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Dairy 2014

Trends in Dairy Cattle Health and Management Practices in the United States, 1991-2014

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Cover photo courtesy of Dr. Jason Lombard

Acknowledgments

This is the fifth report from the U.S. Department of Agriculture's (USDA) National Health Monitoring System's (NAHMS) Dairy 2014 study. NAHMS is part of USDA's Veterinary Services, which, in turn, is part of USDA's Animal and Plant Health Inspection Service (APHIS). The report takes an indepth look at trends in the U.S. dairy industry from 1991 to 2014 and was prepared using data compiled and analyzed from five national NAHMS studies: 1991-92 National Dairy Heifer Evaluation Project, Dairy 1996, Dairy 2002, Dairy 2007, and Dairy 2014. All five studies were cooperative efforts among State and Federal agricultural statisticians, animal health officials, university researchers, and extension personnel.

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Items of Note

The number of U.S. milk cows decreased by almost 8 percent from 1991 to 2014 (9.965 million to 9.207 million, respectively), and from 1991 to 2012 the number of U.S. dairy operations decreased by about 68 percent (180,640 to 58,000, respectively).

The large decrease in the number of dairy operations and the moderate decrease in the number of dairy cows has led to an increase in herd sizes. Only 11.5 percent of operations had 100 or more cows in 1991 compared with 25.9 percent of operations in 2012. Similarly, 1.9 percent of U.S. dairy operations had 500 or more cows in 1997 compared with 5.7 percent of operations in 2012, and this 5.7 percent represented 58.5 percent of all U.S. dairy-cattle inventory in 2012. The U.S. average herd size in 2007 was 130.4 cows, more than double the average in 1991 (53.9 cows).

Some of the changes highlighted in this report are the result of changes in the industry structure, mainly the decrease in the number of small operations. These changes are evident when estimates within herd size categories are similar across study years but the 'All operations' estimates are different.

With the exception of 2001, milk production per cow has increased approximately 1 to 3 percent annually since 1991. Milk production per cow was 22,249 pounds in 2014 compared to 15,031 pounds in 1991, a 48.0 percent increase. Total U.S. milk production has increased 39.5 percent during the same time frame.

As milk production has increased, so has milk quality (based on bulk-tank somatic cell counts [BTSCCs]). Lower BTSCCs have been associated with better udder health, and increases in cheese yield and the shelf life of dairy products. Since 1997, BTSCCs have decreased from 295,000 cells/mL to 193,000 cells/mL in 2014, a 34.6 percent decrease.

Operation types

While the majority of operations and cows were managed conventionally (i.e. the majority of forage on the operation is not harvested by cows) from 2007 to 2014, the percentage of grazing operations doubled from 2007 to 2014 (3.1 percent to 6.7 percent, respectively), while the percentage of cows on grazing operations remained at 1.7 percent during the same period. The percentage of organic dairy operations increased from 1.7 percent in 2007 to 7.4 percent in 2014, while the percentage of cows on organic operations increased from 1.2 percent to 4.5 percent during the same period.

Animal identification (ID)

The percentage of operations using "any" individual-animal ID has not changed since 1996 and remains around 95 percent. The use of ear tags and collars as individual-animal ID has decreased since 1996, while the use of electronic IDs has increased from 0.2 percent of operations in 1996 to 8.2 percent in 2014.

Dairy breeds
Although Holsteins are the primary breed on the majority of U.S. dairy operations, the percentage of operations with Holsteins was lower in 2014 compared with 1996, 2002, and 2007. Alternatively, the percentages of operations with Jersey or “other” breeds were higher in 2014 than in 1996, 2002, and 2007.

Age at first calving and calving interval
Operation average age of heifers at first calving decreased by about one month from 1991 to 2014, while the operation average age of heifers at first calving decreased by about 2 months during the same period. The operation average and cow average calving intervals have decreased slightly since 2002.

Source of heifers
Although the majority of operations have heifers born and raised on-site, since 2002 the percentage of operations with heifers born on-site but raised off-site (and the percentage of heifers on those operations) has increased threefold. In 2002, 7.4 percent of heifers were born on-site but raised off-site and that increased to 25.7 percent in 2014.

Colostrum management
From 2007 to 2014, calves received their first feeding of colostrum at 3.5 hours (operation average) following birth.

The percentage of operations that hand-fed colostrum from a bucket or bottle increased from 62.5 percent of operations in 1996 to 86.0 percent in 2014. During this same period, the percentage of operations that allowed calves to suckle their dam to get their first feeding of colostrum decreased from 33.5 percent to 6.4 percent. The percentage of heifer calves that were fed colostrum via an esophageal feeder increased from 8.3 percent in 1996 to 23.1 percent in 2014. Alternatively, the percentage of heifer calves that received colostrum via suckling decreased from 29.4 percent in 1996 to 1.8 percent in 2014.

From 2002 to 2014, the percentage of all operations that evaluated colostrum quality increased substantially from 5.8 to 53.3 percent, respectively. The percentage of operations that estimated IgG levels in colostrum increased nearly 10-fold across all herd sized from from 2002 to 2014 (5.8 to 53.3 percent, respectively).

A lower percentage of operations pooled colostrum in 2014 than in 2002 (20.3 and 28.4 percent, respectively).

Treating colostrum with heat reduces pathogens and leads to increased absorption of immunoglobulins. A higher percentage of medium, large, and all operations heat-treated colostrum in 2014 than in 2007 and 2002. In 2014, 24.0 percent of large operations and 5.6 percent of all operations heat-treated colostrum.

The percentage of operations that fed calves four or more quarts of colostrum in the first 24 hours following birth almost tripled from 2007 to 2014 (31.3 to 87.5 percent of operations, respectively).

The percentage of heifers on large operations that were routinely monitored for serum proteins to assess passive immunity status increased from 24.4 percent of calves in 2007 to 53.9 percent in 2014. The percentage of heifers on all operations that were routinely monitored for serum proteins increased from 12.6 percent to 35.3 percent during the same period.

Heifer housing

From 2002 to 2014, the majority of operations (~75 percent) primarily used individual housing for preweaned heifers. An open/dry lot with barn or shed and multiple-animal inside area/barn were used to house weaned heifers on the majority of operations since 2002.

Heifer nutrition

Milk replacer was fed to preweaned heifers on a lower percentage of operations in 2014 than in 2007 (49.9 and 68.6 percent of operations, respectively). Unpasteurized milk was fed to preweaned heifers on a lower percentage of operations in 2014 than in 2002 (55.7 and 86.2 percent, respectively). The percentage of operations that fed pasteurized milk increased from 1.0 percent in 2002 to 7.4 percent in 2014. A lower percentage of preweaned heifers on small, medium, and all operations were fed medicated milk replacer in 2014 than 2007.

Weaning

The operation average age of heifer calves at weaning increased from 8.0 weeks in 2002 to 9.0 weeks in 2014.

Vaccination and other preventive practices

A lower percentage of operations (~80 percent) administered any vaccines to heifers in 2014 compared with ~90 percent in 1991, 1996, 2002, and 2007. For study years 1996, 2002, 2007, and 2014, more than 90 percent of operations used at least one preventive practice for heifers (e.g., dewormers, vitamin injections, ionophores).

