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Antimicrobial Use and Stewardship on U.S. Feedlots, 2017

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Items of Note

This report represents the first time that the USDA's National Animal Health Monitoring System (NAHMS) has conducted a targeted study on antimicrobial use and stewardship, and it is also the first time that NAHMS has collected detailed information on antimicrobial use in feed and water in feedlots with a capacity of 50-999 head. In the past, as part of the NAHMS feedlot studies conducted in 1999 and 2011, NAHMS collected information on antimicrobials used in feed and water and the duration of their use on feedlots with a capacity of at least 1,000 head.

NAHMS Antimicrobial Use and Stewardship on U.S. Feedlots, 2017 study focused on how antimicrobials were used on U.S. cattle feedlots with 50 or more head in 2016—before the U.S. Food and Drug Administration (FDA) implemented antimicrobial use policy changes[1] on January 1, 2017. Data were collected as a benchmark for comparison with antimicrobial use on feedlots in future studies, after the implementation of the FDA policy changes. In total, 378 feedlots provided data for this report.

Overall, 87.5 percent of feedlots gave antimicrobials in feed, water, or by injection in 2016. Almost all large feedlots (1,000 or more head capacity) and more than 8 of 10 small feedlots (50 to 999 capacity) used any (one or more) antimicrobials in feed, water, or by injection (99.5 and 86.6 percent of feedlots, respectively).

Antimicrobials were administered in feed on 70.8 percent of all feedlots, 87.1 percent of large feedlots, and 69.5 percent of small feedlots. Of the 85.7 percent of feedlots that placed cattle weighing less than 700 pounds (lb), 71.6 percent gave antimicrobials to these cattle. Of the 28.2 percent of feedlots that placed cattle weighing 700 lb or more, 68.0 percent gave antimicrobials to these cattle. Reasons for feeding antimicrobials included prevention, control, or treatment of respiratory disease; prevention and control of coccidiosis; and growth promotion. Ionophores and chlortetracycline were the antimicrobials fed on the highest percentages of feedlots.

Almost one-half of feedlots (44.4 percent) did not use any medically important antimicrobials in feed. Of the 85.7 percent of feedlots that placed cattle weighing less than 700 lb, 42.6 percent did not use any medically important antimicrobials in feed for these cattle. Of the 28.2 percent of feedlots that placed cattle weighing 700 lb or more, 60.9 percent did not use any medically important antimicrobials in feed for these cattle.

Only 8.5 percent of all feedlots administered any (one or more) antimicrobials in water. For small feedlots, 9.1 percent administered antimicrobials in water compared with 1.1 percent of large feedlots. Control or treatment of respiratory disease was the reason for using antimicrobials in water by the highest percentage of feedlots.

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[1]FDA Guidance for Industry #209, #213

Some cattle, especially those at high risk of disease, might be treated as a group upon arriving at the feedlot. Overall, 14.8 percent of feedlots treated cattle as a group with injectable antimicrobials. A higher percentage of large feedlots than small feedlots treated cattle as a group with injectable antimicrobials (39.3 and 12.8 percent, respectively).

Overall, 80.0 percent of feedlots treated at least one sick steer or heifer with injectable antimicrobials in 2016. A higher percentage of large feedlots than small feedlots (97.9 and 78.5 percent, respectively) treated at least one sick steer or heifer with injectable antimicrobials in 2016.

Nearly 80 percent of feedlots used the services of a veterinarian in 2016. About 85 percent of feedlots had a veterinarian-client-patient relationship (VCPR). Of those feedlots, 13.7 percent described their VCPR as a written document signed by the veterinarian and the producer, 42.4 percent had a verbal agreement, and 43.8 percent had an implied VCPR based on the relationship between the veterinarian and the producer.

Of feedlots that used a veterinarian in 2016, a veterinarian visited the feedlot more than once on 80.5 percent of all feedlots. A veterinarian visited more than once during the year on a higher percentage of large feedlots than small feedlots (95.8 and 78.8 percent, respectively).

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Acknowledgments

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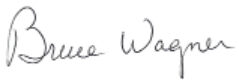
All participants are to be commended, particularly the producers whose voluntary efforts made this study possible.



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Introduction

This report represents the first time that the USDA's National Animal Health Monitoring System (NAHMS) has conducted a targeted study on antimicrobial use and stewardship, and it is also the first time that NAHMS has collected detailed information on antimicrobial use in feed and water and their duration of use on feedlots with a capacity of 50-999 head. Overall, 4,682 feedlots were eligible to participate in the study, of which 912 consented and 378 completed the questionnaire. Previously, NAHMS has collected and reported information on antimicrobials used in feed and water as part of two national feedlot studies conducted in 1999 and 2011. These two studies looked at feedlots with 1,000 head or more.

Designed to meet the Nation's animal health information needs, NAHMS is a nonregulatory program of the USDA's Animal and Plant Health Inspection Service (APHIS). The USDA's Antimicrobial Resistance Action Plan, released in 2015, recommended that USDA agencies perform enhanced monitoring of antimicrobial use in food-producing animals. In addition, beginning on January 1, 2017, the U.S. Food and Drug Administration (FDA) completed implementation of policy changes regarding the use of antimicrobials in food-producing animals. These changes included

- Eliminating the use of medically important antimicrobials for growth promotion purposes in food-producing animals, and
- Requiring veterinary oversight for use of medically important antimicrobials in animal feed or water.

This Antimicrobial Use and Stewardship on U.S. Feedlots, 2017 study represents data collected from feedlots with a capacity of at least 50 head in 2016—before the FDA policy changes mentioned above were implemented. NAHMS intends to periodically repeat the study to monitor changes in antimicrobial use practices over time.

Study objectives follow:

- Describe antimicrobial-use practices in feed and water on feedlots with a capacity of at least 50 head.
- Estimate the percentage of feedlots administering and the percentage of cattle receiving specific antimicrobials in feed and water, by reasons for use.
- Provide baseline data on antimicrobial-use practices in place prior to implementation of FDA policy changes. This baseline can be used for evaluating trends over time.
- Describe antimicrobial stewardship practices on U.S. feedlots.

The Antimicrobial Use and Stewardship on U.S. Feedlots, 2017 study was conducted in 22 top cattle-producing States. Feedlots were categorized by their capacity: small feedlots (50 to 999 head) were selected from 13 of the 22 participating States, and large feedlots (1,000 or more head) were selected from 16 of the 22 participating States.

The 13 States from which small feedlots were selected represented 93.2 percent of U.S. cattle inventory on feedlots with 50 to 999 head and 91.3 percent of feedlots with a capacity of 50 to 999 head. The 16 States from which large feedlots were selected represented 92.8 percent of U.S. cattle inventory on feedlots with 1,000 or more head capacity and 92.3 percent of feedlots with 1,000 or more head capacity.

Using the study methodology described in Section II: Methodology, the statistical results from this study can be generalized to the population of feedlots with a 50-999 head capacity in the 13 States from which small feedlots were selected, and to the population of feedlots with a capacity of 1,000 or more head in the 16 States from which large feedlots were selected. Initial contact was made via phone by USDA–National Agricultural Statistics Service (NASS), and interested respondents signed a consent form allowing contact information to be given to USDA–APHIS-Veterinary Services. Personal interviews were conducted by State and Federal veterinary medical officers to collect data on antimicrobial use and stewardship practices in 2016. The study questionnaire was administered from July through September 2017.

Terms Used in This Report

Antibiotic: A chemical compound generally produced by molds that inhibits and/or kills certain bacteria. Antibiotics are very effective against illnesses caused by bacteria.

Antimicrobial: Any substance of natural, semisynthetic, or synthetic origin that kills or inhibits the growth of microorganisms but causes little or no damage to the host. All antibiotics are antimicrobials, but not all antimicrobials are antibiotics. For the purposes of this report, the terms “antimicrobial” and “antibiotic’ are considered synonymous.

Stewardship and judicious use: Includes keeping records on antimicrobial use, offering employees training regarding antimicrobials, periodically undergoing facility audits or assessments, using a veterinarian for guidance on antimicrobial use, having a valid veterinarian-client-patient-relationship, and taking steps to prevent disease.

> **Antimicrobial stewardship:** Refers to the actions veterinarians and producers take to preserve the effectiveness and availability of antimicrobial drugs through conscientious oversight and responsible decision-making, while safeguarding animal, public, and environmental health.[2]
>
> **Judicious use of antimicrobials:** When the decision is reached to use antimicrobials for treatment, control, or prevention of disease, veterinarians should strive to optimize therapeutic efficacy and minimize resistance to antimicrobials to protect public and animal health and well-being.[3]

Backgrounded cattle: An intermediate step in cattle production that begins after weaning, usually at a location different from the farm or ranch of origin. Producers who background cattle help the animals through the stress of weaning and get them ready for placement at their next destination, which could be a feedlot or pasture. Sometimes the terms backgrounder or stocker are used interchangeably, but cattle generally spend a longer time at a stocker operation than a backgrounder operation. In general, backgrounded cattle present a lower risk of introducing disease upon arrival at the feedlot.

[2]As defined by the American Veterinary Medical Association (AVMA), https://www.avma.org/KB/Policies/Pages/Antimicrobial-Stewardship-Definition-and-Core-Principles.aspx

[3]As defined by the AVMA, https://www.avma.org/KB/Policies/Pages/Judicious-Therapeutic-Use-of-Antimicrobials.aspx

Beef Quality Assurance (BQA): A national program that raises consumer confidence through offering proper management techniques and a commitment to quality within every segment of the beef industry. Nearly every U.S. State has an active BQA program. The program links all beef producers with livestock production specialists, veterinarians, nutritionists, marketers, and food purveyors interested in maintaining and improving the quality of the beef they produce. BQA principles are based on good management practices designed to meet the need of the Nation's food production system. In addition, BQA programming focuses on educating and training cattle producers, farm advisors, and veterinarians on animal husbandry practices as well as issues regarding food safety and quality.

BQA Feedyard Assessment: An onsite educational tool that allows for assessing and benchmarking key indicators of animal care and welfare as well as feedyard conditions. The assessment has three main areas of focus: animal records, protocols, and facilities/equipment. Assessments might be utilized as a self-assessment, completed by a second party, or conducted by a third-party assessor.

Cattle on feed: Cattle being fed a high-energy ration consisting of components such as grain, silage, hay, and/or protein supplement before being sent to slaughter. Operations with cattle being "backgrounded only" for later sale as feeders or for placement in another feedlot were excluded from this study. This report is restricted to steers and heifers.

Cattle placed/placement: This report is restricted to steers and heifers placed in a feedlot and fed a ration that will produce a "select or better" carcass at slaughter. Placement refers to the time that cattle entered the feedlot.

Feedlot: An operation that feeds cattle for the slaughter market.

Feedlot capacity: The total number of cattle that could be accommodated in the feedlot at one time. For this study, feedlots were categorized as small or large:

Small: Feedlot capacity of 50 to 999 head.

Large: Feedlot capacity of 1,000 or more head.

Heifer: A young female bovine that has not calved.

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. Ionophores are not categorized by the FDA as medically important antimicrobials for humans.

Medically important antimicrobial: Any antimicrobial the FDA deems medically important with respect to the use of that class of antimicrobials for therapeutic use in human medicine. As of January 1, 2017, medically important antimicrobials are no longer approved by the FDA for use in food producing animals for growth promotion purposes, and medically important antimicrobials used in animal feed or water require veterinary oversight. See Appendix II for more information.

Medicated feed: There are several different types of medicated feed:

> **Type A medicated article:** Intended solely for manufacturing another Type A medicated article or a Type B or C medicated feed. A Type A article consists of a new drug(s) for use in animals, with or without carrier (e.g., calcium carbonate, rice hull, corn, gluten) and with or without inactive ingredients.
>
> **Type B medicated feed:** Less concentrated than a Type A medicated article but more concentrated than Type C medicated feed. Type B medicated feed is used to make other Type B medicated feeds or Type C medicated feeds. Type B medicated feed is never fed directly to animals, but could be used for a premix designed to be mixed with other feedstuffs to make a finished feed.
>
> **Type C medicated feed:** The least concentrated medicated feed. Type C feed can be fed to animals without further mixing and can be fed as the sole ration, top dressed, or by free choice.

Percent cattle: The total number of cattle on all feedlots with a certain attribute divided by the total number of cattle on all feedlots (or on all feedlots within a certain category, e.g., capacity).

Percent feedlots: The number of feedlots with a certain attribute divided by the total number of feedlots (or by the total number of feedlots within a certain category, e.g., capacity). Percentages will sum to 100 if attributes are mutually exclusive (e.g., percentage of feedlots within a capacity category). Percentages will not sum to 100 if attributes are not mutually exclusive (e.g., the percentage of feedlots using treatment methods in which feedlots might have used more than one method).

Placement weight: These data were collected from the time cattle were placed in the feedlot at the specified weight class until the cattle were marketed. Some data in this report were collected according to the weight of cattle when placed in the feedlot. There were two weight categories: less than 700 lb at placement and 700 lb or more at placement. The breakpoint of 700 lb was chosen because cattle 700 lb or more are more likely to have spent time on backgrounder or stocker operations, which lowers their risk of disease upon placement into the feedlot.

Less than 700 lb at placement: Cattle less than 700 lb at placement are generally young and have recently been weaned. Cattle that have not been backgrounded or preconditioned have a higher risk of disease upon entering the feedlot. These cattle are typically on feed for a longer duration than cattle 700 lb or more at placement.

700 lb or more at placement: Cattle 700 lb or more at placement are generally older and are more likely to have spent time on a backgrounder or stocker operation before entering the feedlot. These cattle are on feed for a shorter duration, and they have a lower risk of disease. Many of these cattle enter the feedlot as yearlings, which are generally considered to have the lowest risk of disease of cattle entering the feedlot.

Population estimates: Point estimates in this report (weighted percentages or averages) are provided with a measure of precision called the standard error. A 95-percent confidence interval can be approximated 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. 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). When the estimates are reported as being “higher” or “lower”, a statistical difference is implied but not tested. Not all statistically different estimates are mentioned in the text of this report. All estimates in this report are rounded to the nearest tenth. If the estimate rounded to 0, the standard error was reported (0.0). If there were no reports of the event (0.0 percent) or if all operations reported the event (100.0 percent), no standard error was reported (—).

Preconditioned cattle: Preconditioning refers to a management practice designed to prepare calves to better adapt to a new location. Preconditioned calves are usually held on the operation of origin for a set period (e.g., 1-2 months) after weaning, allowing calves to recover from the stress of weaning before they leave the operation of origin. Practices typically used in a preconditioning program include vaccination, castration, dehorning (if necessary), and introduction to a feed bunk. Preconditioned calves present a lower risk of having disease upon arrival at a feedlot.

Reason for use: Respondents were provided a list of approved antimicrobials with approved indications for use and asked to identify which ones they used and the reason for their use. The reasons for using antimicrobials included therapeutic purposes (i.e., prevention, control, or treatment of different diseases or conditions), or for growth promotion/feed efficiency. Respondents were not asked to specify one of the three therapeutic purposes for each drug, as this would have required nonveterinary respondents to make a clinical decision or diagnosis. In addition, many FDA labels for veterinary antimicrobial drugs do not distinguish among therapeutic purposes, and some antimicrobials have labels with more than one purpose or indication.

Growth promotion: Includes use of antimicrobials for increased rate of weight gain or improved feed efficiency. Prior to January 1, 2017, some medically important antimicrobial products included label claims for growth promotion. As of January 1, 2017, however, labels on medically important antimicrobials do not indicate approved use for growth promotion. Antimicrobials not considered medically important by the FDA, such as ionophores, bambermycin, and bacitracin zinc, continue to have label claims for growth promotion in feedlot cattle.

