure accurate reporting of estimates.

E. Sample Evaluation

The purpose of this section is to provide counts and percentages of operations by response category, which can be used to compute various measures of response. Historically, the term “response rate” was used as a catch-all parameter, but there are many ways to define and calculate response rates. Therefore, counts and percentages of operations by response code category are presented below so that response rates can be calculated according to the preferred definition of “response rate.”

Additionally, the Office of Management and Budget (OMB) has provided guidance regarding the calculation and reporting of response rates in their Standards and Guidelines for Statistical Surveys (2006), Section 3.2. The response rate advocated for in the OMB guidance estimates the percentage of eligible operations that completed the questionnaire. The calculation of this specific response rate is performed for both phases of the study.

1. Phase I response rates

Of the 4,000 operations selected for participation, 317 were ineligible (no resident beef cows, out of business, or out of scope). Of the 3,683 eligible operations, 462 were not contacted (office holds, deliberately not contacted, and inaccessible operations). Of the 3,221 eligible operations that were contacted, 2,013 (766 + 1,247) provided complete questionnaire data. Of those, 766 operations agreed to be contacted for the Phase II of the study.

Response category group label	Response category group	Response category	Number operations	Percent operations	Weighted percent operations*
(*a*)	In-scope – Complete	Completed NASS interview for baseline report, signed consent for phase II	766	19.2	19.3
		Completed NASS interview for baseline report, refused consent for phase II	1,247	31.2	36.5
(*b*)	In-scope – Refused	Refused	1,208	30.2	25.8
(*c*)	Out of scope	No beef cows on hand between January 1, 2017 and December 31, 2017	269	6.7	7.4
		Out of business	45	1.1	1.6
		Out of scope	3	0.1	0.1
(*d*)	Not contacted	Office hold	145	3.6	1.7
		Inaccessible	317	7.9	7.8
		Total	4,000	100.0	100.0

* Weighted percentages calculated using the initial sampling weights.

According to the OMB guidance, the response rate for this study would be calculated according to the following formula,

$$\frac{a}{(a+b)+\rho*(d)}$$

where the letters *a*, *b*, and *d* represent the counts (or percentages) of operations in each of the response category groups in the table above and ρ is the proportion of the non-contacted operations that are expected to be in-scope. Specifically,

$$\rho = \frac{(a+b)}{(a+b+c)} = \frac{3{,}221}{3{,}538} \approx 0.910.$$

Thus, the OMB guidance-based response rate for Phase I of the NAHMS Beef 2017 study is calculated as follows

$$\frac{2{,}013}{3{,}221 + 0.910 * 462} = 0.553,$$

meaning approximately 55.3 percent of eligible operations completed the Phase I questionnaire. The weighted OMB guidance-based response rate for Phase I of the NAHMS Beef 2017 study is 61.8 percent (calculated using the initial sampling weights), which means that Phase I questionnaire information is available for approximately 61.8 percent of the beef cow-calf operations with at least 1 beef cow in the 24 study states after taking into account the survey design and weighting.

2. Phase II response rates

Of the 766 operations that elected to turn their contact information over to participate in Phase II of the Beef 2017 study, 22 were ineligible (no beef cows). Of the 744 eligible operations, 130 were not contacted. Of the 614 eligible operations that were contacted, 262 provided complete survey data to the Phase II questionnaire.

Response category label	Response category	Number operations	Percent operations	Weighted percent operations*
(*a*)	Survey Complete	262	34.2	29.2
(*b*)	Survey Refused	352	46.0	46.6
(*c*)	Out of Scope – No Beef Cows	22	2.9	4.3
(*d*)	Inaccessible	130	17.0	20.0
	Total	766	100.0	100.0

* Weighted percentages calculated using the turnover weights.

Using the same approach to calculate the OMB guidance-based response rate as above in Section II.E.1, the proportion of the non-contacted operations expected to be in-scope is as follows

$$\rho = \frac{614}{636} \approx 0.965.$$

Therefore, the OMB guidance-based response rate for Phase II of the NAHMS Beef 2017 study is calculated as such:

$$\frac{262}{614 + 0.965 * 130} = 0.354,$$

meaning approximately 35.4 percent of eligible operations completed the Phase II questionnaire. The weighted OMB guidance-based response rate for Phase II of the NAHMS Beef 2017 study is 30.8 percent (calculated using the turnover weights).