Heifer health

The percentage of calves born alive decreased from 93.4 percent in 1996 to 85.9 percent in 2007 and increased from 85.9 in 2007 to 89.8 percent in 2014. Since 2002, respiratory disease and diarrhea or other digestive problems affected approximately 10 and 20 percent of preweaning heifers, respectively. Respiratory disease affected the highest percentage of weaned heifers, regardless of study year. Preweaned heifer deaths were highest in 1996 at 11.0 percent and have decreased to 6.4 percent in 2014. Scours/diarrhea and respiratory problems accounted for about 80 percent of preweaning heifer deaths since 1996. Deaths in weaned heifer calves have remained around 3 percent since 1996. The percentage of weaned heifer deaths caused by respiratory problems has increased from 45.4 percent 1996 to 58.9 percent in 2014. In 2007 and 2014, about 10 percent of operations with deaths in preweaned or weaned heifers performed necropsies on the heifers.

Cow housing

Freestall housing for lactating cows was used by a higher percentage of operations in 2014 than in previous study years. In contrast, tie stalls or stanchions were the primary housing type used for lactating cows on a lower percentage of operations in 2014 than in 2007 and 2002. During summer, a lower percentage of operations routinely allowed lactating cows access to outside concrete alleyways or pens in 2014 than in 2007. Additionally, a higher percentage of operations did not allow outside access in summer to lactating cows in 2014 (21.2 percent) than in 2007 (13.1 percent). Similarly, for dry cows, a lower percentage of operations in 2014 than in 2007 allowed cows access to pasture (11.3 and 20.5 percent, respectively). A higher percentage of operations used free stalls or open/dry lot as primary housing for dry cows in 2014 than in 2007.

The highest percentage of lactating cows were bedded with composted/dried manure during the previous 90 days in 2014, and its use has more than tripled since 1996. Sand as bedding was also used for a large percentage of cows (34.6 percent) in 2014, and its use more than doubled since 1996 (15.3 percent of cows). The use of corncobs and stalks as bedding for dry cows during the previous 90 days increased from 2007 to 2014.

Cow vaccination and other preventive practices

The percentage of operations that administered any vaccines to cows decreased in 2014 (73.8 percent) compared with previous study years in which more than 80 percent of operations administered vaccines to cows.

A higher percentage of operations in 2014 than in 1996 used dewormers and probiotics. Additionally, the use of propylene glycol as a drench increased from 2002 to 2014, while the use of ionophores increased from 2007 to 2014 (26.8 percent and 37.0 percent, respectively).

Recombinant bovine somatotropin (rbST)
The percentage of operations that administered rbST to cows increased from 1996 to 2002, remained steady from 2002 to 2007, and then decreased from 2007 to 2014.

Cow health
The percentages of cows experiencing clinical mastitis or lameness increased from 1996 to 2014, while other reported diseases decreased from 2007 to 2014.

Permanently removed cows
A higher percentage of cows were permanently removed in 2014 (28.4 percent) than in previous study years when about 25 percent of cows were removed. In 2014, about 25 percent of permanently removed cows were removed due to reproductive reasons, and another 20 percent due to poor production. These percentages were similar to those reported in 1996. The percentage of cows removed due to mastitis or lameness decreased from 1996 to 2014. In 2014, almost 60 percent of permanently removed cows were sent to a market, auction, or stockyard, which is a lower percentage compared with all previous study years.

Cow mortality
The percentage of cows that died in 2014 (5.6 percent) was similar to the percentage that died in 2002 (4.8 percent) and 2007 (5.7 percent) but was higher than reported in 1996 (3.8 percent). Of the cows that died in 2014, one-quarter were nonambulatory. Lameness and mastitis each accounted for more than 10 percent of cow deaths, and these percentages were similar to 1996 estimates. Necropsies were performed by a higher percentage of operations in 2014 than in 2007 (22.2 and 13.3 percent, respectively). Rendering was used by a lower percentage of operations in 2014 than in 2002, while composting carcasses increased during this period.

Biosecurity
Fewer dairy operations brought on any new cattle or dairy cattle in 2014 compared with previous study years. Any new additions were quarantined on a lower percentage of operations in 2014 than previous study years. The percentage of operations that required vaccination prior to bringing animals onto the operation decreased from 66.6 percent in 1996 to 33.7 percent in 2014. Testing new additions was performed by a lower percentage of operations in 2014 than in 1996. A similar percentage of operations required herd-of-origin information for new animals in 2007 and 2014.

Off-site heifer rearing
There were no changes from 2007 to 2014 in the percentage of operations that raised any heifers off-site. Almost one-half of large operations raised some calves off-site. In 2014, about one-fourth of all heifer calves were raised off-site. Preweaned and weaned

heifers were the primary heifer classes raised off-site by operations in 2007 and 2014. A single rearing facility where cattle had contact with cattle from other operations was used by about one-half of the operations in 2007 and 2014. About two-thirds of operations in 2007 and 2014 brought back or bought pregnant heifers from the off-site rearing facility.

Disease familiarity

Since 2002, a higher percentage of producers have become fairly knowledgeable or knew some basics about hemorrhagic bowel syndrome (HBS) and *mycoplasma* mastitis. More than 90 percent of producers in each of the three study years (2002, 2007, and 2014) reported that they would very likely contact their private veterinarian if an outbreak of a foreign animal disease occurred. Almost all producers (>97 percent) in each study year would contact their private veterinarian if they suspected a foreign animal disease on their operation.

Employees and visitors

The percentage of operations that had employees increased from 47.2 percent in 2002 to 70.9 percent in 2014. For operations with employees, a higher percentage in 2014 than in 2002 had written standard operating procedures for employees while a lower percentage of operations had restrictions on employee livestock ownership outside their operation in 2014 than in 2002.

Equipment

There were no changes across study years in the percentage of operations that never used the same equipment to handle manure and feed cattle. For operations that ever used the same equipment to handle manure and feed cattle, the majority of operations in each study year reported washing equipment with water or steam only. There were no substantial changes across study years or by herd size in the percentage of operations that had shared heavy equipment with other livestock operations during the previous 12 months.

Reproductive practices

More than one-half of operations in 2007 and 2014 used AI to natural estrus as the first-service breeding for the majority of cows. Timed AI was used by similar percentages of operations for heifers or cows in 2007 and 2014. For operations that used a timed AI program, the average number of years that timed AI programs were used increased from 7.6 years in 2007 to 11.1 years in 2014. The percentage of operations that used sexed semen in heifers increased from 15.7 percent in 2007 to 41.1 percent in 2014. Similarly, a higher percentage of operations used sexed semen in cows in 2014 than in 2007 (18.6 and 6.3 percent, respectively). There were no differences from 2007 to 2014 in the operation average percentages of pregnancies by breeding method. About 50 percent of pregnancies were conceived by AI after detected estrus, while about a 25 percent of pregnancies were conceived by natural service. Pregnancy exams were performed weekly on a higher percentage of operations in 2014 than in 2007

(14.4 and 4.3 percent, respectively). A higher percentage of operations routinely used ultrasound to determine pregnancy status in 2014 than in 2007 (44.1 and 25.4 percent, respectively). For operations that routinely performed pregnancy exams via rectal palpation or ultrasound, a private veterinarian performed the majority of pregnancy exams in both 2007 and 2014.