Route of administration:

Feed: Antimicrobials added in feed for preventing, controlling, or treating disease, or for increasing rate of gain and/or improving feed efficiency. Some antimicrobials in feed are pulse-dosed (e.g., chlortetracycline), meaning that the same antimicrobial was used in the same pen of cattle multiple times.

Water: Antimicrobials added to water for control or treatment of disease in a group of cattle.

Injection (individual treatment): Individual sick animals treated with injectable antimicrobials for disease treatment.

Injection (group treatment): For the purposes of this report, “treated as a group” means that at least 90 percent of cattle in a pen or group were treated with an injectable antimicrobial for preventing, controlling, or treating a disease outbreak, such as bovine respiratory disease or shipping fever.

Steer: A male bovine castrated before sexual maturity.

Stocker cattle: Refers to cattle typically put on pasture after weaning and before being placed in a feedlot. Stocker cattle are often sent to a location other than the farm or ranch of origin and are often sold as yearlings, which have a low risk of disease upon feedlot placement.

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

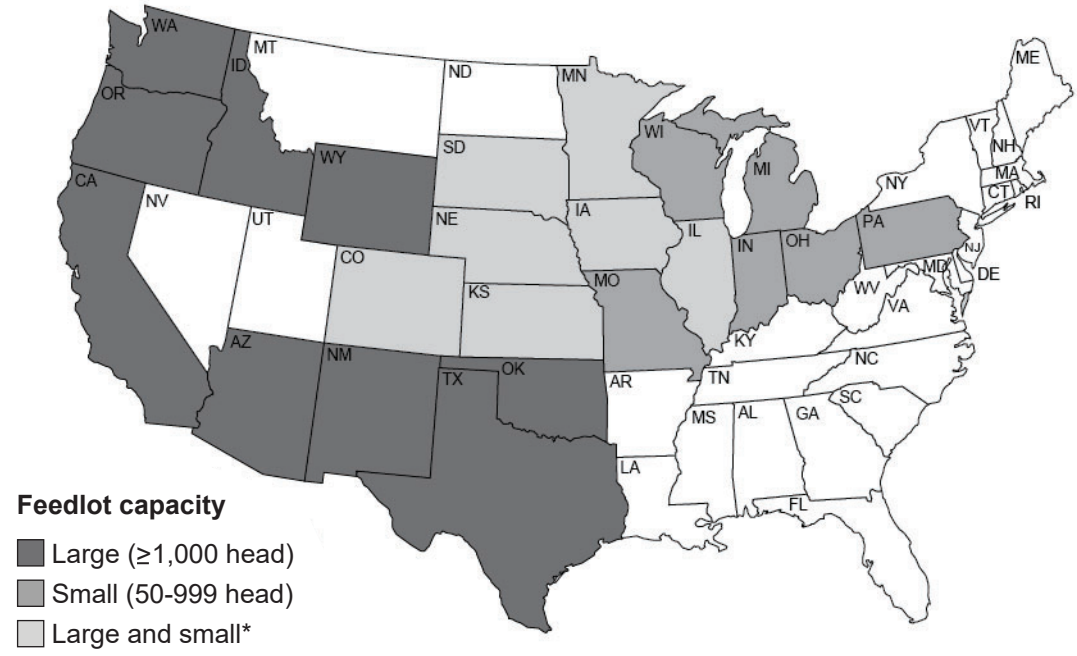
1. A veterinarian has assumed the responsibility for making medical judgments regarding the health of (an) animal(s) and the need for medical treatment, and the client (the owner of the animal or animals or other caretaker) has agreed to follow the instructions of the veterinarian;

2. There is sufficient knowledge of the animal(s) by the veterinarian to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s); and

3. The practicing 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 has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of examination of the animal(s), and/or by medically appropriate and timely visits to the premises where the animal(s) are kept.

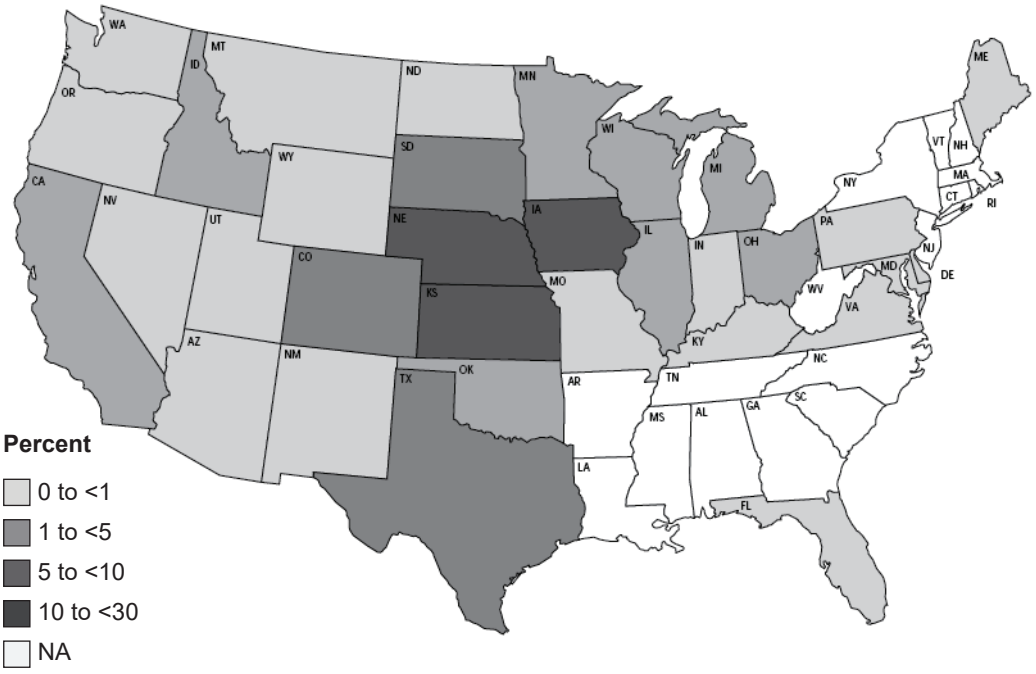
*Available at: https://www.ecfr.gov/cgi-bin/text-idx?SID=99550a83c97103df1503d4e34b99b26b&mc=true&node=pt21.6.530&rgn=div5#se21.6.530_13

States participating in the NAHMS Antimicrobial Use and Stewardship on U.S. Feedlots, 2017 study, by feedlot capacity



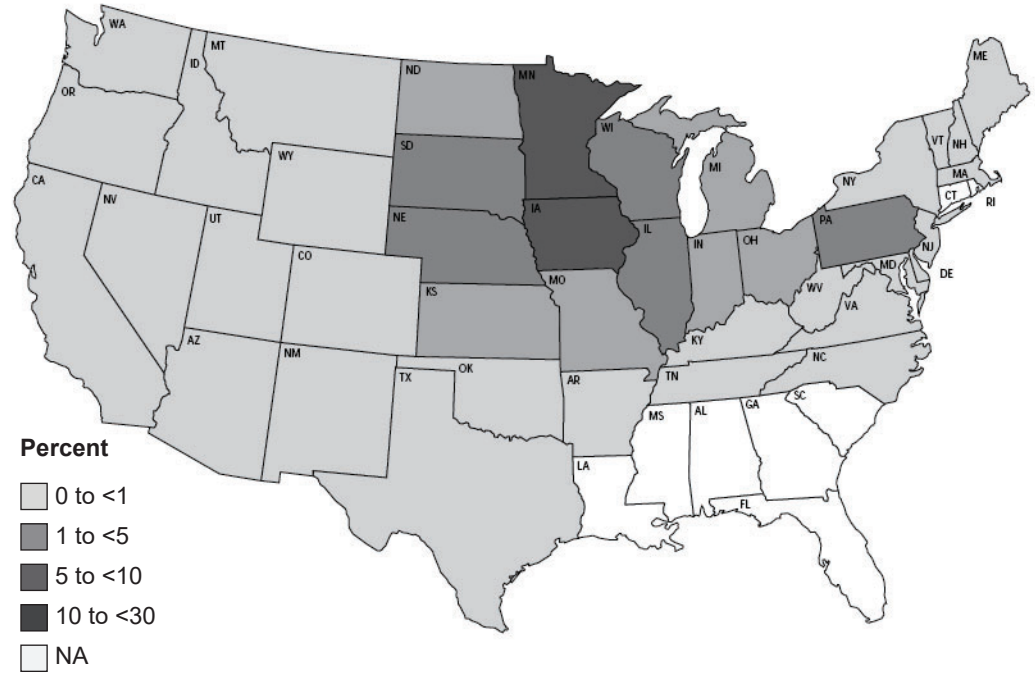
*Refers to States in which data were collected from both large and small feedlots.

Percentage of U.S. feedlots (≥1,000)



* Data from USDA-NASS 2012 Census of Agriculture.

Percentage of U.S. feedlots (< 50-999 head)*



* Data from USDA-NASS 2012 Census of Agriculture.

Section I: Survey Results

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. Columns or rows not summing to 100.0 indicate that the options were not mutually exclusive.

Note: Unless otherwise specified, the time period for all tables is January 1 through December 31, 2016, prior to FDA policy changes that took effect January 1, 2017 (see Introduction on p 1).

A. Cattle on Feed

The weighted percentage of small feedlots participating in the NAHMS 2017 study was 92.5 percent, and the weighted percentage of large feedlots was 7.5 percent. These percentages were very similar to those published in the 2012 Census of Agriculture, the most recently published national information on feedlot and inventory counts for the 50-999 and 1,000-or-more-head categories. In both studies, about 92 percent of feedlots had a capacity of 50-999 head, and about 8 percent of feedlots had a capacity of 1,000 head or more.

A.1. Percentage of feedlots that placed cattle, by NAHMS study, 2012 Census of Agriculture, and feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Study/Census	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
NAHMS 2017 study	92.5	(0.5)	7.5	(0.5)	100.0	(—)
2012 Census of Agriculture (NASS)	92.2	NA	7.8	NA	100.0	NA

The percentages of cattle placed on feedlots were similar in the NAHMS 2017 study and the 2012 Census of Agriculture. In the NAHMS study, about 18 percent of cattle were placed on feedlots with a capacity of 50-999 head, and about 82 percent of cattle were placed on feedlots with a capacity of 1,000 or more head.

A.2. Percentage of cattle placed on feedlots by NAHMS study, 2012 Census of Agriculture, and feedlot capacity:

	Percent Cattle					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
	Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
NAHMS 2017 study	17.9	(2.0)	82.1	(2.0)	100.0	(—)
2012 Census of Agriculture (NASS)	21.9	NA	78.1	NA	100.0	NA

In 2016, 85.7 percent of feedlots placed cattle less than 700 lb, and 28.2 percent placed cattle 700 lb or more. A higher percentage of large capacity feedlots placed cattle 700 lb or more (79.8 percent) than small capacity feedlots (24.0 percent). A higher percentage of large capacity feedlots placed any beef breeds (95.6 percent) than small capacity feedlots (73.4 percent). In contrast, a higher percentage of small capacity feedlots placed dairy breeds or crossbreeds (40.3 percent) than large capacity feedlots (17.7 percent).

A.3. Percentage of feedlots by breed type, placement weight, and feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Breed type and placement weight (lb)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Beef breeds <700	63.3	(5.2)	75.4	(3.2)	64.2	(4.8)
Dairy breeds or dairy crossbreeds <700	36.6	(5.6)	14.1	(2.3)	34.9	(5.2)
Any cattle <700	86.1	(3.4)	80.3	(3.0)	85.7	(3.1)
Beef breeds ≥700	20.1	(4.3)	79.6	(2.9)	24.5	(4.0)
Dairy breeds or dairy crossbreeds ≥700	5.7	(2.2)	6.5	(2.2)	5.7	(2.1)
Any cattle ≥700	24.0	(4.5)	79.8	(2.9)	28.2	(4.2)
Any beef breeds	73.4	(4.9)	95.6	(1.6)	75.0	(4.6)
Any dairy breeds or dairy crossbreeds	40.3	(5.8)	17.7	(3.0)	38.6	(5.4)

Overall, 48.9 percent of cattle were less than 700 lb when placed, and 51.1 percent were 700 lb or more. More than 8 of 10 cattle placed were beef breeds (83.6 percent) and less than 2 of 10 were dairy or dairy crossbreeds (16.4 percent).

A.4. Percentage of cattle by breed type, placement weight, and feedlot capacity:

	Percent Cattle					
	Feedlot Capacity (number head)					
	Small (50-999)		**Large** (1,000 or more)		**All feedlots**	
Breed type and placement weight (lb)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Placement weight (lb)						
Any cattle <700	79.9	(5.2)	42.1	(2.2)	48.9	(2.3)
Any cattle ≥700	20.1	(5.2)	57.9	(2.2)	51.1	(2.3)
Total	100.0		100.0		100.0	
Breed type						
Any beef breeds	58.6	(7.8)	89.0	(2.0)	83.6	(2.4)
Any dairy breeds or dairy crossbreeds	41.4	(7.8)	11.0	(2.0)	16.4	(2.4)
Total	100.0		100.0		100.0	
Breed type and placement weight (lb)						
Beef breeds <700	47.2	(7.0)	33.3	(1.8)	35.8	(1.9)
Dairy breeds or dairy crossbreeds <700	32.6	(7.6)	8.8	(1.3)	13.1	(2.0)
Beef breeds ≥700	11.3	(2.7)	55.7	(2.6)	47.8	(2.5)
Dairy breeds or dairy crossbreeds ≥700	8.8	(4.8)	2.2	(1.3)	3.4	(1.4)
Total	100.0		100.0		100.0	

As a feedlot average, beef breeds on small feedlots spent more time on feed than those on large feedlots (278 and 228 days, respectively), regardless of placement weight. Dairy breeds or dairy crossbreeds placed at less than 700 lb were on feed longer than beef breeds placed at less than 700 lb. Dairy breeds, such as Holstein steers, are often placed in feedlots at weights of 250 to 350 pounds, which is lower than the placement weights of typical beef calves. The light placement weight for dairy breed steers means that they will spend a longer time on the feedlot compared with beef breeds.

A.5. Feedlot average number of days on feed (from placement to marketing) for cattle placed in 2016, by breed type, placement weight, and feedlot capacity:

	Feedlot Average Days on Feed					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Breed type and placement weight (lb)	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Beef breeds <700	278	(19)	228	(5)	273	(18)
Dairy breeds or dairy cross breeds <700	404	(23)	343	(19)	402	(22)
Beef breeds ≥700	219	(24)	160	(5)	204	(18)
Dairy breeds or dairy crossbreeds ≥700	303	(47)	239	(30)	298	(43)

In 2016, 2.3 percent of cattle placed at less than 700 lb died compared with 1.2 percent of cattle placed at 700 lb or more.

A.6. Percentage of cattle that died at the feedlot in 2016, by placement weight and by feedlot capacity:

	Percent Cattle					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Placement weight (lb)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
<700	2.3	(0.4)	2.3	(0.2)	2.3	(0.2)
≥700	1.0	(0.2)	1.2	(0.1)	1.2	(0.1)

B. Overall Antimicrobial Use

Note: The time period for this table is January 1 through December 31, 2016, prior to FDA policy changes that took effect January 1, 2017 (see Introduction on p 1).

In 2016, 87.5 percent of feedlots gave cattle any (one or more) antimicrobials in feed, water, or by injection. Over the course of a year, it is likely that at least one animal on a feedlot will get sick and require antimicrobial therapy, and this likelihood increases as the number of cattle on the feedlot increases. Almost half of feedlots (44.4 percent) did not use any medically important antimicrobials in feed. Almost all large feedlots (97.9 percent) gave injectable antimicrobials to individual sick animals compared with 78.5 percent of small feedlots. Overall, 39.3 percent of large feedlots administered injectable antimicrobials to groups of cattle compared with 12.8 percent of small feedlots. Only 8.5 percent of feedlots gave antimicrobials in water.