3. Communicating response rates

The unweighted response rates, 55.3 for Phase I and 35.4 percent for Phase II, are the rates that will be used, generally, to communicate the response rate for the respective phases of the NAHMS Beef 2017 study, as they represent the likelihood that eligible operations completed the survey at each phase.

Appendix I: Sample Profile

1. Size of operations

	Number of Responding Operations[1]	
Herd Size (Total beef cow inventory)	**Phase I**	**Phase II**
1 to 49	902	81
50 to 199	653	96
200 or more	458	85
Total	2,013	262

[1] Respondent provided answers to all or nearly all questions.

2. Regions

	Number of Responding Operations[1]	
Region	**Phase I**	**Phase II**
West[2]	780	92
Central[3]	511	97
East[4]	722	73
Total	2,013	262

[1] Respondent provided answers to all or nearly all questions.
[2] CA, CO, ID, MT, OK, OR, TX, WY
[3] IA, KS, MN, MO, NE, ND, SD
[4] AL, AR, FL, GA, KY, MS, OH, TN, VA

Appendix II: U.S. Beef Cow Population and Operations

		Number of Beef Cows and Number of Beef Cow Operations on December 31, 2017	
Region	**State**	**Beef Cow Inventory Dec. 31, 2017*** (Thousand Head)	**Beef Cow Operations 2017***
West	California	682	10,254
	Colorado	806	12,407
	Idaho	498	8,149
	Montana	1,488	10,290
	Oklahoma	2,129	46,080
	Oregon	539	11,548
	Texas	4,573	134,250
	Wyoming	716	4,982
	Total	11,431	237,960
Central	Iowa	939	19,171
	Kansas	1,500	23,682
	Minnesota	368	13,339
	Missouri	2,164	48,122
	Nebraska	1,896	17,707
	North Dakota	985	8,245
	South Dakota	1,800	12,613
	Total	9,652	142,879
East	Alabama	718	20,004
	Arkansas	927	23,036
	Florida	882	18,493
	Georgia	488	14,869

Table cont'd →

Number of Beef Cows and Number of Beef Cow Operations on December 31, 2017			
Region	**State**	**Beef Cow Inventory Dec. 31, 2017*** (Thousand Head)	**Beef Cow Operations 2017***
East	Kentucky	1,032	33,864
	Mississippi	503	14,752
	Ohio	301	17,733
	Tennessee	906	32,960
	Virginia	638	18,453
	Total	6,397	194,164
Total (24 States)		27,479	575,003
24 States as a % of 50 States		86.6	78.9
Total U.S. (50 States)		31,722	729,046

* Source: NASS, 2017 Census of Agriculture. State level estimates only available in conjunction with the Census of Agriculture every 5 years. Beef cow inventory is reported to the closest 1,000 head. Sums may not equal totals due to rounding.

Appendix III: Antimicrobial Classes for Oral Products (Bolus or Drench)

The table below shows antibiotics within each antimicrobial class from table D.2.l. The antibiotics below do not represent all antibiotics within a given class. For example, there are other tetracycline-class oral antibiotics approved for use in cattle, such as chlortetracycline. However, the antibiotics in the table below are ones that operations specifically indicated they used in 2017.