Milk quality and procedures

The percentage of operations with bulk-tank somatic cell counts (BTSCCs) less than 200,000 cell/mL remained relatively constant from 1996 to 2007, before increasing from 2007 to 2014. The percentage of operations that used a parlor milking facility and the percentage of cows milked in a parlor have increased since 1996. A higher percentage of operations used a parallel parlor in 2014 than in 2007 (29.9 percent and 19.4 percent, respectively) and a higher percentage of cows were milked in a parallel parlor in 2014 than in 2007 (44.7 percent and 30.6 percent, respectively). A higher percentage of all operations in 2007 and 2014 used automatic takeoffs compared with operations in 2002. Milkers wore gloves to milk all cows on a higher percentage of operations in 2007 and 2014 than in 2002. The percentage of cows milked twice per day remained constant from 2002 to 2007 but decreased from 2007 to 2014. The percentage of operations that milked the majority of cow three times per day increased from 7.0 percent in 2007 to 12.0 percent in 2014. Across study years, about 95 percent of operations disinfected teats postmilking. A lower percentage of operations in 2014 (27.9 percent) than in 2007 and 2002 (37.6 and 36.0 percent, respectively) vaccinated cows for coliform mastitis during the previous 12 months.

Dry-off procedures

Approximately 90 percent of operations dry-treated some cows with intramammary antimicrobials in 2007 and 2014, and these operations represented about 95 percent of all cows in 2007 and 2014. For cows treated with dry cow intramammary antimicrobials, the percentage that received beta-lactam third generation cephalosporins increased from 7.0 percent of dry cows treated in 2007 to 22.7 percent of dry cows treated in 2014.

Antimicrobial use

Preweaned heifers

The majority of preweaned heifers (>75 percent) affected with diarrhea or other digestive problem, respiratory disease, or navel infection were treated with antimicrobials across study years. There were no substantial differences across study years or by disease or disorder in the percentages of affected preweaned heifers treated with antimicrobials. The percentage of operations and the percentage of treated preweaned heifers by primary antimicrobial used for diarrhea or other digestive problem, respiratory disease, or navel infection were similar across study years.

Weaned heifers

There were no differences from 2007 to 2014 in the percentages of operations by antimicrobial use in weaned-heifer rations to prevent disease or promote growth. A higher percentage of operations in 2014 than in 2002 used macrolides as the primary antimicrobial to treat weaned heifers for respiratory disease (14.1 and 6.5 percent, respectively). A higher percentage of weaned heifers were given tetracycline to treat respiratory disease in 2002 (34.3 percent) than in 2014 (14.7 percent).

Cows

The percentage of cows affected and treated for reproductive disease decreased from 2007 to 2014 (74.7 percent and 52.8 percent, respectively). The percentage of cows affected and treated for diarrhea or other digestive problem decreased from 2002 to 2014, as did the percentage of cows affected and treated for lameness. A lower percentage of operations in 2014 than in 2002 used beta-lactam penicillins to treat mastitis, and a lower percentage of cows were treated with beta-lactam penicillins in 2014 than in 2002. The use of lincosamide as the primary antimicrobial for treating mastitis decreased from 15.8 percent of operations in 2007 to 6.0 percent in 2014, while the percentage of cows treated with lincosamide remained at about 20 percent during the same period. Mastitis was treated on about 85 percent of operations during all three study years. The percentage of cows treated for mastitis increased from 15.0 percent in 2002 to 22.0 percent in 2014.

Dehorning

Across study years, a lower percentage of large operations routinely dehorned heifer calves compared with small and medium operations, which might be because a higher percentage of large operations than medium or small operations send their heifers to an off-site rearing facility. While a hot iron/electric dehorner was used on about 70 percent of operations in 2007 and 2014, the percentage of operations that used a tube, spoon, or gouge dehorner decreased from 28.2 percent in 2007 to 14.0 percent in 2014. For operations that routinely dehorned heifer calves, the percentage that used analgesics/anesthetics when dehorning heifer calves with a hot iron/electric dehorner increased from 13.8 percent in 2007 to 30.0 percent in 2014.

Tail docking

No changes were observed from 2002 to 2014 in the percentage of operations by percentage of cows on the operation with docked tails. Across study years, about one-third of cows had docked tails. In 2002 and 2007, a higher percentage of cows on medium operations than on small or large operations had docked tails.

Hoof health

Footbath use increased as herd size increased across study years. A higher percentage of operations in 2014 than in 1996 used a footbath for cows throughout the year (30.6 and 13.6 percent, respectively). For operations that used footbaths for cows, copper sulfate was the primary medication used in footbaths from 2007 to 2014.

Hoof trimming was performed on a higher percentage of operations in 2014 than in 1996. For operations that had cows' hooves trimmed, professional hoof trimmers were used by a higher percentage of operations in 2014 than in 1996 (80.2 and 50.8 percent, respectively).

Injection practices

The operation average number of injections an individual cow received, for all operations was similar (~13 injections) in 2007 and 2014. About one-half of operations across study years gave 2 to 10 injections before changing needles. The operation average percent of intramuscular injections accounted for two-thirds of all injections. Vaccinations represented about 40 percent of all IM injections in both study years. The hind leg was the primary injection location for about 60 percent of IM injections in 2007 and 2014.

Nutrient management

Although a lower percentage of operations in 2014 than in 2007 left manure on pasture for weaned heifers, it was still used by 78.0 percent of operations in 2014. Additionally, a lower percentage of operations in 2014 than in 2007 left manure on pasture, scraped a dry lot, or used a gutter cleaner in housing areas for cows even though these still ranked as the top 3 methods of manure handling for cows in 2014.

Bedded pack was the primary manure handling method used on operations in housing areas for weaned heifer housing areas on 36.4 percent of operations in 2014, which is an increase over previous study years. A higher percentage of operations scraped dry lots in heifer housing in 2014 compared with 2002 (20.0 and 14.0 percent, respectively). For cow housing areas, scraping dry lots was used by a higher percentage of operations in 2014 compared with 2002 (13.4 and 7.5 percent, respectively). The use of gutter cleaners in cow housing areas was lower in 2014 compared with 2002 (35.8 and 43.4 percent, respectively).

Manure was stored in a manure spreader on a higher percentage of operations in 2014 than in other study years. The percentage of operations that used a manure pack increased from 21.4 percent in 1996 to 57.6 percent in 2014.

Manure was applied to land either owned or rented on nearly all operations across study years. For operations that applied manure to land, the use of a broadcast/solid spreader to apply manure to land was used by more than 85 percent of operations across study years.

The percentage of operations that had a written nutrient management plan was higher within each herd size category and for all operations in 2014 than in 2002. In 2014, 50.8 percent of operations had a written nutrient management plan compared with 30.6 percent in 2002.

Table of Contents

Introduction

The USDA's National Animal Health Monitoring System (NAHMS) is a nonregulatory program of the USDA's Animal and Plant Health Inspection Service. NAHMS is designed to help meet the Nation's animal health information needs and has collected data on dairy health and management practices through four previous studies:

The 1991–92 National Dairy Heifer Evaluation Project (NDHEP) provided the dairy industry's first national information on the health and management of U.S. dairy cattle. Just months after the study's first results were released in 1993, cases of acute bovine viral diarrhea surfaced in the United States (following a 1993 outbreak in Canada). Information from NDHEP on vaccination and biosecurity practices helped officials address the risk of disease spread and target educational efforts on vaccination protocols. In addition, an outbreak of human illness was reported in 1993 in the Pacific Northwest related to *Escherichia coli* O157:H7. NDHEP data on the prevalence of *E. coli* O157:H7 in dairy cattle helped officials define public health risks as well as research needs. This baseline picture of the industry also helped identify additional research and educational efforts in various production areas, such as feed management and weaning practices.