B.1. Percentage of feedlots that gave any cattle any antimicrobials in feed, water, or by injection, by route of administration and by feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Route of administration	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Feed—any medically important antimicrobial	53.8	(6.0)	77.8	(3.6)	55.6	(5.5)
Feed—only nonmedically important antimicrobials[1]	15.6	(4.6)	9.3	(2.5)	15.2	(4.2)
Feed—any antimicrobial	69.5	(4.8)	87.1	(2.8)	70.8	(4.5)
Water[2]	9.1	(3.2)	1.1	(0.7)	8.5	(2.9)
Injection (group)[2]	12.8	(3.8)	39.3	(3.4)	14.8	(3.5)
Injection (individual)[2]	78.5	(4.9)	97.9	(1.0)	80.0	(4.6)
Any antimicrobials	86.6	(4.0)	99.5	(0.5)	87.5	(3.7)

[1]Ionophores were the only antimicrobials used by feedlots in this report that are not considered medically important by the FDA.

[2]All antimicrobials used in water or by injection in this report are considered medically important by the FDA.

C. Antimicrobial Use in Feed

Note: Unless otherwise specified, the time period for all tables is January 1 through December 31, 2016, prior to FDA policy changes that took effect January 1, 2017 (see Introduction on p 1).

Antimicrobial use in feed was captured by different placement weights of cattle. This report will first cover all cattle, followed by cattle less than 700 lb at placement and cattle 700 lb or more at placement.

The use of antimicrobials in feed is regulated by the FDA Center for Veterinary Medicine through product labeling regarding appropriate indications (reasons for use) and levels of inclusion in feed. Extra-label use of antimicrobials in livestock feed (i.e., using antimicrobials in feed for indications that do not appear on the label or at levels other than those approved on the label) is not allowed under any circumstances. In order to legally use more than one antimicrobial in feed for a group of cattle on the same day, the antimicrobials must be approved as combination products. For example, monensin with tylosin is approved as a combination product for use in beef cattle, so these two antimicrobials can be used at the same time for a group of cattle. In contrast, chlortetracycline with tylosin is not an approved combination product for beef cattle, so these two drugs cannot be used at the same time in a group of cattle. This restriction includes a prohibition on practices such as feeding chlortetracycline in the morning and feeding tylosin in the evening.

Many antimicrobials, whether single or combination products, have multiple approved indications for their use. For example, in 2016, ionophores such as monensin were approved for preventing and controlling coccidiosis and for improving feed efficiency/ growth promotion. Another example is chlortetracycline, which is approved in beef cattle for treatment of bacterial enteritis and bacterial pneumonia, control of bacterial pneumonia, reduction of the incidence of liver abscesses, and control of active infection of anaplasmosis. In 2016, chlortetracycline was also approved for increased rate of gain and improved feed efficiency.

Before January 1, 2017, there were several medically important antimicrobials that could be used for increased rate of gain and improved feed efficiency (i.e., growth promotion) in cattle feed. These included chlortetracycline, oxytetracycline, virginiamycin, and neomycin/oxytetracycline. As of January 1, 2017, these medically important antimicrobials can no longer be used for growth promotion in cattle feed. Antimicrobials not categorized as medically important, including ionophores, bambermycin, and bacitracin zinc, can still be used for growth promotion in cattle feed.

Respondents were asked to indicate the percentage of cattle that received specific antimicrobials, the reason for their use, and the feedlot average number of days the antimicrobial was used. Respondents were given a list of reasons for use that was

developed according to the labels of antimicrobials approved for use in beef cattle feed. Respondents could select combinations, if appropriate. For example, monensin with tylosin is approved for prevention and control of coccidiosis, improved feed efficiency, and reduction of liver abscesses. Respondents could have selected any combination of the three approved indications for monensin with tylosin.

1. All cattle

In 2016, 70.8 percent of all feedlots gave cattle any (one or more) antimicrobials, including ionophores, in feed for any reason. A higher percentage of small feedlots (30.5 percent) did not give antimicrobials in feed compared with large feedlots (12.9 percent). The highest percentages of feedlots gave antimicrobials in feed to prevent, control, or treat respiratory disease or for growth promotion, regardless of feedlot capacity. A higher percentage of large feedlots than small feedlots fed antimicrobials for liver abscesses.

C.1.a. Percentage of feedlots that gave any cattle any antimicrobials in feed in 2016, by reason(s) for using antimicrobials and by feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	40.4	(6.0)	59.5	(3.6)	41.8	(5.5)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(—)	0.4	(0.4)	0.0	(0.0)
Prevent, control, or treat liver abscesses	3.0	(2.1)	8.1	(1.6)	3.4	(1.9)
Prevent or control coccidiosis	6.6	(3.5)	5.4	(1.3)	6.5	(3.3)
Growth promotion	29.3	(5.7)	30.6	(3.5)	29.4	(5.2)
Combination of liver abscesses, coccidiosis, and growth promotion	0.2	(0.1)	9.6	(1.6)	0.9	(0.2)

continued→

C.1.a. (cont'd.) Percentage of feedlots that gave any cattle any antimicrobials in feed in 2016, by reason(s) for using antimicrobials and by feedlot capacity:

Combination of liver abscesses and growth promotion	1.6	(1.0)	13.1	(2.7)	2.4	(0.9)
Combination of respiratory disease and growth promotion	0.7	(0.7)	2.1	(1.1)	0.8	(0.6)
Combination of diarrhea and growth promotion	0.0	(0.0)	1.1	(0.6)	0.1	(0.1)
Combination of coccidiosis and growth promotion	7.8	(3.1)	13.9	(2.5)	8.3	(2.9)
Other disease prevention, control, or treatment	5.6	(1.5)	7.8	(2.1)	5.8	(1.4)
Any reason	69.5	(4.8)	87.1	(2.8)	70.8	(4.5)
No use	30.5	(4.8)	12.9	(2.8)	29.2	(4.5)

In 2016, 35.9 percent of cattle received antimicrobials in feed for growth promotion; 30.4 percent received antimicrobials in feed for prevention, control, or treatment of liver abscesses and for growth promotion; and 25.6 percent received antimicrobials in feed to prevent, control, or treat respiratory disease.

C.1.b. Percentage of cattle given any antimicrobials in feed, by reason(s) for using antimicrobials and by feedlot capacity:

	Percent Cattle					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	40.3	(7.6)	22.4	(3.5)	25.6	(3.3)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(0.0)	0.0	(0.0)	0.0	(0.0)
Prevent, control, or treat liver abscesses	2.7	(1.4)	5.6	(1.7)	5.1	(1.4)

continued→

C.1.b. (cont'd.) Percentage of cattle given any antimicrobials in feed, by reason(s) for using antimicrobials and by feedlot capacity:

Prevent or control coccidiosis	6.0	(4.0)	1.8	(0.7)	2.5	(0.9)
Growth promotion	36.7	(8.3)	35.7	(5.7)	35.9	(4.9)
Combination of liver abscesses, coccidiosis, and growth promotion	0.9	(0.6)	20.3	(4.1)	16.8	(3.3)
Combination of liver abscesses and growth promotion	8.8	(5.1)	35.2	(5.8)	30.4	(5.0)
Combination of respiratory disease and growth promotion	0.6	(0.6)	0.7	(0.3)	0.7	(0.3)
Combination of diarrhea and growth promotion	0.0	(0.0)	1.1	(0.6)	0.9	(0.5)
Combination of coccidiosis and growth promotion	9.0	(3.1)	6.9	(1.7)	7.3	(1.5)
Other disease prevention, control, or treatment	6.0	(3.8)	7.2	(3.9)	7.0	(3.2)

Ionophores (monensin, lasalocid, laidlomycin) used alone and chlortetracycline used alone were the antimicrobials used in feed by the highest percentages of feedlots: about 40 percent of all feedlots gave these antimicrobials in feed. Ionophores are primarily used for growth promotion and to prevent and control coccidiosis. Chlortetracycline is primarily used to control and treat respiratory disease (see table C.1.e).

Ionophores could be given alone or in combination with another antimicrobial; 49.3 percent of feedlots gave ionophores in feed alone or in combination, and 15.2 percent gave only ionophores (no other antimicrobials were used). A lower percentage of small feedlots than large feedlots gave chlortetracycline (38.9 and 59.4 percent, respectively) and monensin with tylosin (6.0 percent and 29.0 percent, respectively).

Of the antimicrobials in the following table, ionophores, bacitracin, and bambermycin are not categorized as medically important by the FDA. All other antimicrobials in the table are categorized as medically important. Bacitracin and bambermycin were not used by any feedlots in this study, so ionophores were the only antimicrobials used that were not categorized as medically important. Overall, 44.4 percent of feedlots did not feed any medically important antimicrobials. A higher percentage of large feedlots (77.8 percent) gave cattle medically important antimicrobials in feed compared with small feedlots (53.8 percent).

C.1.c. Percentage of feedlots that gave any cattle the following antimicrobial(s) in feed in 2016, by feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Antimicrobial	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Noncombination ionophore (e.g., monensin, lasalocid, laidlomycin)	41.0	(5.3)	49.9	(3.7)	41.7	(4.9)
Bacitracin	0.0	(—)	0.0	(—)	0.0	(—)
Bambermycin	0.0	(—)	0.0	(—)	0.0	(—)
Chlortetracycline	38.9	(5.5)	59.4	(3.7)	40.4	(5.1)
Chlortetracycline with sulfamethazine	5.4	(2.3)	6.6	(2.0)	5.5	(2.1)
Laidlomycin with chlortetracycline	1.2	(0.9)	1.3	(0.9)	1.2	(0.8)
Lasalocid with chlortetracycline	1.2	(0.8)	3.0	(1.3)	1.4	(0.8)
Lasalocid with oxytetracycline	0.0	(—)	0.3	(0.2)	0.0	(0.0)
Lasalocid with tylosin (heifers only)[1]	0.0	(—)	4.7	(1.3)	0.4	(0.1)
Monensin with tylosin	6.0	(2.5)	29.0	(3.3)	7.7	(2.3)
Monensin with tilmicosin	0.1	(0.1)	0.7	(0.5)	0.2	(0.1)
Neomycin	0.0	(—)	0.0	(—)	0.0	(—)
Neomycin with oxytetracycline	0.0	(—)	0.0	(—)	0.0	(—)
Oxytetracycline	0.1	(0.0)	2.9	(1.4)	0.3	(0.1)
Tilmicosin	0.0	(—)	0.3	(0.3)	0.0	(0.0)
Tylosin	4.2	(2.6)	5.3	(1.4)	4.3	(2.4)
Virginiamycin	0.0	(—)	0.0	(—)	0.0	(—)
Any ionophore	47.2	(5.3)	75.5	(3.4)	49.3	(4.9)
Only ionophores used	15.6	(4.6)	9.3	(2.5)	15.2	(4.2)
Any medically important antimicrobial[2]	53.8	(6.0)	77.8	(3.6)	55.6	(5.5)
Any antimicrobial	69.5	(4.8)	87.1	(2.8)	70.8	(4.5)

[1]The only approved combination product with lasalocid (Bovatec®) and tylosin (Tylan®) also includes melengestrol. This combination is fed to heifers only. Melengesterol is not an antimicrobial.

[2]See Appendix II.

Ionophores used alone and monensin (an ionophore) with tylosin were the two antimicrobial products given in feed to the highest percentages of cattle; 48.8 percent of all cattle were given an ionophore used alone, and 52.1 percent were given monensin with tylosin. A higher percentage of cattle on large feedlots were given monensin with tylosin in feed than cattle on small feedlots (60.9 and 11.7 percent, respectively). About one-fourth of cattle (26.1 percent) were fed chlortetracycline.

C.1.d. Percentage of cattle by antimicrobial(s) received in feed, and by feedlot capacity:

Percent Cattle

Feedlot Capacity (number head)

	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Antimicrobial	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Noncombination ionophore (monensin, lasalocid, laidlomycin)	52.5	(7.1)	47.9	(5.5)	48.8	(4.7)
Bacitracin	0.0	(—)	0.0	(—)	0.0	(—)
Bambermycin	0.0	(—)	0.0	(—)	0.0	(—)
Chlortetracycline	41.1	(7.4)	22.8	(3.6)	26.1	(3.4)
Chlortetracycline with sulfamethazine	4.5	(2.2)	4.7	(3.3)	4.7	(2.8)
Laidlomycin with chlortetracycline	1.2	(0.8)	0.2	(0.2)	0.4	(0.2)
Lasalocid with chlortetracycline	1.0	(0.6)	0.7	(0.3)	0.7	(0.3)
Lasalocid with oxytetracycline	0.0	(—)	0.0	(0.0)	0.0	(0.0)
Lasalocid with tylosin (heifers only)*	0.0	(—)	2.4	(0.8)	2.0	(0.7)
Monensin with tylosin	11.7	(5.0)	60.9	(4.3)	52.1	(4.1)
Monensin with tilmicosin	0.1	(0.1)	0.5	(0.4)	0.4	(0.3)
Neomycin	0.0	(—)	0.0	(—)	0.0	(—)
Neomycin with oxytetracycline	0.0	(—)	0.0	(—)	0.0	(—)
Oxytetracycline	0.2	(0.2)	0.8	(0.4)	0.7	(0.3)
Tilmicosin	0.0	(—)	0.0	(0.0)	0.0	(0.0)
Tylosin	1.4	(1.0)	3.2	(1.0)	2.9	(0.8)
Virginiamycin	0.0	(—)	0.0	(—)	0.0	(—)

*The only approved combination product with lasalocid (Bovatec®) and tylosin (Tylan®) also includes melengestrol. This combination is fed to heifers only. Melengesterol is not an antimicrobial.

Note: In order to protect producer confidentiality, the remainder of the tables in this section apply only to antimicrobials that were reported as used in feed by 15 percent or more of feedlots. These antimicrobials include noncombination ionophores and chlortetracycline.

For the 41.7 percent of feedlots that gave cattle noncombination ionophores in feed, 69.2 percent gave ionophores for growth promotion alone, 15.8 percent for coccidiosis, and 15.0 percent for coccidiosis and growth promotion. For the 40.4 percent of feedlots that gave cattle chlortetracycline in feed, 85.7 percent gave chlortetracycline to prevent, control, or treat respiratory disease.

C.1.e. For the 41.7 percent of feedlots that gave cattle ionophores in feed, and for the 40.4 percent that gave cattle chlortetracycline in feed (table C.1.c), percentage of feedlots by reason(s) for using each antimicrobial:

	Percent Feedlots			
	Antimicrobial			
	Noncombination ionophore (monensin, lasalocid, laidlomycin)		Chlortetracycline	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	0.2	(0.2)	85.7	(4.0)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(—)	0.1	(0.1)
Prevent, control, or treat liver abscesses	0.1	(0.1)	0.4	(0.2)
Prevent or control coccidiosis	15.8	(7.9)	0.1	(0.1)
Growth promotion	69.2	(9.1)	0.1	(0.0)
Combination of liver abscesses, coccidiosis, and growth promotion	0.1	(0.1)	0.0	(—)
Combination of liver abscesses and growth promotion	0.6	(0.6)	0.1	(0.1)
Combination of respiratory disease and growth promotion	0.1	(0.1)	0.2	(0.2)
Combination of diarrhea and growth promotion	0.2	(0.1)	0.0	(—)
Combination of coccidiosis and growth promotion	15.0	(4.9)	0.0	(—)
Other disease prevention, control, or treatment	0.2	(0.2)	13.5	(3.9)
Total*	101.5	(—)	100.2	(—)

*Columns do not sum to exactly 100 percent because feedlots could have administered the same antimicrobial to cattle <700 lb at placement for one reason and to cattle ≥700 lb at placement for a different reason; thus, the reasons for administering a single antimicrobial were not mutually exclusive.