Antimicrobial class	Antibiotic	Example product names
Aminoglycoside	Spectinomycin	Spectam® Scour Halt®, SpectoGard® Scour-Chek®
Sulfonamide	Sulfadimethoxine (solution)	Albon® solution, Sulfadimethoxine soluble powder, Sulfadimethoxine 12.5% oral solution, Di-Methox® 12.5% oral solution, Di-Methox® 12.5% soluble powder, Sulfa-Med-G® soluble powder
	Sulfamethazine (solution)	SMZ-Med® 454 soluble powder, Sulmet® solution, Sulmet® soluble powder
	Sulfaquinoxaline (solution)	S.Q. Soluble, Sulfa-Nox Concentrate, Sul-Q-Nox®
	Sulfadimethoxine (bolus)	Albon S.R.® Bolus, Albon® Bolus
	Sulfamethazine (bolus)	Sulmet® Oblets, Sustain III® Bolus, SulfaSURE SR Bolus, Supra Sulfa™ III
Tetracycline	Oxytetracycline (solution)	Terramycin® soluble powder, Oxytetracycline HCL, Agrimycin®, Oxymycin, Oxy-Sol, Oxytet 343, Pennox 343®, Tetroxy® 343, Tetroxy® 25
	Oxytetracycline (bolus)	Terramycin® Scour Tablets, Oxy 500 and 1000 calf bolus
Trimethoprim/ sulfa	Trimethoprim/ sulfamethoxazole	Bactrim® tablets, SMZ/TMP Tablets, TMP-sulfa, Tribrissin® tablets
	Trimethoprim/ sulfadiazine	Uniprim Powder

Appendix IV: Antimicrobial Classes for Injectable Products

The table below shows antibiotics within each antimicrobial class from table D.2.m. The antibiotics below do not represent all antibiotics within a given class. For example, ampicillin (Polyflex®) is a non-cephalosporin beta-lactam-class injectable antibiotic approved for use in cattle that does not appear in the table below. With the exception of the cephalosporin and tetracycline antibiotics, the injectable antibiotics in the table below are ones that operations specifically indicated they used in 2017. For the cephalosporin and tetracycline antibiotics, the questionnaire only specified "ceftiofur" or "oxytetracycline" and, for example, did not specifically ask about use of ceftiofur sodium versus ceftiofur hydrochloride. These specific antibiotics for ceftiofur and oxytetracycline are listed in the table below for ease in understanding the product names. The numbers associated with the oxytetracycline products refer to the concentration of oxytetracycline per ml. For example, LA-200 has 200 mg of oxytetracycline per ml of product in the bottle. The oxytetracycline 100 products are highly unlikely to be used in cow-calf operations since these products should be administered intravenously. The oxytetracycline 200 and 300 products are given intramuscularly and are much easier to administer.

Antimicrobial class	Antibiotic	Example product names
Cephalosporin	Ceftiofur sodium	Naxcel®, Ceftiflex®
	Ceftiofur hydrochloride	EXCENEL® RTU EZ, Cefenil® RTU
	Ceftiofur crystalline free acid	EXCEDE®
Non-cephalosporin beta-lactam	Amoxicillin	Amoxi-Inject
	Penicillin G Procaine	Norocillin®, Aquacillin, Agri-Cillin®, Pen-G Max®, Pro-Pen-G®, Penicillin Injectable, Bactracillin G®, Pen-Aqueous®
	Penicillin G Procaine/ Penicillin G Benzathine	Combi-Pen-48®, Dual-Cillin, Pen-BP-48, Flo-cillin®, Dura-Pen, Combicillin, Bactracillin G® Benzathine
Fluoroquinolone	Enrofloxacin	Baytril® 100, Enroflox® 100, EnroMed™ 100, Quellaxin™ 100

Table cont'd →

Antimicrobial class	Antibiotic	Example product names
Macrolide	Gamithromycin	Zactran®
	Tildipirosin	Zuprevo®
	Tilmicosin	Micotil®
	Tulathromycin	Draxxin®
	Tylosin	Tylan® Injectable, Tylan® 200, Tylan® 50
Phenicol	Florfenicol	Nuflor®, Norfenicol®
	Florfenicol with flunixin meglumine	Resflor Gold®
Tetracycline	Oxytetracycline 100	Agrimycin® 100, Oxytet 100, Duramycin-100, Terra-Vet® 100, Vetrimycin™ 100
	Oxytetracycline 200	Liquamycin® LA-200®, Agrimycin® 200, Bio-Mycin® 200, Duramycin 72-200, Oxytetracycline 200, Terra-Vet® 200, Vetrimycin™ 200
	Oxytetraycline 300	Noromycin 300-LA, 300 Pro LA®
	Oxytetraycline 300 with flunixin meglumine	Hexasol®
Sulfonamide	Sulfadimethoxine	Di-methox® 40%, Agribon Injection 40%, SulfaMed™ Injection 40%