Dairy 1996 helped the U.S. dairy industry identify educational needs and prioritize research efforts on such topics as antimicrobial use and Johne's disease, as well as digital dermatitis, bovine leukosis virus, and potential foodborne pathogens, including *E. coli, Salmonella, and Campylobacter.*

Dairy 2002 described management strategies that prevent and reduce Johne's disease and determined management factors associated with *Mycoplasma* and *Listeria* in bulk-tank milk. Additionally, levels of participation in quality assurance programs, the incidence of digital dermatitis, a profile of animal-waste handling systems used on U.S. dairy operations, and industry changes since the NDHEP 1991–92 and Dairy 1996 studies were examined in Dairy 2002.

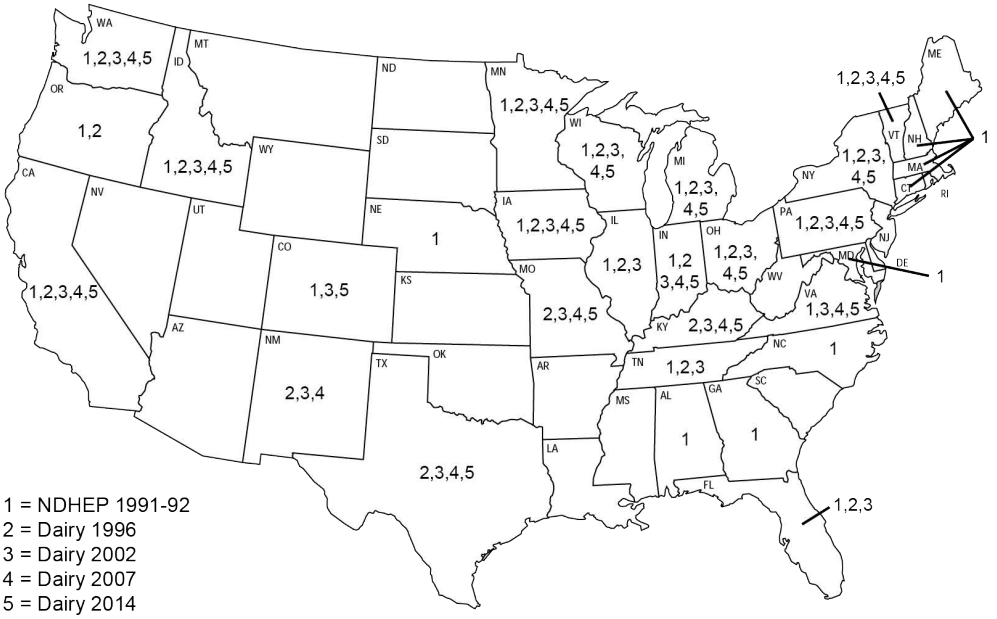
Dairy 2007 evaluated cow comfort using an on-farm assessment tool and evaluated passive transfer (maternal antibody) and growth in preweaned heifer calves. In addition, the study estimated the prevalence of multiple diseases, including bovine viral diarrhea virus, contagious mastitis pathogens, Johne's disease, and food safety pathogens such as *Salmonella* and *Listeria*. The implementation of biosecurity practices was also evaluated, as has been done in every NAHMS dairy study. Additionally, industry changes since the NDHEP 1991–92, Dairy 1996, and Dairy 2002 studies were examined.

Dairy 2014 is the latest NAHMS dairy study and was conducted in 17 of the Nation's major dairy States (see map on next page). The study provides valuable information to participants, stakeholders, and the dairy industry as a whole. The States in this study represented 80.5 percent of U.S. dairy operations and 81.3 percent of U.S. dairy cows. Results from the study are presented in a variety of publications, including the following reports:

- **Report 1—**"Dairy Cattle Management Practices in the United States, 2014" contains national information collected from 1,261 dairy operations participating in the NAHMS Dairy 2014 study.
- **Report 2—**"Milk Quality, Milking Procedures, and Mastitis on U.S. Dairy Operations, 2014," contains information from 265 operations with 30 or more dairy cows, a subset of the 1,261 operations described in "Dairy Cattle Management Practices in the United States, 2014."
- **Report 3—**"Health and Management Practices on U.S. Dairy Operations, 2014" contains information from 265 operations with 30 or more dairy cows, a subset of the 1,261 operations described in "Dairy Cattle Management Practices in the United States, 2014."
- **Report 4—**"Nutrient Management Practices on U.S. Dairy Operations, 2014" contains information from 1,261 operations described in "Dairy Cattle Management Practices in the United States, 2014."
- **Report 5—**"Changes in Dairy Cattle Health and Management Practices in the United States, 1991-2014" presents trends in the dairy industry by providing national estimates of comparable populations from the 1991-92 NDHEP, Dairy 1996, Dairy 2002, Dairy 2007, and Dairy 2014 studies. In order to make the populations comparable, some estimates were recomputed. Estimates in this report are either from operations with 1 or more cows or with 30 or more cows, and these estimates might be slightly different from previously published estimates because of the change in population.

All NAHMS Dairy reports are available at: http://www.aphis.usda.gov/nahms

States participating in NAHMS Dairy studies, 1991-92, 1996, 2002, 2007, 2014



Terms Used in This Report

Age at first calving— Heifer age at first calving. The recommended age is 20 to 24 months.

Anestrus— Refers to heifers and cows that do not display estrus. It is during estrus that cows show interest in mating and are sexually receptive.

Antibiotics— Substances produced by microorganisms that kill or inhibit the growth of other microorganisms.

Antimicrobial— Any substance, including antibiotics, that kills or inhibits the growth of microorganisms.

Breeding Programs

Ovsynch— A series of injections that synchronizes ovulation in cows, eliminating the need for estrus detection. The protocol calls for two injections of a gonadotropin-releasing hormone (GnRH) analogue, separated by a single administration of prostaglandin (PGF2α).

Presynch— A series of two PGF2α injections that synchronizes the estrous cycle of cows to better respond to the Ovsynch protocol.

Resynch— A single GnRH injection given to cows 7 days prior to pregnancy examination. Cows not pregnant are administered PGF2α at the time of examination, GnRH 48 hours later, and timed AI 8 to 18 hours later.

Calving interval— The period from one calving to the next, which depends on how quickly a cow conceives after calving.

Cattle class:

Calf— A male or female bovine less than one year old.

Heifer— Female dairy bovine of any age that has not yet calved.

Preweaned heifer— Female dairy bovine primarily on a liquid diet of milk or milk replacer.

Weaned heifer— Female dairy bovine no longer on liquid feed (i.e., milk or milk replacer) and is not pregnant.

Pregnant heifer— Female dairy bovine pregnant for the first time.

Cow— Female dairy bovine that has calved at least once.

Close-up cow— Cow approximately 2 to 4 weeks from calving.

Dry cow— Cow that has completed at least one lactation and is not currently producing milk.

Fresh cow— Cow that has given birth within the last few days to weeks.