For the 48.8 percent of cattle given ionophores in feed, 71.4 percent were given ionophores for growth promotion. For the 26.1 percent of cattle given chlortetracycline in feed, 85.5 percent were given chlortetracycline for respiratory disease.

C.1.f. For the 48.8 percent of cattle given ionophores in feed, and for the 26.1 percent of cattle given chlortetracycline in feed (table C.1.d), percentage of cattle by reason(s) for using each antimicrobial:

	Percent Cattle			
	Antimicrobial			
	Noncombination ionophore (monensin, lasalocid, laidlomycin)		Chlortetracycline	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	0.5	(0.4)	85.5	(4.4)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(—)	0.0	(0.0)
Prevent, control, or treat liver abscesses	0.3	(0.2)	0.7	(0.5)
Prevent or control coccidiosis	5.1	(1.9)	0.3	(0.3)
Growth promotion	71.4	(5.8)	1.9	(1.8)
Combination of liver abscesses, coccidiosis, and growth promotion	0.6	(0.6)	0.0	(—)
Combination of liver abscesses and growth promotion	0.6	(0.6)	2.5	(2.4)
Combination of respiratory disease and growth promotion	0.3	(0.3)	1.8	(1.1)
Combination of diarrhea and growth promotion	1.4	(1.0)	0.0	(—)
Combination of coccidiosis and growth promotion	13.9	(3.4)	0.0	(—)
Other disease prevention, control, or treatment	6.6	(5.6)	7.7	(3.2)
Total*	100.7	(—)	100.4	(—)

*Columns do not sum to exactly 100 percent because feedlots could have administered the same antimicrobial to cattle <700 lb at placement for one reason and to cattle ≥700 lb at placement for a different reason; thus, the reasons for administering a single antimicrobial were not mutually exclusive.

2. Cattle less than 700 lb at placement

Cattle less than 700 lb at placement are generally young and recently weaned. Placed cattle that have not been backgrounded or preconditioned have a higher risk of disease, especially if they originate from multiple sources.

Of feedlots that placed any cattle less than 700 lb, 71.6 percent gave those cattle any (one or more) antimicrobials in feed. The highest percentages of feedlots gave antimicrobials in feed to these cattle to prevent, control, or treat respiratory disease (45.0 percent) or for growth promotion (29.8 percent).

C.2.a. For the 85.7 percent of feedlots that placed any cattle less than 700 lb (table A.3), percentage of feedlots that gave these cattle any antimicrobials in feed, by reason(s) for using antimicrobials and by feedlot capacity:

Percent Feedlots

Feedlot Capacity (number head)

Reason for use	Small (50–999) Pct.	Small (50–999) Std. error	Large (1,000 or more) Pct.	Large (1,000 or more) Std. error	All feedlots Pct.	All feedlots Std. error
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	43.9	(6.4)	59.1	(4.0)	45.0	(6.0)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(—)	0.5	(0.5)	0.0	(0.0)
Prevent, control, or treat liver abscesses	2.5	(2.2)	7.9	(1.8)	2.9	(2.1)
Prevent or control coccidiosis	7.4	(4.1)	5.5	(1.5)	7.3	(3.8)
Growth promotion	30.0	(6.2)	26.2	(3.5)	29.8	(5.8)
Combination of liver abscesses, coccidiosis, and growth promotion	0.2	(0.1)	11.4	(1.9)	1.0	(0.2)
Combination of liver abscesses and growth promotion	0.5	(0.3)	12.0	(2.8)	1.3	(0.4)
Combination of respiratory disease and growth promotion	0.8	(0.8)	2.7	(1.4)	1.0	(0.8)
Combination of diarrhea and growth promotion	0.0	(0.0)	1.4	(0.8)	0.1	(0.1)
Combination of coccidiosis and growth promotion	8.7	(3.6)	14.3	(2.9)	9.1	(3.4)
Other disease prevention, control, or treatment	5.1	(1.0)	6.5	(2.3)	5.2	(1.0)
Any reason	70.7	(5.4)	84.2	(3.9)	71.6	(5.0)
No use	29.3	(5.4)	15.8	(3.9)	28.4	(5.0)

Overall, 36.7 percent of cattle less than 700 lb at placement were given antimicrobials in feed for growth promotion. About one-third of these cattle (33.7 percent) were given antimicrobials in feed for respiratory disease.

C.2.b. For the 48.9 percent of cattle less than 700 lb at placement (table A.4), percentage of cattle given any antimicrobial in feed, by reason(s) for using antimicrobials and by feedlot capacity:

Percent Cattle

Feedlot Capacity (number head)

	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	47.6	(8.5)	27.9	(4.3)	33.7	(4.2)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(—)	0.0	(0.0)	0.0	(0.0)
Prevent, control, or treat liver abscesses	1.7	(1.2)	5.2	(1.4)	4.2	(1.0)
Prevent or control coccidiosis	6.9	(5.0)	2.0	(0.9)	3.4	(1.6)
Growth promotion	42.1	(9.3)	34.5	(5.8)	36.7	(4.9)
Combination of liver abscesses, coccidiosis, and growth promotion	0.6	(0.4)	16.6	(3.2)	11.9	(2.3)
Combination of liver abscesses and growth promotion	2.4	(1.9)	32.6	(6.0)	23.8	(4.6)
Combination of respiratory disease and growth promotion	0.8	(0.7)	1.4	(0.7)	1.2	(0.5)
Combination of diarrhea and growth promotion	0.0	(0.0)	1.6	(0.9)	1.1	(0.6)
Combination of coccidiosis and growth promotion	8.8	(3.7)	12.4	(3.4)	11.3	(2.6)
Other disease prevention, control, or treatment	6.8	(4.7)	6.2	(4.0)	6.3	(3.1)

The highest percentages of feedlots gave an ionophore or chlortetracycline in feed to cattle less than 700 lb at placement (each given on 43.3 percent of feedlots). A higher percentage of large feedlots than small feedlots gave cattle monensin with tylosin in feed (29.8 and 4.5 percent, respectively). Ionophores can be fed alone or with another antimicrobial in a combination product. About one-half of feedlots (50.3 percent) fed any ionophore (alone or in a combination product), and 14.3 percent of feedlots used only ionophores.

Almost one-half of feedlots (42.6 percent) did not give cattle less than 700 lb at placement any (one or more) medically important antimicrobials in feed. A higher percentage of large feedlots (79.2 percent) than small feedlots (55.7 percent) gave cattle any medically important antimicrobials in feed.

C.2.c. For the 85.7 percent of feedlots that placed any cattle less than 700 lb (table A.3), percentage of feedlots that gave these cattle the following antimicrobial(s) in feed, by feedlot capacity:

Percent Feedlots

Feedlot Capacity (number head)

Antimicrobial	Small (50–999) Pct.	Small (50–999) Std. error	Large (1,000 or more) Pct.	Large (1,000 or more) Std. error	All feedlots Pct.	All feedlots Std. error
Noncombination ionophore (monensin, lasalocid, laidlomycin)	43.1	(5.8)	46.1	(4.0)	43.3	(5.4)
Bacitracin	0.0	(—)	0.0	(—)	0.0	(—)
Bambermycin	0.0	(—)	0.0	(—)	0.0	(—)
Chlortetracycline	42.2	(6.2)	57.4	(4.2)	43.3	(5.7)
Chlortetracycline with sulfamethazine	4.1	(1.9)	5.3	(1.9)	4.2	(1.8)
Laidlomycin with chlortetracycline	1.4	(1.0)	1.1	(1.0)	1.3	(0.9)
Lasalocid with chlortetracycline	1.3	(0.9)	2.9	(1.5)	1.4	(0.9)
Lasalocid with oxytetracycline	0.0	(—)	0.3	(0.3)	0.0	(0.0)
Lasalocid with tylosin (heifers only)[1]	0.0	(—)	5.2	(1.5)	0.4	(0.1)

continued→

C.2.c. (cont'd.) For the 85.7 percent of feedlots that placed any cattle less than 700 lb (table A.3), percentage of feedlots that gave these cattle the following antimicrobial(s) in feed, by feedlot capacity:

Monensin with tilmicosin	0.1	(0.1)	0.3	(0.3)	0.2	(0.1)
Monensin with tylosin	4.5	(2.7)	29.8	(3.6)	6.3	(2.5)
Neomycin	0.0	(—)	0.0	(—)	0.0	(—)
Neomycin with oxytetracycline	0.0	(—)	0.0	(—)	0.0	(—)
Oxytetracycline	0.1	(0.0)	3.6	(1.7)	0.3	(0.1)
Tilmicosin	0.0	(—)	0.0	(—)	0.0	(—)
Tylosin	4.8	(2.9)	5.5	(1.6)	4.8	(2.7)
Virginiamycin	0.0	(—)	0.0	(—)	0.0	(—)
Any ionophore	48.6	(5.9)	73.6	(4.2)	50.3	(5.4)
Only ionophores used	15.0	(4.8)	5.0	(1.4)	14.3	(4.4)
Any medically important antimicrobial[2]	55.7	(6.6)	79.2	(4.0)	57.4	(6.1)
Any antimicrobial	70.7	(5.4)	84.2	(3.9)	71.6	(5.0)

[1]The only approved combination product with lasalocid (Bovatec) and tylosin (Tylan) also includes melengestrol. This combination is fed to heifers only.
[2]See appendix II.

Overall, 55.6 percent of cattle less than 700 lb at placement were given an ionophore alone in feed. More than one-third of cattle less than 700 lb at placement (37.8 percent) were given monensin with tylosin. A higher percentage of cattle on large feedlots than on small feedlots were given monensin with tylosin (51.6 percent and 4.4 percent respectively). About one-third of cattle less than 700 lb at placement (33.9 percent) were fed chlortetracycline.

C.2.d. For the 48.9 percent of cattle less than 700 lb at placement (table A.4), percentage of cattle by antimicrobial(s) given in feed, and by feedlot capacity:

Percent Cattle

Feedlot Capacity (number head)

	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Antimicrobial	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Noncombination ionophore(monensin, lasalocid, laidlomycin)	58.9	(7.3)	54.3	(5.3)	55.6	(4.3)
Bacitracin	0.0	(—)	0.0	(—)	0.0	(—)
Bambermycin	0.0	(—)	0.0	(—)	0.0	(—)
Chlortetracycline	48.6	(8.2)	27.9	(4.3)	33.9	(4.2)
Chlortetracycline with sulfamethazine	4.5	(2.6)	5.9	(4.0)	5.5	(2.9)
Laidlomycin with chlortetracycline	1.5	(1.0)	0.3	(0.3)	0.6	(0.4)
Lasalocid with chlortetracycline	1.0	(0.8)	1.0	(0.5)	1.0	(0.4)
Lasalocid with oxytetracycline	0.0	(—)	0.1	(0.1)	0.1	(0.0)
Lasalocid with tylosin (heifers only)*	0.0	(—)	3.6	(1.3)	2.6	(0.9)
Monensin with tilmicosin	0.1	(0.1)	0.1	(0.1)	0.1	(0.1)
Monensin with tylosin	4.4	(2.0)	51.6	(5.1)	37.8	(4.3)
Neomycin	0.0	(—)	0.0	(—)	0.0	(—)
Neomycin with oxytetracycline	0.0	(—)	0.0	(—)	0.0	(—)
Oxytetracycline	0.3	(0.2)	1.8	(0.9)	1.4	(0.7)

continued→

C.2.d. (cont'd.) For the 48.9 percent of cattle less than 700 lb at placement (table A.4), percentage of cattle by antimicrobial(s) given in feed, and by feedlot capacity:

Tilmicosin	0.0	(—)	0.0	(—)	0.0	(—)
Tylosin	1.8	(1.3)	3.6	(1.1)	3.1	(0.9)
Virginiamycin	0.0	(—)	0.0	(—)	0.0	(—)

*The only approved combination product with lasalocid (Bovatec) and tylosin (Tylan) also includes melengestrol. This combination is fed to heifers only. Melengestrol is not an antimicrobial.

Note: In order to protect producer confidentiality, the remaining tables in this section present only antimicrobials that were reported as used in feed by 15 percent or more of feedlots. These antimicrobials include noncombination ionophores and chlortetracycline.

For the 43.3 percent of feedlots that gave cattle less than 700 lb at placement ionophores alone in feed, 66.3 percent gave ionophores for growth promotion, 16.7 percent for coccidiosis, and 15.5 percent for coccidiosis and growth promotion; 88.0 percent of these feedlots gave chlortetracycline in feed for respiratory disease.

C.2.e. For the 43.3 percent of feedlots that gave cattle less than 700 lb at placement ionophores in feed, and for 43.3 percent that gave chlortetracycline in feed (table C.2.c), percentage of feedlots by reason(s) for using each antimicrobial:

	Percent Feedlots			
	Antimicrobial			
	Noncombination ionophore (monensin, lasalocid, laidlomycin)		Chlortetracycline	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	0.2	(0.2)	88.0	(2.8)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(—)	0.1	(0.1)
Prevent, control, or treat liver abscesses	0.1	(0.1)	0.3	(0.2)
Prevent or control coccidiosis	16.7	(8.7)	0.1	(0.1)
Growth promotion	66.3	(9.9)	0.1	(0.1)
Combination of liver abscesses, coccidiosis, and growth promotion	0.1	(0.1)	0.0	(—)
Combination of liver abscesses and growth promotion	0.7	(0.6)	0.1	(0.1)
Combination of respiratory disease and growth promotion	0.1	(0.1)	0.3	(0.2)
Combination of diarrhea and growth promotion	0.2	(0.1)	0.0	(—)
Combination of coccidiosis and growth promotion	15.5	(5.4)	0.0	(—)
Other disease prevention, control, or treatment	0.3	(0.2)	11.1	(2.7)
Total	100.0	(—)	100.0	(—)

Of the 55.6 percent of cattle less than 700 lb at placement given an ionophore alone in feed, 64.4 percent were given the ionophore for growth promotion and 20.1 percent for coccidiosis and growth promotion. Of the 33.9 percent of cattle less than 700 lb at placement given chlortetracycline in feed, 86.1 percent were given it for respiratory disease.

C.2.f. For the 55.6 percent of cattle less than 700 lb at placement given ionophores alone in feed, and for the 33.9 percent of cattle given chlortetracycline in feed (table C.2.d), percentage of cattle by reason(s) for using each antimicrobial:

	Percent Cattle			
	Antimicrobial			
	Noncombination ionophore (monensin, lasalocid, laidlomycin)		Chlortetracycline	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	0.3	(0.3)	86.1	(4.9)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(—)	0.0	(0.0)
Prevent, control, or treat liver abscesses	0.2	(0.2)	0.1	(0.1)
Prevent or control coccidiosis	5.9	(2.9)	0.4	(0.4)
Growth promotion	64.4	(6.1)	1.5	(1.4)
Combination of liver abscesses, coccidiosis, and growth promotion	1.1	(1.0)	0.0	(—)
Combination of liver abscesses and growth promotion	1.0	(1.0)	1.2	(1.2)
Combination of respiratory disease and growth promotion	0.2	(0.2)	2.4	(1.5)
Combination of diarrhea and growth promotion	1.3	(0.9)	0.0	(—)
Combination of coccidiosis and growth promotion	20.1	(4.9)	0.0	(—)
Other disease prevention, control, or treatment	5.7	(5.1)	8.2	(4.3)
Total	100.0	(—)	100.0	(—)

The feedlot average number of days that cattle less than 700 lb at placement were given ionophores was 246 days. Beef breeds less than 700 lb at placement spent an average of 273 days on the feedlot, and dairy breeds spent an average of 402 days on the feedlot (table A.5). On average, chlortetracycline was given to these cattle for 24 days.