Cow average— The average computed estimate for all cows; the reported value for each operation multiplied by the number of cows on that operation is summed over all operations and divided by the number of cows on all operations. This way, the result is adjusted for the number of cows on each operation. For instance, in Section III, table B.2., the average age at first calving is multiplied by the number of cows for each operation. This product is then summed over all operations and divided by the sum of cows over all operations. The result is the average age at first calving for all cows.

Cystic ovaries— A cause of reproductive failure in cows involving a follicular or luteal cyst. Cows with cystic ovaries are generally in anestrus.

Dairy Herd Improvement Association (DHIA)— An organization with programs and objectives intended to improve the production and profitability of dairy farming. DHIA also aids farmers in keeping milk production and management records.

Dry-off— The cessation of lactation. This is the time when intramammary antimicrobials and/or teat sealants may be administered.

Dry period— The period from the end of one lactation to the beginning of a new lactation. A 60-day dry period is commonly recommended.

Feed line— The location of cattle feed. Feedline location can vary, based on housing characteristics.

Heifer average— Same as cow average but for all heifers on the operation.

Herd size— Herd size is based on an operation’s January 1 respective dairy cow inventory. Very small operations had fewer than 30 head; small operations had 30 to 99 head; medium operations had 100 to 499 head; and large operations had 500 or more head. In some study years, producers on very small operations completed an abbreviated questionnaire that included a subset of questions administered to producers on operations with 30 or more dairy head.

Housing types

Freestall— Housing consisting of resting stalls or “beds” in which individual dairy cows are free to enter and leave at will.

Multiple-animal area— Housing other than freestalls or open dry-lots that allow cows to move from one area to another, such as in a bedded pack barn.

Open dry-lot— An open, dirt lot used for housing cows in arid and semi-arid climates.

Pasture— An area with vegetation suitable for grazing.

Stanchion— Housing in which a cow is restrained in an individual stall by a device with two rails that close around the cow’s neck after she enters the stall. Cows must be released from the rails in order to exit the stalls.

Tie stall— Housing in which a cow is restrained by a neck collar tethered to an individual stall. Cows must be un-tethered to in order to exit leave the stalls.

Identification

Electronic— Any electronic ID system comprising a transponder containing a microantenna that, when read at a specific radio frequency, emits a signal containing a unique electronic code. Commonly referred to as radio frequency identification (RFID).

Herd identification— Refers to an ID used for the same or all animals in a herd. The ID designates the animals as belonging to a specific operation.

Individual-animal identification— Unique identification for each animal in a herd.

Ionophore— A feed additive that promotes the efficient use of feedstuffs by altering the fermentation pattern in the rumen which can reduce methane production. 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.

Licensed dairy herds— Operations with a license from State and/or other regulatory agencies to sell milk.

Manure— Cattle waste (feces and urine) product, which is frequently applied to land as fertilizer as part of a nutrient management plan. There are three common types of manure:

Solid manure is typically found in housing systems where dirt, pasture, or bedding are used to absorb moisture from the manure. Solid manure is usually made up of more than 15 percent solids.

Slurry manure is generated when there are limited or no materials to absorb the moisture from manure; solids content is typically between 5 and 15 percent.

Liquid manure is generated when waste or rain water ends up in manure; the solids content is typically 5 percent or less.

For the purposes of this report, liquid and slurry manure are considered one and the same.

Manure handling methods

Alley flush with recycled water— System in which lagoon water is used to flush manure from alleyways. The lagoon water and manure are collected, and the solids are usually separated (mechanical or gravity system) before the waste water is recycled and used again.

Alley scraper (mechanical or tractor)— A mechanical system used to clean cow alleyways using either a scraper blade that is dragged along alleyways via chain or cable, or a tractor is used with a bucket or blade to remove manure.

Bedded pack (manure pack)— Manure accumulates in a pack that is frequently bedded with an organic bedding material. The pack is completely removed during cleaning.

Gutter cleaner— A conveyor system with paddles that moves manure from the trough behind the cows to another handling method or to a storage area.

Manure left on pasture— Manure is not handled, although the pasture may be harrowed to break up and spread manure.

Manure vacuum— A piece of equipment that sucks slurry manure from a concrete surface and into a tank.

Open/dry lot scraped— Manure from a dry lot is usually scraped using a tractor bucket or blade.

Slotted floor— A system in which the floor has perforations or slots, and the manure falls to a collection pit below.

Manure storage and treatment systems

Below-floor slurry or deep pit— A concrete lined or earthen pit positioned below flooring and intended to collect and store manure.

Collected methane/biogas— Byproduct of storing manure in an anaerobic environment and capturing the gas produced.

Composted (actively managed to produce a composted material)— manure that is monitored for temperature and regularly turned/mixed to aerate.

Manure pack (bedded pack/inside barn)— Accumulated manure stored in a pack and frequently bedded. The pack is completely removed during cleaning.

Manure spreader— Equipment used to scatter manure. Manure might be stored in the spreader for brief periods

Outside storage for solid manure not in dry lot or pen— Manure is stored in a pile not accessible by cattle.

Outside storage for solid manure on a dry lot or within a pen— Manure is stored in a pile within the pen of cattle.

Slurry stored in tank (either above or below ground)— A system that captures liquid manure in a tank.

Slurry or liquid manure stored in earthen basin and not treated— Storage in a basin without treatment of the manure.

Solid manure stored in a building without cattle access— Collection of solid manure in areas with a solid separator or other means of reducing moisture content of the manure.

Solid manure stored with a picket dam— A pit or lagoon-type structure that has a permeable barrier, usually a wooden fence-like structure, to allow excess water from rainfall or other sources to drain away from the manure.

Solids separator— Device that physically separates liquids from manure, usually through pressure.

Treatment lagoon (mechanically aerated)— Structure similar to a pond in which manure and waste water accumulate and manure decomposes. Aerators are used to provide oxygen to support aerobic bacteria.

Treatment lagoon (not mechanically aerated)— Structure similar to a pond engineered and designed to allow manure and waste water to accumulate and decompose in an anaerobic environment.

Mastitis— Inflammation of the mammary glands, most commonly caused by a bacterial infection.

Milking facilities

Tie stall/stanchion barns— Portable milking equipment is moved between cows.

Parlors—Fixed milking equipment and cows move to the equipment. Cows are milked on an elevated platform while the people milking stand at a lower level in what is referred to as the pit.

Parlor types

Flat barn— Similar to tie stall or stanchion barns, except that milking equipment is permanently fixed and cows move to the milking equipment. Cow are usually not milked on an elevated platform.

Herringbone (fishbone)— Elevated platform on which the cows face away from the milking pit at an angle. Cows on one side of the parlor exit at the same time.

Parabone— Similar to a herringbone, except that cows are at more of an angle to the milking pit.

Parallel (side by side)— Elevated platform on which cows face away from the milking pit, and the milking units are applied by going between the cows' back legs. Cows on one side of the parlor exit at the same time.

Rotary (carousel)— Elevated, moving platform that rotates in a circle, similar to a carousel. Cows enter and exit the platform one at a time and are milked from behind.

Side opening (tandem)— Parlors with milking stalls that might be angled away from the milking pit. A side-opening parlor is similar to a herringbone, but cows are released individually, instead of waiting for the entire side to finish milking.

Swing— Usually a parabone-type configuration with the milking units in the center of the milking pit, allowing for only one side of the parlor to be milked at a time.

Milk urea nitrogen (MUN)— An individual or group milk test used to determine if rations are properly balanced for protein and energy.

Operation average— The average estimate for all operations. A single value for each operation is summed over all operations reporting divided by the number of operations reporting. For example, the operation average rolling herd average (RHA) milk production (section III, table A.1.b., pg. 53) is calculated by summing the reported RHA milk production for each operation divided by the number of operations.

Operation type

Conventional— An operation in which the majority of forage is not harvested by cows.

Combination— An operation that uses both conventional and grazing practices.

Grazing— An operation in which the majority of forage consumed is harvested by cows during the growing season.

Organic— A farm that meets organic standards set by the USDA.

Population estimates— Estimates in this report are provided with a measure of precision called the standard error. A 95-percent confidence interval can be created with bounds equal to the estimate, plus or minus two standard errors. If the only error is sampling error, the confidence intervals created in this manner will contain the true population mean 95 out of 100 times. 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 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. The term ‘no substantial differences’ is used when estimates appear numerically different but the 95-percent confidence intervals overlap. All estimates in this report are rounded to the nearest tenth. If rounded to 0, the standard error was reported as (0.0). If there were no reports of the event (0.0 percent) or if all operations reported the event (100.0 percent), no standard error was reported (—). When an estimate cell is grayed out, the question did not contain that category as a response option.

Recombinant bovine somatotropin (rbST)— A protein hormone synthesized for use in dairy cows that increases milk production by about 15 percent. Naturally occurring bovine somatotropin (bST) is produced in the pituitary gland.

Rolling herd average (RHA) milk production— Average milk production per cow (lb/cow) in the herd during the previous 12 months.

Sample profile— Information that describes characteristics of the operations from which data were collected.

Sexed semen— Semen containing mostly X chromosomes. Sexed semen, consisting of about 90 percent X chromosomes, is generally used to service heifers, since they are more fertile than cows. Using sexed semen increases the number of heifer calves born, which can be used as replacements.

Somatic cell count (SCC)— Used as an indicator of milk quality, SCC is the number of white blood cells and secretory cells per milliliter of raw milk. SCC in bulk-tank milk is usually abbreviated BTSCC.

Superovulation— A process used during embryo transfer to ovulate multiple ova at one time.

Usual calving area— An area separate from housing for lactating cows designated specifically for calving.

Section I: Historical Changes in the U.S. Dairy Industry

Note: Unless otherwise noted, tables in this section were comprised from data collected by USDA's National Agricultural Statistics Service (NASS).

A. General Trends

1. Milk-cow inventory

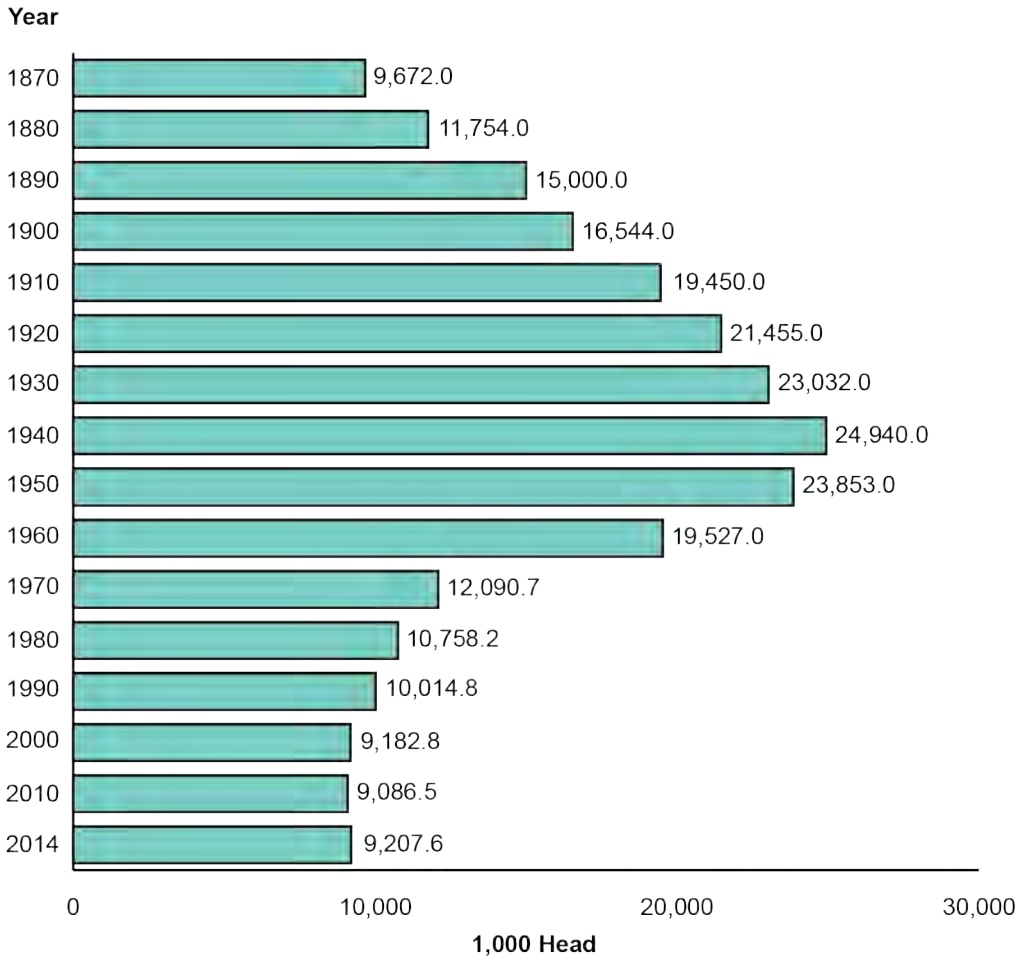
On January 1, 2014, U.S. milk cows numbered 9,207,600 head, which was 95.2 percent of the 9,672,000 U.S. milk cows in 1870. All U.S. cattle and calves numbered 88,526,000 head in 2014, nearly three times the number of all cattle and calves in 1870 (31,082,000 head).

A.1.a. Long-term changes in U.S. milk cows and all cattle and calves January 1 inventory, 1870–2014:

	Milk Cows			All cattle and calves
Year	1,000 head	Percent of 1870	Percent of all cattle and calves	1,000 head
1870	9,672.0	100.0	31.1	31,082.0
1880	11,754.0	121.5	27.1	43,347.0
1890	15,000.0	155.1	25.0	60,014.0
1900	16,544.0	171.1	27.7	59,739.0
1910	19,450.0	201.1	33.0	58,993.0
1920	21,455.0	221.8	30.5	70,400.0
1930	23,032.0	238.1	37.8	61,003.0
1940	24,940.0	257.9	36.5	68,309.0
1950	23,853.0	246.6	30.6	77,963.0
1960	19,527.0	201.9	20.3	96,236.0
1970	12,090.7	125.0	10.8	112,368.7
1980	10,758.2	111.2	9.7	111,242.4
1990	10,014.8	103.5	10.5	95,816.2
2000	9,182.8	94.9	9.4	98,199.0
2010	9,086.5	93.9	9.7	94,081.2
2014	9,207.6	95.2	10.4	88,526.0

Source: USDA–NASS Quick Stats Database, 1870–1960; USDA–NASS Cattle - Final Estimates, 1970–2010; USDA–NASS Cattle, January 2015.