C.2.g. Feedlot average number of days a typical pen consisting of cattle less than 700 lb received the following antimicrobial(s) in feed:

Antimicrobial	Feedlot average number of days	Std. error
Noncombination ionophore (monensin, lasalocid, laidlomycin)	246	(25)
Chlortetracycline	24	(8)

3. Cattle 700 lb or more at placement

Cattle 700 lb or more at placement are more likely to have spent time on a backgrounder or stocker operation prior to entering the feedlot, so they often have a lower risk of disease upon placement. Many of these cattle enter the feedlot as yearlings, which are generally considered the lowest risk cattle entering the feedlot.

Of the feedlots that placed cattle weighing 700 lb or more, 68.0 percent gave those cattle any (one or more) antimicrobials in feed. More than one-fourth of feedlots (26.3 percent) fed these cattle antimicrobials for growth promotion. About one-fifth of feedlots (22.8 percent) fed antimicrobials for respiratory disease, with a higher percentage of large feedlots feeding antimicrobials for respiratory disease than small feedlots (48.0 and 16.0 percent, respectively).

C.3.a. For the 28.2 percent of feedlots that placed any cattle 700 lb or more (table A.3), percentage of feedlots that gave these cattle any antimicrobials in feed, by reason(s) for using antimicrobials and by feedlot capacity:

Percent Feedlots

Feedlot Capacity (number head)

	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	16.0	(7.3)	48.0	(4.2)	22.8	(6.0)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(—)	0.0	(—)	0.0	(—)
Prevent, control, or treat liver abscesses	4.0	(3.1)	5.9	(1.6)	4.4	(2.5)
Prevent or control coccidiosis	7.5	(6.4)	4.9	(1.5)	6.9	(5.1)
Growth promotion	25.6	(10.0)	28.5	(3.9)	26.3	(7.9)
Combination of liver abscesses, coccidiosis, and growth promotion	0.6	(0.4)	9.6	(1.8)	2.5	(0.6)
Combination of liver abscesses and growth promotion	4.7	(3.8)	16.1	(3.4)	7.1	(3.1)
Combination of respiratory disease and growth promotion	0.0	(—)	1.3	(1.2)	0.3	(0.3)
Combination of diarrhea and growth promotion	0.0	(—)	0.8	(0.6)	0.2	(0.1)
Combination of coccidiosis and growth promotion	6.8	(3.6)	10.7	(2.4)	7.6	(2.9)
Other disease prevention, control, or treatment	5.2	(5.0)	7.6	(2.5)	5.7	(3.9)
Any reason	63.9	(8.5)	83.1	(3.6)	68.0	(6.6)
No use	36.1	(8.5)	16.9	(3.6)	32.0	(6.6)

For the 51.1 percent of cattle 700 lb or more at placement, 36.8 percent were given an antimicrobial in feed for a combination of liver abscesses and growth promotion, and 35.0 percent were given an antimicrobial in feed for growth promotion.

C.3.b. For the 51.1 percent of cattle 700 lb or more at placement (table A.4), percentage of cattle given any antimicrobials in feed, by reason(s) for using antimicrobials and by feedlot capacity:

	Percent Cattle					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	11.5	(4.9)	18.4	(4.3)	17.9	(4.0)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(—)	0.0	(—)	0.0	(—)
Prevent, control, or treat liver abscesses	7.0	(4.6)	5.9	(2.2)	5.9	(2.1)
Prevent or control coccidiosis	2.3	(1.6)	1.6	(0.7)	1.7	(0.6)
Growth promotion	14.9	(8.7)	36.5	(6.1)	35.0	(5.8)
Combination of liver abscesses, coccidiosis, and growth promotion	2.0	(1.5)	22.9	(5.1)	21.5	(4.8)
Combination of liver abscesses and growth promotion	34.1	(17.7)	37.0	(6.3)	36.8	(6.0)
Combination of respiratory disease and growth promotion	0.0	(—)	0.1	(0.1)	0.1	(0.1)
Combination of diarrhea and growth promotion	0.0	(—)	0.7	(0.5)	0.7	(0.4)
Combination of coccidiosis and growth promotion	10.0	(5.2)	2.9	(1.0)	3.4	(1.0)
Other disease prevention, control, or treatment	2.8	(2.8)	7.9	(4.2)	7.5	(3.9)

Overall, 13.9 percent of feedlots fed monensin with tylosin to cattle 700 lb or more at placement; about one-third of large feedlots (32.2 percent) gave monensin with tylosin compared with about one-tenth of small feedlots (8.9 percent). Nearly one-half of large feedlots (45.7 percent) fed chlortetracycline compared with about 1 of 10 small feedlots (10.5 percent). Overall, 40.8 percent of feedlots gave an ionophore not in combination with another antimicrobial to cattle that were 700 lb or more at placement, and 54.2 percent of feedlots fed any ionophore, which could have been fed alone or in a combination product with another antimicrobial. Over one-fourth of feedlots (29.0 percent) used only ionophores (no other antimicrobials used in feed).

Of feedlots with cattle 700 lb or more at placement, 60.9 percent did **not** give any medically important antimicrobials to cattle, with a higher percentage of large feedlots (71.6 percent) giving a medically important antimicrobial than small feedlots (30.3 percent).

C.3.c. For the 28.2 percent of feedlots that placed any cattle 700 lb or more (table A.3), percentage of feedlots that gave these cattle the following antimicrobial(s) in feed, by feedlot capacity:

Percent Feedlots

	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Antimicrobial	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Noncombination ionophore (monensin, lasalocid, laidlomycin)	39.9	(10.5)	44.3	(4.2)	40.8	(8.3)
Bacitracin	0.0	(—)	0.0	(—)	0.0	(—)
Bambermycin	0.0	(—)	0.0	(—)	0.0	(—)
Chlortetracycline	10.5	(5.5)	45.7	(4.3)	18.0	(4.6)
Chlortetracycline with sulfamethazine	11.0	(6.9)	6.5	(2.2)	10.1	(5.5)
Laidlomycin with chlortetracycline	0.0	(—)	1.6	(1.2)	0.4	(0.3)
Lasalocid with chlortetracycline	0.6	(0.6)	2.5	(1.4)	1.0	(0.6)
Lasalocid with oxytetracycline	0.0	(—)	0.0	(—)	0.0	(—)
Lasalocid with tylosin (heifers only)[1]	0.0	(—)	3.9	(1.4)	0.8	(0.3)

continued→

C.3.c. (cont'd.) For the 28.2 percent of feedlots that placed any cattle 700 lb or more (table A.3), percentage of feedlots that gave these cattle the following antimicrobial(s) in feed, by feedlot capacity:

Monensin with tylosin	8.9	(4.9)	32.2	(3.9)	13.9	(4.1)
Monensin with tilmicosin	0.0	(—)	0.5	(0.5)	0.1	(0.1)
Neomycin	0.0	(—)	0.0	(—)	0.0	(—)
Neomycin with oxytetracycline	0.0	(—)	0.0	(—)	0.0	(—)
Oxytetracycline	0.0	(—)	2.2	(1.5)	0.5	(0.3)
Tilmicosin	0.0	(—)	0.4	(0.3)	0.1	(0.1)
Tylosin	0.0	(—)	3.1	(1.2)	0.7	(0.3)
Virginiamycin	0.0	(—)	0.0	(—)	0.0	(—)
Any ionophore	48.8	(10.1)	74.3	(4.1)	54.2	(7.9)
Only ionophores used	33.7	(10.7)	11.5	(3.1)	29.0	(8.7)
Any medically important antimicrobial[2]	30.3	(9.2)	71.6	(4.3)	39.1	(7.5)
Any antimicrobial	63.9	(8.5)	83.1	(3.6)	68.0	(6.6)

[1]The only approved combination product with lasalocid (Bovatec) and tylosin (Tylan) also includes melengestrol. This combination is fed to heifers only. Melengestrol is not an antimicrobial.
[2]See appendix II.

Ionophores alone and monensin with tylosin were the two in-feed antimicrobial products given to the highest percentages of cattle 700 lb or more at placement; 65.9 percent of cattle were fed monensin with tylosin, and 42.2 percent were given ionophores not in a combination with other antimicrobials.

C.3.d. For the 51.1 percent of cattle 700 lb or more at placement (table A.4), percentage of cattle that received the following antimicrobial(s) in feed, by feedlot capacity:

	Percent Cattle					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Antimicrobial	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Noncombination ionophore (monensin, lasalocid, laidlomycin)	27.3	(10.9)	43.3	(6.3)	42.2	(6.0)
Bacitracin	0.0	(—)	0.0	(—)	0.0	(—)
Bambermycin	0.0	(—)	0.0	(—)	0.0	(—)
Chlortetracycline	12.0	(5.7)	19.1	(4.3)	18.6	(4.0)
Chlortetracycline with sulfamethazine	4.5	(2.4)	3.9	(2.9)	4.0	(2.7)
Laidlomycin with chlortetracycline	0.0	(—)	0.2	(0.2)	0.2	(0.2)
Lasalocid with chlortetracycline	1.0	(1.0)	0.5	(0.3)	0.5	(0.3)
Lasalocid with oxytetracycline	0.0	(—)	0.0	(—)	0.0	(—)
Lasalocid with tylosin (heifers only)*	0.0	(—)	1.5	(0.6)	1.4	(0.5)
Monensin with tylosin	40.9	(16.5)	67.7	(4.7)	65.9	(4.5)
Monensin with tilmicosin	0.0	(—)	0.7	(0.7)	0.7	(0.6)
Neomycin	0.0	(—)	0.0	(—)	0.0	(—)
Neomycin with oxytetracycline	0.0	(—)	0.0	(—)	0.0	(—)
Oxytetracycline	0.0	(—)	0.1	(0.0)	0.1	(0.0)
Tilmicosin	0.0	(—)	0.0	(0.0)	0.0	(0.0)
Tylosin	0.0	(—)	2.9	(1.2)	2.7	(1.1)
Virginiamycin	0.0	(—)	0.0	(—)	0.0	(—)

*The only approved combination product with lasalocid (Bovatec) and tylosin (Tylan) also includes melengestrol. This combination is fed to heifers only. Melengestrol is not an antimicrobial.

Note: In order to protect producer confidentiality, the remainder of the tables in this section only present antimicrobials that were reported as used in feed by 15 percent or more of feedlots. These antimicrobials include noncombination ionophores and chlortetracycline.

For the 40.8 percent of feedlots that gave ionophores in feed to cattle 700 lb or more at placement, 63.1 percent gave the ionophores for growth promotion, and 18.0 percent gave them for coccidiosis and growth promotion. Of the 18.0 percent of feedlots that gave cattle chlortetracycline, 68.4 percent gave it for respiratory disease.

C.3.e. For the 40.8 percent of feedlots that gave ionophores in feed to cattle 700 lb or more at placement, and for the 18.0 percent that gave cattle 700 lb or more at placement chlortetracycline in feed (table C.3.c), percentage of feedlots by reason for using each antimicrobial:

	Percent Feedlots			
	Antimicrobial			
	Noncombination ionophore (monensin, lasalocid, laidlomycin)		Chlortetracycline	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	0.2	(0.1)	68.4	(16.1)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(—)	0.0	(—)
Prevent, control, or treat liver abscesses	0.3	(0.3)	2.3	(1.8)
Prevent or control coccidiosis	17.0	(11.5)	0.0	(—)
Growth promotion	63.1	(12.8)	0.4	(0.4)
Combination of liver abscesses, coccidiosis, and growth promotion	0.2	(0.2)	0.0	(—)
Combination of liver abscesses and growth promotion	0.0	(—)	0.6	(0.6)
Combination of respiratory disease and growth promotion	0.0	(—)	1.5	(1.5)
Combination of diarrhea and growth promotion	0.4	(0.3)	0.0	(—)
Combination of coccidiosis and growth promotion	18.0	(7.6)	0.0	(—)
Other disease prevention, control, or treatment	0.8	(0.6)	26.8	(16.9)
Total	100.0	(—)	100.0	(—)

Of the 42.2 percent of cattle 700 lb or more at placement that were given ionophores in feed, 79.9 percent were given ionophores for growth promotion. Of the 18.6 percent of cattle 700 lb or more at placement fed chlortetracycline, 84.1 were given chlortetracycline for respiratory disease.

C.3.f. For cattle 700 lb or more at placement given the following antimicrobials in feed (table C.3.d), percentage of cattle by antimicrobial(s) given and by reason for using each antimicrobial:

	Percent Cattle			
	Antimicrobial			
	Noncombination ionophore (monensin, lasalocid, laidlomycin)		Chlortetracycline	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Prevent, control, or treat respiratory disease (e.g., bacterial pneumonia)	0.4	(0.4)	84.1	(6.6)
Prevent, control, or treat diarrhea (e.g., bacterial enteritis)	0.0	(—)	0.0	(—)
Prevent, control, or treat liver abscesses	0.4	(0.4)	1.0	(0.9)
Prevent or control coccidiosis	4.0	(1.6)	0.0	(—)
Growth promotion	79.9	(6.9)	2.6	(2.5)
Combination of liver abscesses, coccidiosis, and growth promotion	0.0	(0.0)	0.0	(—)
Combination of liver abscesses and growth promotion	0.0	(—)	4.7	(4.5)
Combination of respiratory disease and growth promotion	0.0	(—)	0.7	(0.7)
Combination of diarrhea and growth promotion	1.6	(1.2)	0.0	(—)
Combination of coccidiosis and growth promotion	6.0	(2.0)	0.0	(—)
Other disease prevention, control, or treatment	7.6	(6.5)	6.9	(3.9)
Total	100.0	(—)	100.0	(—)

The feedlot average number of days that antimicrobials were given in feed to a typical pen consisting of cattle 700 lb or more at placement varied by antimicrobial used. The feedlot average duration of use was 14 days for chlortetracycline and 154 days for noncombination ionophores. The feedlot average number of days cattle 700 lb or more at placement spent in the feedlot was 204 days for beef breeds and 209 days for dairy breeds (table A.5).

C.3.g. Feedlot average number of days a typical pen of cattle consisting of cattle 700 lb or more at placement received the following antimicrobials in feed:

Antimicrobial	Feedlot average number of days	Std. error
Noncombination ionophore (monensin, lasalocid, laidlomycin)	154	(9)
Chlortetracycline	14	(2)

D. Antimicrobial Use in Water

Note: The time period for the following tables is January 1 through December 31, 2016, prior to FDA policy changes that took effect January 1, 2017 (see Introduction on p 1).

The use of antimicrobials in water is not a common practice on cattle feedlots. Because of the anticipated low use of antimicrobials in water, information for this report was captured only by feedlot capacity, not by the weight of cattle at placement.

In 2016, only 8.5 percent of feedlots used any (one or more) antimicrobials in water. Most feedlots did not use antimicrobials in water, with 90.9 percent of the small feedlots and 98.9 percent of the large feedlots not administering any antimicrobials in water. In small feedlots, 8.3 percent used antimicrobials in water to control or treat respiratory disease.

D.1. Percentage of feedlots that gave any cattle any antimicrobials in water, and percentage of cattle that received antimicrobials in water, by reason(s) for using antimicrobials and by feedlot capacity:

Percent

Feedlot Capacity (number head)

	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Reason for use	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Feedlots						
Control or treatment of:						
Respiratory disease (e.g., bacterial pneumonia)	8.3	(3.1)	1.1	(0.7)	7.8	(2.9)
Diarrhea (e.g., bacterial enteritis)	0.7	(0.7)	0.0	(—)	0.7	(0.6)
Foot rot	0.0	(—)	0.0	(—)	0.0	(—)
Other disease	0.0	(—)	0.0	(—)	0.0	(—)
Other reason	0.0	(—)	0.0	(—)	0.0	(—)
Any reason	9.1	(3.2)	1.1	(0.7)	8.5	(2.9)
No use	90.9	(3.2)	98.9	(0.7)	91.5	(2.9)

continued→

D.1. (cont'd.) Percentage of feedlots that gave any cattle any antimicrobials in water, and percentage of cattle that received antimicrobials in water, by reason(s) for using antimicrobials and by feedlot capacity:

Cattle						
Control or treatment of:						
Respiratory disease (e.g., bacterial pneumonia)	3.6	(1.3)	0.0	(0.0)	0.7	(0.2)
Diarrhea (e.g., bacterial enteritis)	0.4	(0.4)	0.0	(—)	0.1	(0.1)
Foot rot	0.0	(—)	0.0	(—)	0.0	(—)
Other disease	0.0	(—)	0.0	(—)	0.0	(—)
Other reason	0.0	(—)	0.0	(—)	0.0	(—)

No specific antimicrobial was used more than any other in water. All antimicrobials in the following table are considered medically important by the FDA (see Appendix II).