Long-term changes in U.S. milk cow January 1 inventory, 1870–2014



Source: USDA–NASS Quick Stats Database, 1870–1960; USDA–NASS Cattle - Final Estimates, 1970–2010; USDA–NASS Cattle, January 2015.

The number of milk cows has decreased by almost 9.0 percent from 1991 to 2002 but has remained stable since 2002.

A.1.b. Recent changes in U.S. milk cow January 1 inventory, 1991–2014:

	Milk Cows					
Year	1,000 head	Percent previous year	Percent of 1991	Percent of 1996	Percent of 2002	Percent of 2007
1991	9,965.0	99.5	100.0			
1992	9,728.2	97.6	97.6			
1993	9,658.1	99.3	96.9			
1994	9,507.0	98.4	95.4			
1995	9,481.8	99.7	95.2			
1996	9,419.9	99.3	94.5	100.0		
1997	9,317.9	98.9	93.5	98.9		
1998	9,199.0	98.7	92.3	97.7		
1999	9,128.0	99.2	91.6	96.9		
2000	9,182.8	100.6	92.2	97.5		
2001	9,171.7	99.9	92.0	97.4		
2002	9,105.6	99.3	91.4	96.7	100.0	
2003	9,141.7	100.4	91.7	97.0	100.4	
2004	8,987.5	98.3	90.2	95.4	98.7	
2005	9,003.5	100.2	90.4	95.6	98.9	
2006	9,103.9	101.1	91.4	96.6	100.0	
2007	9,129.0	100.3	91.6	96.9	100.3	100.0
2008	9,257.0	101.4	92.9	98.3	101.7	101.4
2009	9,332.8	100.8	93.7	99.1	102.5	102.2
2010	9,086.5	97.4	91.2	96.5	99.8	99.5
2011	9,155.6	100.8	91.9	97.2	100.5	100.3
2012	9,235.5	100.9	92.7	98.0	101.4	101.2
2013	9,221.2	99.8	92.5	97.9	101.3	101.0
2014	9,207.6	99.9	92.4	97.7	101.1	100.9

Source: USDA–NASS Cattle - Final Estimates, 1991–2013; USDA–NASS Cattle, January 2015.

The January 1, 2014, number of replacement heifers has increased 11.1 percent compared with the 1991 inventory. Since 1991, replacement heifers as a percentage of milk cow inventory has ranged from 41.1 to 50.1 percent, with 2010 to 2014 showing higher percentages.

A.1.c. Recent changes in U.S. replacement heifer January 1 inventory, 1991–2014:

Milk Cow Replacement Heifers							
Year	1,000 head	Percent previous year	Percent of 1991	Percent of 1996	Percent of 2002	Percent of 2007	Percent of milk cows
1991	4,093.0	98.1	100.0				41.1
1992	4,131.4	100.9	100.9				42.5
1993	4,176.2	101.1	102.0				43.2
1994	4,124.5	98.8	100.8				43.4
1995	4,121.3	99.9	100.7				43.5
1996	4,090.3	99.2	99.9	100.0			43.4
1997	4,058.4	99.2	99.2	99.2			43.6
1998	3,985.7	98.2	97.4	97.4			43.3
1999	4,068.8	102.1	99.4	99.5			44.6
2000	3,999.8	98.3	97.7	97.8			43.6
2001	4,057.0	101.4	99.1	99.2			44.2
2002	4,054.8	99.9	99.1	99.1	100.0		44.5
2003	4,113.9	101.5	100.5	100.6	101.5		45.0
2004	4,018.0	97.7	98.2	98.2	99.1		44.7
2005	4,116.6	102.5	100.6	100.6	101.5		45.7
2006	4,298.0	104.4	105.0	105.1	106.0		47.2
2007	4,324.9	100.6	105.7	105.7	106.7	100.0	47.4
2008	4,415.0	102.1	107.9	107.9	108.9	102.1	47.7
2009	4,409.5	99.9	107.7	107.8	108.7	102.0	47.2
2010	4,551.2	103.2	111.2	111.3	112.2	105.2	50.1
2011	4,577.2	100.6	111.8	111.9	112.9	105.8	50.0
2012	4,618.0	100.9	112.8	112.9	113.9	106.8	50.0
2013	4,545.7	98.4	111.1	111.1	112.1	105.1	49.3
2014	4,548.7	100.1	111.1	111.2	112.2	105.2	49.4

Source: USDA–NASS Cattle - Final Estimates, 1992–2013; USDA–NASS Cattle, January 2015.

2. Number and size of dairy operations

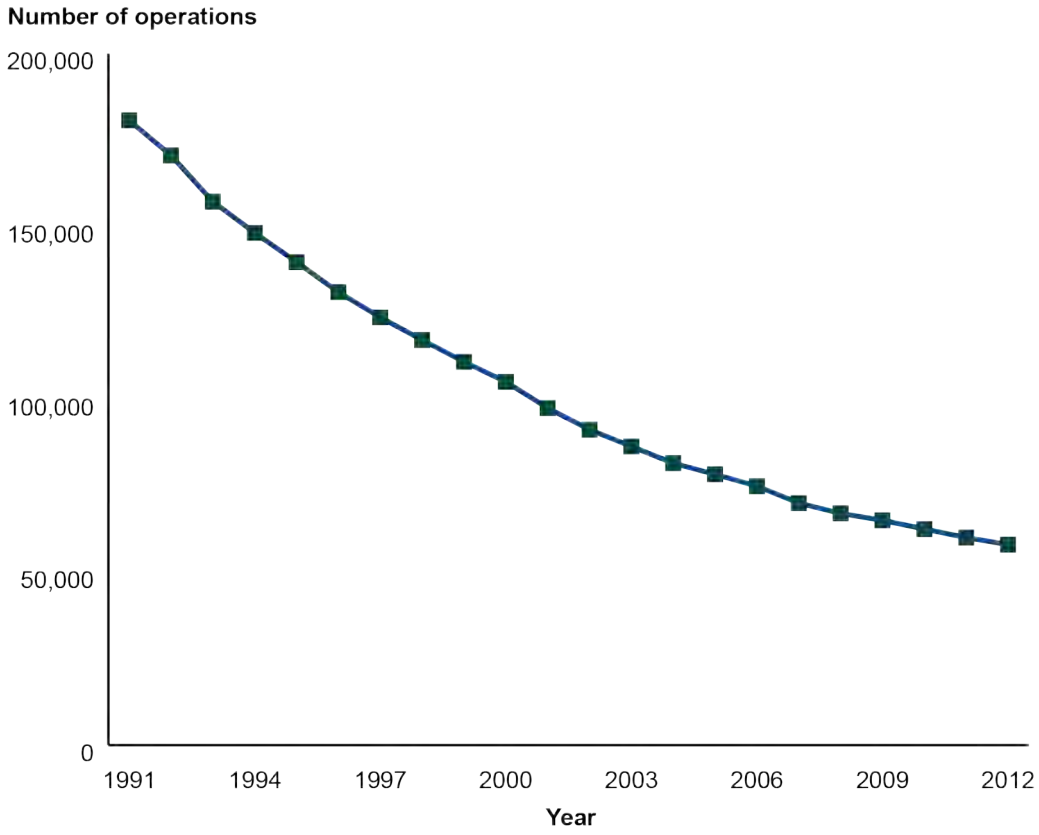
Each year since 1991, approximately 4 to 7 percent of U.S. dairy operations have gone out of business. For example, since 1991 the number of dairy operations has decreased by 67.9 percent, while milk cow numbers as of 2014 were at 92.4 percent of 1991 estimates (table A.1.b). During this period, milk production per cow increased by 48.0 percent (table A.3.a), and total milk production increased by 39.5 percent (table A.3.b).