D.2. Percentage of feedlots that gave any cattle the following antimicrobials in water, and percentage of cattle that received antimicrobials, by feedlot capacity:

Percent

Feedlot Capacity (number head)

Antimicrobial*	Small (50–999) Pct.	Small (50–999) Std. error	Large (1,000 or more) Pct.	Large (1,000 or more) Std. error	All feedlots Pct.	All feedlots Std. error
Feedlots						
Chlortetracycline	1.2	(1.2)	0.0	(—)	1.1	(1.1)
Neomycin	0.7	(0.7)	0.0	(—)	0.7	(0.6)
Oxytetracycline	0.9	(0.7)	0.0	(—)	0.8	(0.6)
Spectinomycin	0.0	(—)	0.0	(—)	0.0	(—)
Sulfadimethoxine	6.7	(3.1)	0.4	(0.3)	6.2	(2.9)
Sulfamethazine	0.4	(0.3)	0.7	(0.7)	0.4	(0.2)
Tetracycline	0.2	(0.2)	0.0	(—)	0.2	(0.2)
Cattle						
Chlortetracycline	0.6	(0.6)	0.0	(—)	0.1	(0.1)
Neomycin	0.4	(0.3)	0.0	(—)	0.1	(0.1)
Oxytetracycline	0.4	(0.3)	0.0	(—)	0.1	(0.1)
Spectinomycin	0.0	(—)	0.0	(—)	0.0	(—)
Sulfadimethoxine	2.5	(1.3)	0.0	(0.0)	0.4	(0.2)
Sulfamethazine	0.1	(0.1)	0.0	(0.0)	0.0	(0.0)
Tetracycline	0.0	(0.0)	0.0	(—)	0.0	(0.0)

*No other antimicrobials were reported as used in water.

E. Injectable Antimicrobials

Note: Unless otherwise specified, the time period for all tables in this section is January 1 through December 31, 2016, prior to FDA policy changes that took effect January 1, 2017, (see Introduction on p 1).

1. Group treatment with injectable antimicrobials

For the purposes of this report, “treated as a group” means that at least 90 percent of the cattle in a pen or group were treated with any (one or more) injectable antimicrobials for purposes such as preventing, controlling, or treating a disease outbreak.

Shipping fever, or bovine respiratory disease complex, is one of the most common illnesses impacting feedlot cattle. The occurrence of shipping fever in groups of cattle is associated with various factors, including vaccination and nutritional status, source of cattle, and stress associated with transport. When an arriving group of cattle exhibits signs of respiratory disease or is at a high risk of developing shipping fever, feedlots sometimes treat all cattle in the group with an injectable antimicrobial to prevent or control an outbreak. This practice is known as metaphylaxis.

In 2016, 14.8 percent of feedlots ever treated cattle as a group with injectable antimicrobials. A higher percentage of large feedlots ever treated cattle as a group with injectable antimicrobials compared with small feedlots (39.3 and 12.8 percent, respectively).

E.1.a Percentage of feedlots that treated cattle as a group with any injectable antimicrobials, by antimicrobial(s) given and by feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Antimicrobial	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Amoxicillin	0.0	(—)	0.5	(0.5)	0.0	(0.0)
Ceftiofur	2.2	(1.4)	8.7	(2.0)	2.7	(1.3)
Danofloxacin	0.0	(—)	0.8	(0.7)	0.1	(0.1)
Enrofloxacin	2.5	(2.2)	1.1	(0.6)	2.4	(2.0)
Florfenicol	2.3	(2.2)	3.8	(1.6)	2.5	(2.0)
Florfenicol with flunixin meglumine	1.1	(0.7)	1.4	(0.8)	1.1	(0.7)
Gamithromycin	1.9	(1.6)	5.1	(1.2)	2.1	(1.5)
Oxytetracycline	4.6	(2.7)	7.0	(1.6)	4.8	(2.5)
Penicillin	2.3	(1.7)	1.2	(0.6)	2.2	(1.6)
Tildipirosin	0.5	(0.3)	5.8	(1.5)	0.9	(0.3)
Tilmicosin	0.3	(0.2)	10.0	(1.6)	1.0	(0.2)
Tulathromycin	1.5	(0.8)	18.4	(2.6)	2.8	(0.8)
Other	0.0	(—)	0.4	(0.3)	0.0	(0.0)
Any injectable antimicrobial	12.8	(3.8)	39.3	(3.4)	14.8	(3.5)
No use	87.2	(3.8)	60.7	(3.4)	85.2	(3.5)

Overall, 15.6 percent of cattle were treated as a group with any (one or more) injectable antimicrobials.

E.1.b. Percentage of cattle treated as a group when receiving any injectable antimicrobials, by antimicrobial(s) used and by feedlot capacity:

	Percent Cattle					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Antimicrobial	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Amoxicillin	0.0	(—)	0.0	(0.0)	0.0	(0.0)
Ceftiofur	1.9	(1.0)	1.1	(0.4)	1.3	(0.4)
Danofloxacin	0.0	(—)	0.0	(0.0)	0.0	(0.0)
Enrofloxacin	0.1	(0.1)	0.2	(0.1)	0.2	(0.1)
Florfenicol	0.1	(0.1)	0.9	(0.6)	0.7	(0.5)
Florfenicol with flunixin meglumine	0.2	(0.2)	0.6	(0.5)	0.6	(0.4)
Gamithromycin	1.7	(1.6)	3.2	(0.9)	2.9	(0.8)
Oxytetracycline	1.3	(1.2)	1.5	(0.5)	1.4	(0.5)
Penicillin	1.1	(0.9)	0.1	(0.1)	0.3	(0.2)
Tildipirosin	1.6	(1.4)	2.5	(0.7)	2.4	(0.6)
Tilmicosin	0.0	(0.0)	1.7	(0.3)	1.4	(0.3)
Tulathromycin	1.1	(0.5)	5.1	(0.7)	4.4	(0.6)
Other	0.0	(—)	0.0	(0.0)	0.0	(0.0)
Any injectable antimicrobial	8.9	(2.9)	17.0	(1.6)	15.6	(1.4)
No use	91.1	(2.9)	83.0	(1.6)	84.4	(1.4)

Feedlots treat cattle in a group for a variety of reasons. About 8 of 10 feedlots (79.8 percent) indicated that respiratory disease in some cattle in the group was a very important criterion for treating the group with any (one or more) injectable antimicrobials. About 4 of 10 feedlots (38.5 percent) indicated that long shipping distances was a very important criterion for giving groups of cattle injectable antimicrobials. The large standard errors in the following table, however, indicate that there was no single most important criterion for treating cattle as a group with injectable antimicrobials.

E.1.c. For the 14.8 percent of feedlots that treated cattle as a group with any injectable antimicrobials (table E.1.a), percentage of feedlots by criteria used to determine if a group of cattle should be treated with any injectable antimicrobials, and by level of importance of criteria:

	Percent Feedlots						
	Level of Importance						
	Very		Somewhat		Not		
Criteria	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Occurrence of respiratory disease in some of the cattle from the pen/group	79.8	(7.2)	17.1	(6.7)	3.1	(2.2)	100.0
Shipping fever problems in cattle previously received from the same source	62.0	(11.4)	5.6	(1.7)	32.4	(11.1)	100.0
Known lack of preconditioning (other than vaccination) such as lack of introduction to feed bunk, lack of castration, etc.	56.4	(12.0)	12.5	(3.9)	31.1	(11.6)	100.0
Known lack of vaccination against respiratory pathogens	54.3	(11.9)	14.6	(5.7)	31.1	(11.6)	100.0
Season of year (i.e., winter v. summer)	45.6	(12.2)	44.6	(12.3)	9.8	(3.8)	100.0
Long shipping distance (increased stress and shrinkage)	38.5	(11.6)	8.9	(2.6)	52.6	(12.1)	100.0
Purchase source of cattle, such as sale barn	38.4	(11.6)	25.5	(11.6)	36.1	(12.0)	100.0
Appearance of cattle at arrival	37.1	(10.8)	25.5	(11.0)	37.3	(12.5)	100.0
Geographic origin of cattle (e.g., region of U.S.)	18.7	(8.9)	34.2	(12.3)	47.1	(12.1)	100.0
Arrival weight	6.7	(2.0)	38.1	(11.6)	55.1	(11.9)	100.0
Other	9.9	(7.7)	0.0	(—)	90.1	(7.7)	100.0

2. Individual treatment of sick animals with injectable antimicrobials

As the number of cattle on a feedlot increases, so does the likelihood that a disease will occur that requires treatment with injectable antimicrobials. Overall, 80.0 percent of feedlots treated sick animals individually with injectable antimicrobials. Almost all large feedlots (97.9 percent) treated sick individual cattle with any (one or more) injectable antimicrobials compared with 78.5 percent of small feedlots.

E.2.a. Percentage of feedlots that treated sick cattle individually with any injectable antimicrobials, by feedlot capacity:

Percent Feedlots

Feedlot Capacity (number head)					
Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Percent	**Std. error**	**Percent**	**Std. error**	**Percent**	**Std. error**
78.5	(4.9)	97.9	(1.0)	80.0	(4.6)

F. Stewardship

Antimicrobial stewardship and judicious use practices include keeping records of antimicrobial use, offering training to employees, periodically undergoing facility audits or assessments, using a veterinarian, having a valid veterinarian-client-patient relationship, and taking steps to prevent disease.

1. Record-keeping practices

Maintaining accurate, thorough, and up-to-date records of antimicrobial use and treatment outcomes is one of the core principles of judicious antimicrobial use. Keeping records on antimicrobial use allows for the evaluation of therapeutic regimens and helps to ensure adherence to appropriate withdrawal periods. Withdrawal periods are established by the FDA in order to avoid violative drug residues at slaughter. Some antimicrobials used in cattle feed, such as ionophores and tylosin, do not have a specified withdrawal period. Chlortetracycline and oxytetracycline can have short withdrawal periods, depending on the dose used. Chlortetracycline with sulfamethazine has a 7-day withdrawal period. Ionophores and tylosin are typically the only antimicrobials used late in the feeding period. Thus, there is not much incentive for feedlots to record information such as the dates on which antimicrobial use began and ended or on the withdrawal period, if there is no withdrawal period on the products used near the time of marketing.

Of feedlots that gave cattle any (one or more) antimicrobials in feed, 35.4 percent always recorded the date antimicrobial use began, the date antimicrobial use ended (37.1 percent), the antimicrobial used (41.2 percent), and the treatment withdrawal period (30.1 percent). If ionophores and tylosin are excluded because they do not have specified withdrawal periods, the percentage of feedlots that recorded the treatment withdrawal period were not statistically different from the percentage of feedlots shown in the following table.

F.1.a. For the 70.8 percent of feedlots that gave cattle any antimicrobials in **feed** (table C.1.a), percentage of feedlots by type of treatment information recorded and by frequency information was recorded:

Percent Feedlots

Frequency

Information	Never Pct.	Never Std. error	Sometimes Pct.	Sometimes Std. error	Most of the time Pct.	Most of the time Std. error	Always Pct.	Always Std. error	Total
Date antimicrobial use began	38.6	(6.8)	8.2	(3.8)	17.7	(6.3)	35.4	(6.6)	100.0
Date antimicrobial use ended	40.7	(6.9)	11.6	(4.7)	10.5	(4.9)	37.1	(6.7)	100.0
Antimicrobial used	41.3	(6.7)	8.7	(3.9)	8.8	(3.8)	41.2	(6.9)	100.0
Treatment withdrawal period	61.8	(6.9)	4.0	(2.3)	4.0	(2.4)	30.1	(6.6)	100.0

In 2016, more than 90 percent of large feedlots ever recorded the date antimicrobial use began (91.7 percent), the date antimicrobial use ended (91.7 percent), or the antimicrobial given (92.3 percent). About one-half of small feedlots ever recorded this information. About 7 of 10 large feedlots (74.0 percent) ever recorded treatment withdrawal periods compared with about one-third of small feedlots (34.7 percent).

F.1.b. For the 70.8 percent of feedlots that gave cattle any antimicrobials in **feed** (table C.1.a), percentage of feedlots that ever recorded the following treatment information, by feedlot capacity:

Percent Feedlots

Feedlot Capacity (number head)

Information	Small (50–999) Pct.	Small (50–999) Std. error	Large (1,000 or more) Pct.	Large (1,000 or more) Std. error	All feedlots Pct.	All feedlots Std. error
Date antimicrobial use began	58.4	(7.5)	91.7	(2.7)	61.4	(6.8)
Date antimicrobial use ended	56.1	(7.5)	91.7	(2.7)	59.3	(6.9)
Antimicrobial given	55.4	(7.3)	92.3	(2.7)	58.7	(6.7)
Treatment withdrawal period	34.7	(7.6)	74.0	(3.8)	38.2	(6.9)
Any information recorded	60.9	(7.3)	92.6	(2.7)	63.7	(6.7)

Of the 8.5 percent of feedlots that gave antimicrobials in **water**, 19.9 percent always recorded the date antimicrobial use began and 19.7 percent always recorded the antimicrobial used. About 40 percent of feedlots that gave cattle antimicrobials in water never recorded the date antimicrobial use began (41.2 percent), the date antimicrobial use ended (42.6 percent), or the antimicrobial used (42.6 percent); 80.2 percent of feedlots never recorded the treatment withdrawal period. These estimates reflect a small percentage of feedlots (8.5 percent) and are reflective of the recording frequencies of small feedlots, as a higher percentage of small feedlots than large feedlots (9.1 and 1.1 percent, respectively) gave antimicrobials in water (table D.1).

F.1.c. For the 8.5 percent of feedlots that gave cattle any antimicrobials in **water** (table D.1), percentage of feedlots by type of treatment information recorded and by frequency information was recorded:

	Percent Feedlots								
	Frequency								
	Never		Sometimes		Most of the time		Always		
Information	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Date antimicrobial use began	41.2	(19.6)	24.0	(19.3)	14.8	(12.4)	19.9	(14.5)	100.0
Date antimicrobial use ended	42.6	(19.7)	38.3	(20.9)	14.8	(12.4)	4.3	(4.3)	100.0
Antimicrobial used	42.6	(19.7)	24.0	(19.3)	13.7	(12.4)	19.7	(14.5)	100.0
Treatment withdrawal period	80.2	(13.0)	0.7	(0.7)	13.7	(12.4)	5.4	(4.6)	100.0

For feedlots that treated cattle as a group with **injectable** antimicrobials, about one-half always recorded the date treated, the antimicrobial given, and the treatment withdrawal period (58.7, 57.5 and 54.7 percent, respectively). Over one-fourth of feedlots (25.9 percent) never recorded treatment withdrawal periods.

F.1.d. For the 14.8 percent of feedlots that treated cattle as a group with **injectable** antimicrobials (table E.1.a), percentage of feedlots by type of treatment information recorded and by frequency information was recorded:

	Percent Feedlots								
	Frequency								
	Never		Sometimes		Most of the time		Always		
Information	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Date treated	4.4	(2.6)	0.5	(0.5)	36.4	(13.2)	58.7	(12.9)	100.0
Antimicrobial given	9.2	(5.1)	9.5	(8.9)	23.7	(13.0)	57.5	(12.9)	100.0
Treatment withdrawal period	25.9	(12.1)	18.5	(9.3)	0.8	(0.6)	54.7	(12.5)	100.0

For feedlots that treated cattle as a group with injectable antimicrobials, almost all ever recorded the date treated (95.6 percent) and the antimicrobial given (90.8 percent). About three-quarters of feedlots (74.1 percent) ever recorded the treatment withdrawal period, and 92.8 percent of large feedlots ever recorded the withdrawal period.

F.1.e. For the 14.8 percent of feedlots that treated cattle as a group with **injectable** antimicrobials (table E.1.a), percentage of feedlots that ever recorded the following treatment information, by feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		Large (1,000 or more)		All feedlots	
Information	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Date treated	95.4	(3.2)	96.4	(2.5)	95.6	(2.6)
Antimicrobial given	90.0	(6.4)	93.8	(3.3)	90.8	(5.1)
Treatment withdrawal period	69.4	(14.9)	92.8	(3.4)	74.1	(12.1)
Any information recorded	95.4	(3.2)	97.6	(2.3)	95.9	(2.5)

When treating individual sick cattle with injectable antimicrobials, it is important to know whether the cattle were treated close to the time of marketing. Keeping track of this information can be done via written or electronic records, or feedlots could mark an animal with chalk to indicate that it has been treated. However, recording antimicrobial use information such as the date administered, drug administered, and withdrawal period is recommended to prevent drug residues.

For feedlots that treated cattle **individually** with **injectable** antimicrobials, about one-half always recorded the date treated and the antimicrobial given (55.7 and 53.5 percent. respectively), and about one-third (32.2 percent) always recorded the treatment withdrawal period.

F.1.f. For the 80.0 percent of feedlots that treated sick cattle **individually** with **injectable** antimicrobials (table E.2.a), percentage of feedlots by treatment information recorded and by frequency information was recorded:

	Percent Feedlots								
	Frequency								
	Never		Sometimes		Most of the time		Always		
Information	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Total
Date treated	16.5	(4.2)	4.1	(2.4)	23.8	(6.1)	55.7	(6.6)	100.0
Antimicrobial given	21.4	(5.4)	4.7	(2.6)	20.4	(5.7)	53.5	(6.1)	100.0
Treatment withdrawal period	51.4	(5.7)	7.5	(2.9)	8.9	(3.3)	32.2	(5.3)	100.0

Of feedlots that treated sick cattle **individually** with **injectable** antimicrobials in 2016, 83.5 percent ever recorded the date treated and 78.6 percent ever recorded the antimicrobial given. About half of feedlots (48.6 percent) ever recorded the treatment withdrawal period. A higher percentage of large feedlots than small feedlots ever recorded treatment withdrawal periods (77.2 and 45.6 percent, respectively).

F.1.g. For the 80.0 percent of feedlots that treated sick cattle **individually** with **injectable** antimicrobials (table E.2.a), percentage of feedlots that ever recorded the following treatment information, by feedlot capacity:

Percent Feedlots

Feedlot Capacity (number head)

	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Information	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Date treated	82.6	(4.7)	92.3	(2.6)	83.5	(4.2)
Antimicrobial given	77.2	(6.0)	91.9	(2.6)	78.6	(5.4)
Treatment withdrawal period	45.6	(6.3)	77.2	(3.7)	48.6	(5.7)
Any information recorded	83.0	(4.7)	92.6	(2.6)	84.0	(4.2)

2. Beef Quality Assurance

Beef Quality Assurance (BQA) is a national program that raises consumer confidence in beef by offering proper management techniques and a commitment to quality within every segment of the beef industry. BQA principles are based on standard operating procedures designed to meet the needs of the U.S. food production system. BQA programming focuses on educating and training cattle producers, farm advisors, and veterinarians on issues related to food safety and quality. The program also provides tools for verifying and documenting animal husbandry practices.

Producers on 86.4 percent of all feedlots were familiar with or had heard of the BQA program, and producers on 98.6 percent of large feedlots and 85.5 percent of small feedlots were familiar with or had heard of the program.

F.2.a. Percentage of feedlots by producer familiarity with their State's or National Cattlemen's Beef Association's BQA program, and by feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Familiarity	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Very familiar	33.4	(5.4)	71.3	(3.7)	36.2	(5.0)
Somewhat	35.6	(5.2)	24.7	(3.6)	34.8	(4.8)
Heard of name only	16.5	(5.0)	2.6	(1.2)	15.4	(4.7)
Not familiar	14.5	(4.5)	1.4	(0.6)	13.6	(4.2)
Total	100.0		100.0		100.0	

Overall, 29.5 percent of feedlots had a representative attend BQA training in the past 5 years; 75.0 percent of large feedlots had a representative attend BQA training compared with 25.8 percent of small feedlots.

F.2.b. Percentage of feedlots in which a representative attended a national, State, or local BQA meeting or training session in the previous 5 years, by feedlot capacity:

Percent Feedlots					
Feedlot Capacity (number head)					
Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Percent	**Std. error**	**Percent**	**Std. error**	**Percent**	**Std. error**
25.8	(4.7)	75.0	(3.4)	29.5	(4.3)

A BQA Feedyard Assessment is an onsite educational tool that allows for assessing and benchmarking key indicators of feedlot conditions and animal care and welfare. The assessment has three main areas of focus: animal records, protocols, and facilities/equipment. The assessment can be used as a self-assessment, completed by a second-party, or conducted by a third-party assessor. It is recommended that the BQA Feedyard Assessment be repeated on a periodic basis.

Overall, 9.7 percent of all feedlots had participated in a BQA Feedyard Assessment in the previous 5 years. A higher percentage of large feedlots than small feedlots (45.5 and 6.8 percent, respectively) had participated in a BQA Feedyard Assessment in the previous 5 years.

F.2.c. Percentage of feedlots that had participated in a BQA Feedyard Assessment in the previous 5 years, by feedlot capacity:

Percent Feedlots

Feedlot Capacity (number head)					
Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Percent	**Std. error**	**Percent**	**Std. error**	**Percent**	**Std. error**
6.8	(2.6)	45.5	(3.7)	9.7	(2.4)

Feedlots that had participated in the BQA Feedyard Assessment in the previous 5 years participated an average of 2.0 times.

F.2.d. For the 9.7 percent of feedlots that had participated in a BQA Feedyard Assessment in the previous 5 years (table F.2.c), feedlot average number of times feedlots participated during the 5 years, and by feedlot capacity:

Average number of times	**Std. error**
2.0	(0.2)

3. Use of services of a veterinarian

Veterinarians can help producers select the appropriate antimicrobials and educate them on their appropriate and judicious use. Veterinarians are also involved in disease prevention and diagnosis on feedlots. Nearly 80 percent of all feedlots used the services of a veterinarian in 2016. All large feedlots (100.0 percent) used a veterinarian compared with 78.1 percent of small feedlots. Of small feedlots that did not use the services of a veterinarian, all reported that a veterinarian was not needed (data not shown).

F.3.a. Percentage of feedlots that used the services of a veterinarian/clinic in 2016, by feedlot capacity:

Percent Feedlots

Feedlot Capacity (number head)

Small (50–999)		Large (1,000 or more)		All feedlots	
Percent	**Std. error**	**Percent**	**Std. error**	**Percent**	**Std. error**
78.1	(4.5)	100.0	(—)	79.7	(4.2)

Of feedlots that used the services of a veterinary/clinic in 2016, 88.1 percent used a private veterinary clinic as needed. A higher percentage of large feedlots than small feedlots used a veterinarian from a private clinic who made routine visits (40.5 and 17.2 percent, respectively).

F.3.b. For the 79.7 percent of feedlots that used the services of a veterinarian/clinic in 2016 (table F.3.a), percentage of feedlots by type of veterinarian/clinic used and by feedlot capacity:

Percent Feedlots

Feedlot Capacity (number head)

	Small (50–999)		Large (1,000 or more)		All feedlots	
Type	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Full-time veterinarian on staff	7.5	(3.0)	12.8	(2.7)	8.0	(2.8)
Private veterinary clinic whose veterinarians made regular or routine visits	17.2	(4.7)	40.5	(3.6)	19.4	(4.3)
Private veterinary clinic used as needed	90.1	(3.0)	68.8	(3.2)	88.1	(2.8)

Of feedlots that used a veterinarian/clinic in 2016, a veterinarian visited the feedlot more than once on 80.5 percent of feedlots. A veterinarian visited more than once on 95.8 percent of large feedlots and on 78.8 percent of small feedlots.

F.3.c. For the 79.7 percent of feedlots that used a veterinarian/clinic in 2016 (table F.3.a), percentage of feedlots by number of times the feedlot was visited by a veterinarian, and by feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Number of times	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1	21.2	(5.3)	4.1	(2.1)	19.5	(4.8)
2–5	60.2	(6.0)	28.9	(3.7)	57.1	(5.4)
6–10	9.2	(2.9)	14.2	(2.5)	9.7	(2.7)
11–20	8.0	(3.5)	34.1	(3.7)	10.6	(3.2)
>20	1.4	(0.9)	18.6	(2.8)	3.1	(0.9)
Total	100.0		100.0		100.0	

A veterinarian-client-patient relationship (VCPR) is critical to animal health and is the basis for interaction among veterinarians, their clients, and their patients. The FDA's requirements of a VCPR are in the Terms section of this report. In many States, a VCPR is required by law so that a veterinarian can diagnose and treat animals and prescribe medication.

Overall, 86.1 percent of feedlots were very familiar or somewhat familiar with the meaning of a VCPR. A higher percentage of large feedlots than small feedlots (85.3 and 50.7 percent, respectively) were very familiar with a VCPR.

F.3.d. Percentage of feedlots by familiarity with the meaning of a VCPR,* and by feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Familiarity	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Very familiar	50.7	(6.0)	85.3	(2.5)	53.3	(5.5)
Somewhat familiar	34.7	(5.8)	10.6	(2.2)	32.8	(5.3)
Heard of name only	11.6	(2.9)	4.1	(1.4)	11.0	(2.7)
Not familiar	3.0	(1.8)	0.0	(—)	2.8	(1.7)
Total	100.0		100.0		100.0	

*https://www.ecfr.gov/cgi-bin/text-idx?SID=99550a83c97103df1503d4e34b99b26b&mc=true&node=pt21.6.530&rgn=div5#se21.6.530_13

Overall, 84.8 percent of feedlots had a VCPR. A higher percentage of large feedlots than small feedlots had a VCPR (98.6 and 83.6 percent, respectively).

F.3.e. Percentage of feedlots that had a VCPR, by feedlot capacity:

Percent Feedlots					
Feedlot Capacity (number head)					
Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Percent	**Std. error**	**Percent**	**Std. error**	**Percent**	**Std. error**
83.6	(4.6)	98.6	(0.6)	84.8	(4.2)

The American Association of Bovine Practitioners “Guidelines for Establishing and Maintaining the Veterinary-Client-Patient Relationship in Bovine Practice,”* recommends that a VCPR be a written agreement. The FDA definition, however, does not specify a necessary form for a VCPR agreement.

Overall, 13.7 percent of feedlots had a written VCPR signed by a veterinarian and the producer, while 33.5 percent of large feedlots and 11.8 percent of small feedlots had a written and signed VCPR. Over one-half of all feedlots (56.1 percent) had either an oral or written and signed VCPR.

F.3.f. For the 84.8 percent of feedlots that had a VCPR (table F.3.e), percentage of feedlots by type of VCPR and by feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Type	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
A written document signed by veterinarian and producer	11.8	(4.4)	33.5	(3.6)	13.7	(4.1)
An oral agreement between veterinarian and producer	42.8	(6.1)	38.0	(3.8)	42.4	(5.6)
No formal VCPR but an implied one based on relationship between veterinarian and producer	45.3	(5.0)	28.5	(3.6)	43.8	(4.6)
Total	100.0		100.0		100.0	

*http://www.aabp.org/resources/aabp_guidelines/vcprguidelinefinal11-2013.2.pdf

4. Antimicrobial sources

Feedlots can obtain medicated feed via several different methods. About one-third of feedlots obtained medicated feed from an offsite feed mill (27.3 percent), obtained type A medicated articles to mix into feed on-site (30.3 percent), and obtained type B or C medicated feeds to be fed or mixed in a ration on-site (29.5 percent).

F.4.a. For the 70.8 percent of feedlots that fed medicated feed to cattle (table C.1.a), percentage of feedlots by method of obtaining medicated feed and by feedlot capacity:

	Percent Feedlots					
	Feedlot Capacity (number head)					
	Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Method of obtaining medicated feed	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
From an off-site privately owned or cooperatively owned feed mill that delivered feed with antimicrobials mixed in[1]	27.2	(5.8)	29.0	(3.9)	27.3	(5.4)
Type A medicated articles delivered or brought to the feedlot to be mixed into feed on-site[2]	29.7	(4.6)	38.8	(3.7)	30.3	(4.3)
Type B or C medicated feeds delivered or brought to the feedlot to be fed or mixed in a ration on-site[3]	27.7	(5.6)	53.2	(3.9)	29.5	(5.1)

[1] 4.2 percent of feedlots did not know if they obtained medicated feed from this method.

[2] 10.6 percent of feedlots did not know if they obtained medicated feed from this method.

[3] 10.7 percent of feedlots did not know if they obtained medicated feed from this method.

Prior to January 1, 2017, farm and ranch stores commonly sold bags of medicated feed. In total, 43.2 percent of feedlots purchased bagged medicated feed (e.g., Aureomycin® 4G Crumbles) from a farm/ranch or feed store in 2016.

F.4.b. Percentage of feedlots that purchased bagged medicated feed from a farm/ranch or feed store in 2016, by feedlot capacity:

Percent Feedlots

Feedlot Capacity (number head)					
Small (50–999)		**Large** (1,000 or more)		**All feedlots**	
Percent	**Std. error**	**Percent**	**Std. error**	**Percent**	**Std. error**
43.5	(4.6)	39.8	(3.6)	43.2	(4.2)

5. Antimicrobial use decisions

An important component of antimicrobial stewardship is deciding if, when, and how antimicrobials should be used. Respondents were asked to select all people involved with antimicrobial decision-making. If a veterinarian provided a protocol for antimicrobial use, respondents were instructed to select one of the veterinarian options listed in the following table.

Antimicrobials were administered in feed and by individual injection by the majority of feedlots (70.8 and 80.0 percent, respectively). Antimicrobials were used in water on 8.5 percent of feedlots and via injection for groups of cattle by 14.8 percent. On the highest percentage of feedlots, the owner (nonveterinarian) made the decision whether to use antimicrobials in a given pen of animals, regardless of route of administration. Multiple people, however, were often involved in the decision-making process.

F.5. For feedlots that gave any antimicrobials in 2016, percentage of feedlots by route of administration, and percentage of these feedlots by person who decided to use antimicrobials.

	Percent Feedlots							
	Route of Administration							
	Feed		Water		Group injection		Individual injection	
Person	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Owner of feedlot (nonveterinarian)	84.2	(4.6)	100.0	(—)	79.0	(9.2)	88.8	(3.2)
Farm manager on-site	3.7	(1.3)	1.1	(1.2)	10.1	(2.8)	8.2	(2.0)
Full-time veterinarian on staff	1.8	(1.0)	0.0	(—)	2.3	(0.8)	1.8	(0.8)
Private veterinarian	25.8	(5.5)	25.9	(19.1)	29.7	(10.3)	23.6	(4.9)
Other veterinarian	5.8	(2.9)	0.0	(—)	1.5	(0.7)	12.4	(4.1)
Any veterinarian*	33.3	(5.8)	25.9	(19.1)	33.0	(10.5)	37.6	(5.6)
Nutritionist	27.6	(5.7)	7.9	(7.5)	1.0	(0.6)	1.2	(1.1)
Service manager	0.0	(0.0)	0.0	(—)	0.5	(0.4)	0.1	(0.1)
Other	2.9	(2.0)	0.0	(—)	0.6	(0.4)	3.8	(1.9)

*Includes a full-time veterinarian on staff, a private veterinarian, or other veterinarian.

Section II: Methodology

A. Objectives

Objectives for the NAHMS Antimicrobial Use and Stewardship on U.S. Feedlots, 2017 study were primarily developed based on proposed activities in the USDA Antimicrobial Resistance Action Plan. Study objectives follow:

- Describe antimicrobial use practices in feed and water on feedlots with a capacity of at least 50 head.
- Estimate the percentage of feedlots administering and the percentage of cattle receiving specific antimicrobials in feed and water, by reasons for use.
- Provide baseline data on antimicrobial-use practices in place prior to implementation of FDA policy changes. This baseline can be used for evaluating trends over time.
- Describe antimicrobial stewardship practices on U.S. feedlots.

B. Sampling and Estimation

1. State selection

States were selected based on the number of feedlots and the number of cattle in two capacity categories: small feedlots (50 to 999 head capacity), and large feedlots (1,000 or more head capacity). Small feedlots were selected from 13 States and large feedlots from 16 States.[4]

A goal for NAHMS national studies is to include States that account for at least 70 percent of the animals and operations in the United States. For large feedlots, States were chosen to match the 16 States in which NASS conducts its monthly cattle-on-feed surveys for feedlots with 1,000 or more head; these States represented approximately 92.8 percent of cattle inventory on feedlots with 1,000 head or more capacity and 92.3 percent of feedlots with 1,000 head or more capacity. For small feedlots, the 13 chosen States represented 93.2 percent of cattle inventory on feedlots with 50 to 999 head capacity and 91.3 percent of feedlots with a 50 to 999 head capacity.

2. Feedlot selection

All feedlots included in the study were selected from NASS' list frame. For small feedlots, a total sample of 2,600 feedlots was selected to participate in the study. Within each State, a stratified random sample was selected in which strata were defined by feedlot capacity. All large feedlots (2,082) with 1,000 or more head capacity in the 16 participating States were selected.

[4] **Small:** CO, IA, IL, IN, KS, MI, MN, MO, NE, OH, PA, SD, WI
Large: AZ, CA, CO, IA, ID, IL, KS, MN, NE, NM, OK, OR, SD, TX, WA, WY

3. Population inferences

The estimates in this report apply to the population of feedlots with a capacity of at least 1,000 head in 16 States, feedlots with a 50 to 999 head capacity in 13 States, cattle fed on feedlots (excluding cattle custom fed on feedlots operated by others, cattle being backgrounded only and for sale as feeders for later placement on feed in another feedlot or to be returned to pasture, and cows and bulls fed by the operator for the slaughter market). All respondent data were statistically weighted to reflect the population from which they were selected. The inverse of the probability of selection for each feedlot was the initial selection weight. This selection weight was adjusted for nonresponse within each State and by capacity to allow for inferences back to the original population from which the sample was selected.

The estimates in the “All Feedlots” columns can be interpreted in two distinct ways, depending on the measurement reflected in the table. For tables reporting “Percent Feedlots,” the “All Feedlots” values are similar to those for small feedlots (50 to 999 head capacity) because the overall estimates reflect the population of feedlots in the participating States, and because there are many more small feedlots than large feedlots in the population. According to the most recently published numbers of feedlots with 50 to 999 head and 1,000 or more head (USDA-NASS 2012 Census of Agriculture*), there were approximately 25,000 feedlots in the participating States, and only about 1,100 of those were large feedlots (1,000 or more head inventory). The “Percent Cattle”, estimates for “All Feedlots” are similar to the estimates for large feedlots (1,000 or more head capacity) because the overall estimates reflect the population of cattle in the participating States, and there are many more cattle on large feedlots than on the small feedlots. According to the USDA-NASS 2012 Census of Agriculture,* there were approximately 13.5 million cattle on feed in the participating States, and over three-fourths of those cattle (10 million) were on large feedlots.

*USDA-NASS 2012 Census of Agriculture, available at: https://www.agcensus.usda.gov/Publications/2012/

C. Data Collection

In May 2017, NASS enumerators contacted the selected feedlots to request a personal visit (phase I). During the visit, producers were familiarized with the study and were invited to participate in the data collection phase. If producers expressed interest, they signed a consent form and their contact information was released to APHIS–VS field veterinarians.

APHIS–VS field veterinarians contacted the feedlots and requested a personal visit to administer the questionnaire for the data collection phase (phase II). Data collection occurred from July through September 2017.

During data collection, cattle eligible to be counted in feedlot inventory included any cattle (steers and/or heifers) fed by the operator from January 1 through December 31, 2016. Cattle excluded from these counts were custom fed on feedlots operated by others, cattle being backgrounded only and for sale as feeders for later placement on feed in another feedlot or to be returned to pasture, and cows and bulls fed by the operator for the slaughter market. Antimicrobial use data and stewardship information from January 1 to December 31, 2016, were collected.

D. Data Analysis

All completed questionnaires with identifying information removed were sent to the USDA-NAHMS secure data laboratory in Fort Collins, Colorado, for data entry and analysis. Questionnaires were checked for consistency before data entry, and a second round of data validation was done after all data were entered into a SAS dataset. Data analysis was done using SAS and SUDAAN® software. Survey weights were calculated so that estimates reflected the population from which the sample was selected. Standard errors of the estimates account for the stratified design and use of survey weights.

E. Sample Evaluation

1. Responses

The purpose of this section is to provide various performance measurement parameters. The following table presents an evaluation of responses based upon a number of measurement parameters, which are defined with an “x” in categories that contribute to the measurement.

A total of 4,682 feedlots were selected for the survey. A total of 1,255 feedlots, or 26.8 percent of selected feedlots, gave usable information in phase I (either consented to a phase II contact or had no cattle on feed at the time of contact/out of business). A total of 912 feedlots (19.5 percent of total selected) consented to have their contact information released to APHIS–VS field veterinarians. Of these, 464 provided usable information and 378 completed the survey questionnaire (50.9 and 41.4 percent of consents, respectively).

In additional analyses, the operations with unknown response codes were reassigned to the nonconsent categories using the same proportions as presented in the following tables. For phase I (consent), the unknown response codes were reassigned to the five nonconsent categories (refusal, no cattle on feed/out of business, out of scope, office hold, and inaccessible). Using the reassigned counts, the proportion of in-scope feedlots (consent, refusal, no cattle on feed/out of business, and inaccessible) providing usable information at phase I was 1,950/4,063 (48.0 percent). The proportion of in-scope feedlots that consented at phase I was 912/4,063 (22.4 percent). For phase II, after reassigning the unknown response codes to the nonconsent categories (refusal, out of business/no or too few cattle, other, and inaccessible), the proportion of consenting in-scope feedlots providing usable information was 471/863 (54.6 percent) and the proportion of consenting in-scope feedlots providing complete information was 378/863 (43.8 percent).

Response codes for the phase I (consent):

Collapsed response code	Count	Percent	Contacts	Usable	Consent
Consent	912	19.5	x	x	x
Refusal	559	11.9	x		
No cattle on feed/out of business	343	7.3	x	x	
Out of scope	234	5.0			
Office hold	77	1.6			
Inaccessible	166	3.5			
Unknown*	2,391	51.1			
Total	4,682	100.0	1,814	1,255	912
Percent total feedlots			38.7	26.8	19.5

* Response code not recorded.

For the 912 feedlots that gave consent in phase I, response codes for phase II (Antimicrobial Use and Stewardship questionnaire):

Collapsed response code	Count	Percent	Contacts	Usable	Complete
Complete	378	41.4	x	x	x
Refusal	185	20.3	x		
Out of business/no or too few cattle	46	5.0	x	x	
Out of scope (backgrounder, cow-calf, dairy operation)	45	4.9			
Other	40	4.4	x	x	
Inaccessible	177	19.4			
Unknown*	41	4.5			
Total	912	100.0	649	464	378
Percent total feedlots			71.2	50.9	41.4

* Response code not recorded.

2. Nonresponse bias analysis

Using information collected for all sampled feedlots by NASS through their ongoing sampling efforts, NAHMS staff performed a nonresponse bias analysis to identify potential sources of bias in study-analysis results based on the response propensities of the selected producers. NAHMS and NASS staff prepared a dataset containing information on all sampled feedlots, regardless of whether or not they responded to the Antimicrobial Use and Stewardship on U.S. Feedlots, 2017 study. These variables were used in univariate and multiple regression analyses to identify possible factors related to the response probability of the feedlots under study.

We studied potential sources of bias to response at phase I (whether the feedlot consented to participate in phase II) and the bias to response at phase II (whether the feedlot completed the phase II questionnaire). Using a combination of univariate statistical hypothesis tests and multiple regression modeling, only total feedlot inventory and region[4] were significantly related to response probabilities (at both phases of the study). Specifically, large feedlots and feedlots in the Central region tended to respond with a greater relative frequency than did small feedlots or feedlots in the Other region. These sources of potential bias and bias sources indirectly related to total inventory and region are already accounted for in our analysis via weight construction. Based on this analysis, there were no significant sources of nonresponse bias after weight construction, which provides evidence for the claim that the feedlots that completed the study are not significantly different from the nonresponding feedlots. Given the factors analyzed, it is expected that the statistical results computed using the information from the feedlots completing the questionnaire can be generalized to the population of U.S. feedlots with a capacity of at least 1,000 head in 16 States and feedlots with 50 to 999 head capacity in 13 States and apply to cattle fed on those feedlots (excluding “backgrounded only” cattle and cows and bulls fed on those feedlots).

[4]Regions were different, depending on capacity (Small=50 to 999 head capacity, Large=1,000 or more head capacity) of the feedlot.

Small:
Central region: CO, KS, NE, SD
Other region: IA, IL, IN, MI, MN, MO, OH, PA, WI

Large:
Central region: CO, KS, NE, OK, SD, TX, WY
Other region: AZ, CA, IA, ID, IL, MN, NM, OR, WA

Appendix I: Sample Profile

1. Number of responding feedlots, by feedlot capacity

Feedlot Capacity (number of head)		
Small (50–999)	**Large** (1,000 or more)	**Total**
150	228	378

Appendix II: FDA Categories of Antimicrobials Mentioned in This Report

There are four categories of antimicrobials with respect to their use in human medicine, as determined by the FDA and published in Guidance for Industry #152, Appendix A[1]: not ranked as medically important, important, highly important, and critically important. The table below shows the current ranking of the drug classes mentioned in this report. According to Guidance for Industry #213, FDA stated that it will periodically reassess and publish updates to GFI #152 Appendix A as necessary.

Antimicrobial by importance to human medicine	Drug/drug class
Not ranked	Ionophores (e.g., monensin, lasalocid, laidlomycin)
	Bambermycin
	Bacitracin
Medically important	
Important	None of the antimicrobials included in this report were classified as important
Highly important	Tetracyclines (e.g., oxytetracycline, chlortetracycline, tetracycline)
	Aminoglycosides (e.g., neomycin, spectinomycin)
	Beta lactam-natural penicillins (e.g., penicillin G)
	Phenicols (e.g., florfenicol)
	Aminopenicillins (e.g., amoxicillin)
	Streptogramins (e.g., virginiamycin)
Critically important	Macrolides (e.g., tilmicosin, tylosin, tulathromycin, gamithromycin, tildipirosin)
	Fluoroquinolones (e.g., enrofloxacin, danofloxacin)
	Third generation cephalosporins (e.g., ceftiofur)
	Trimethoprim/sulfamethazine[2]

[1]https://www.fda.gov/downloads/AnimalVeterinary/GuidanceComplianceEnforcement/GuidanceforIndustry/UCM052519.pdf
[2]In FDA GFI #152, Appendix A, the combination drug trimethoprim/sulfamethazine, a potentiated sulfonamide, is currently ranked as critically important. Nonpotentiated sulfonamides, such as sulfamethazine and sulfadimethoxine, have not yet been ranked in Appendix A of GFI #152, but are considered medically important for human health by FDA since they belong to the same drug class as the combination.

Appendix III: Cattle Inventory

	Number of cattle on feed[1]			Number of feedlots[1]		
State	All feedlots	Feedlots with 1,000 or more cattle on feed	Feedlots with 50-999 cattle on feed	All feedlots	Feedlots with 1,000 or more cattle on feed	Feedlots with 50-999 cattle on feed
Arizona	(D)[2]	(D)	NA	5	4	NA
California	485,061	475,639	NA	97	17	NA
Colorado	1,009,873	971,283	37,400	244	77	108
Idaho	263,466	243,950	NA	163	22	NA
Illinois	276,130	42,293	210,351	1,976	19	1,013
Indiana	63,877	NA[3]	50,319	919	NA	309
Iowa	1,550,523	594,610	916,016	5,368	228	3,596
Kansas	2,255,701	2,121,898	130,665	714	127	461
Michigan	148,608	NA	81,822	1,017	NA	431
Minnesota	536,971	114,567	381,390	3,790	56	2,082
Missouri	74,195	NA	65,924	687	NA	330
Nebraska	2,647,855	2,294,260	344,591	1,777	328	1,113
New Mexico	(D)	(D)	NA	12	6	NA
Ohio	141,009	NA	120,722	1,517	NA	646
Oklahoma	350,723	338,576	NA	227	16	NA
Oregon	73,002	63,212	NA	109	9	NA
Pennsylvania	113,586	NA	95,003	1,527	NA	752
South Dakota	418,374	178,148	232,810	1,263	63	924
Texas	2,750,818	2,734,691	NA	375	112	NA
Washington	3,862	(D)	NA	71	11	NA
Wisconsin	270,342	NA	210,736	2,789	NA	1,323
Wyoming	66,090	61,689	NA	55	10	NA
Total (included States)	13,500,066	10,234,816	2,877,749	24,702	1,105	13,088
Total U.S. (50 States)	14,386,188	11,026,165	3,092,212	26,586	1,197	14,329

continued→

Appendix III (cont'd.) Cattle Inventory

Percent represented by included States in 2012	93.8	92.8	93.2	92.9	92.3	91.3

[1]Counts of operations and cattle on feed are from the USDA-NASS 2012 Census of Agriculture and are the most recently published State-level counts of operations with cattle on feed. These represent counts of operations by actual inventory of cattle on feed, rather than capacity.
[2]Values of (D) denote values that are suppressed due to low sample size.
[3]Denotes values that are suppressed because operations with the given capacity were not sampled from the given State in this study.

	Number of cattle on feed			Number of feedlots[1]		
Year	All feedlots	Feedlots with capacity 1,000 or more head	Feedlots with capacity fewer than 1,000 head	All feedlots	Feedlots with capacity 1,000 or more head	Feedlots with capacity fewer than 1,000 head
2017[2]	14,006,400	11,489,000	2,517,400	28,209	2,209	26,000
2016[2]	13,067,000	10,605,000	2,462,000	29,219	2,219	27,000
2015[3]	13,157,000	10,575,000	2,582,000	28,189	2,189	26,000

[1]Number of feedlots by capacity, rather than actual number of cattle on the operation.
[2]February 23, 2018 USDA-NASS Cattle on Feed.
[3]February 24, 2017 USDA-NASS Cattle on Feed.

Appendix IV: Acronyms Used in This Report

AHT	Animal Health Technician
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BQA	Beef Quality Assurance
CEAH	Center for Epidemiology and Animal Health
FDA	Food and Drug Administration
NA	Not applicable
NAHMS	National Animal Health Monitoring System
NASS	National Agricultural Statistics Service
SE	Standard error
USDA	United States Department of Agriculture
VCPR	Veterinarian-client-patient relationship
VMO	Veterinary Medical Officer
VS	Veterinary Services