A.2.a. Recent changes in the number of U.S. dairy operations,[1] 1991–2012:

Year	Number of operations	Percent previous year	Percent of 1991	Percent of 1996	Percent of 2002	Percent of 2007
1991	180,640	93.8	100.0			
1992	170,520	94.4	94.4			
1993	157,150	92.2	87.0			
1994	148,140	94.3	82.0			
1995	139,670	94.3	77.3			
1996	130,980	93.8	72.5	100.0		
1997	123,700	94.4	68.5	94.4		
1998	117,145	94.7	64.8	89.4		
1999	110,855	94.6	61.4	84.6		
2000	105,055	94.8	58.2	80.2		
2001	97,460	92.8	54.0	74.4		
2002	91,240	93.6	50.5	69.7	100.0	
2003	86,360	94.7	47.8	65.9	94.7	
2004	81,520	94.4	45.1	62.2	89.3	
2005	78,300	96.1	43.3	59.8	85.8	
2006	74,880	95.6	41.5	57.2	82.1	
2007	69,995	93.5	38.7	53.4	76.7	100.0
2008	67,000	95.7	37.1	51.2	73.4	95.7
2009	65,000	97.0	36.0	49.6	71.2	92.9
2010	62,500	96.2	34.6	47.7	68.5	89.3
2011	60,000	96.0	33.2	45.8	65.8	85.7
2012[2]	58,000	96.7	32.1	44.3	63.6	82.9

Source: USDA–NASS Cattle - Final Estimates, 1991–1997; USDA–NASS Livestock Operations – Final Estimates, 1998–2007; USDA–NASS Farms, Land in Farms, and Livestock Operations, 2008–2012.
[1]An operation is any place having one or more milk cows—excluding cows used to nurse calves—on hand any time during the year.
[2]NASS stopped releasing annual operation level data after 2012 because operation level data was moved to the Census of Agriculture, which is released every 5 years.

Recent changes in the number of U.S. dairy operations,* 1991 - 2012



Source: USDA–NASS Cattle - Final Estimates, 1991–1997; USDA–NASS Livestock Operations – Final Estimates, 1998–2007; USDA–NASS Farms, Land in Farms, and Livestock Operations, 2008–2012.
*An operation is any place having one or more milk cows—excluding cows used to nurse calves—on hand any time during the year.

The number of licensed dairy herds has decreased by nearly 40 percent since 1992, a 4 to 5 percent per-year decrease each year since 2002.

A.2.b. Recent changes in the number of U.S. licensed dairy herds, 2002–2014:

Year	Number of herds	Percent previous year	Percent of 2002	Percent of 2007
2002	74,110		100.0	
2003	70,375	95.0	95.0	
2004	66,825	95.0	90.2	
2005	64,540	96.6	87.1	
2006	62,070	96.2	83.8	
2007	59,130	95.3	79.8	100.0
2008	57,127	96.6	77.1	96.6
2009	54,932	96.2	74.1	92.9
2010	53,132	96.7	71.7	89.9
2011	51,291	96.5	69.2	86.7
2012	49,281	96.1	66.5	83.3
2013	46,975	95.3	63.4	79.4
2014	44,809	95.4	60.5	75.8

Source: USDA–NASS Milk Production, 2003–2015.

The percentage of operations with fewer than 50 cows has decreased since 1991, while the percentage of operations with 100 or more cows has increased. Only 11.5 percent of operations had 100 or more cows in 1991 compared with 25.9 percent of operations in 2012.

A.2.c. Percentage of U.S. dairy operations by herd size, 1991–2012:

	Percent Operations						
	Herd Size (number of cows)						
Year	**1–29**	**30–49**	**50–99**	**100–199**	**200–499**	**500+**	**Total**
1991	39.8	22.8	25.9	11.5[1]			100.0
1992	38.9	22.1	26.0	13.0[1]			100.0
1993	37.2	22.2	26.9	9.3	4.4[2]		100.0
1994	35.8	22.0	27.7	9.9	4.6[2]		100.0
1995	33.9	22.4	28.1	10.6	5.0[2]		100.0
1996	31.4	22.4	29.1	11.6	5.5[2]		100.0
1997	31.6	22.1	29.0	11.3	4.1	1.9	100.0
1998	30.8	21.8	29.1	11.9	4.4	2.0	100.0
1999	29.7	21.7	29.6	11.9	4.8	2.3	100.0
2000	29.3	21.2	29.7	12.2	5.1	2.5	100.0
2001	29.0	20.4	29.8	12.6	5.3	2.9	100.0
2002	28.9	19.8	30.0	12.6	5.5	3.2	100.0
2003	29.0	19.5	29.9	12.7	5.5	3.4	100.0
2004	29.2	19.0	29.5	12.8	5.8	3.7	100.0
2005	28.7	19.0	29.6	12.8	6.0	3.9	100.0
2006	28.3	18.8	29.6	13.0	6.1	4.2	100.0
2007	31.0	17.5	27.6	12.9	6.2	4.8	100.0
2008	31.8	17.8	26.6	13.0	5.9	4.9	100.0
2009	31.4	17.7	26.6	13.2	5.9	5.2	100.0
2010	32.0	17.3	25.3	13.8	6.3	5.3	100.0
2011	32.3	16.8	24.7	13.8	6.7	5.7	100.0
2012	32.4	16.7	25.0	13.6	6.6	5.7	100.0

Source: USDA–NASS Milk Production, 1991–1992; USDA–NASS Milk Cows and Production – Final Estimates 1993–1997; March 2009; USDA–NASS Livestock Operations–Final Estimates, 1998–2007; USDA–NASS Farms, Land in Farms, and Livestock Operations, 2008–2012.
[1]These estimates include herds with 100 or more head.
[2]These estimates include herds with 200 or more head.

In 2012, 71.0 percent of all U.S. dairy cows were on operations with 200 or more cows, and operations of this size represented 12.3 percent of all U.S. dairy operations (table A.2.c.). In 1993, 31.8 percent of all U.S. dairy cows were on operations with 200 or more cows.

A.2.d. Percentage of U.S. milk cow inventory by herd size, 1991–2014:

	Percent Inventory						
	Herd Size (number of cows)						
Year	**1–29**	**30–49**	**50–99**	**100–199**	**200–499**	**500+**	**Total**
1991	6.3	16.6	31.7	45.4[1]			100.0
1992	5.5	15.2	30.0	49.3[1]			100.0
1993	5.0	14.8	29.2	19.2	31.8[2]		100.0
1994	4.6	14.0	28.7	19.3	33.4[2]		100.0
1995	4.0	13.0	28.0	20.0	35.0[2]		100.0
1996	4.0	12.0	27.0	20.0	37.0[2]		100.0
1997	3.5	11.5	26.0	20.0	14.6	24.4	100.0
1998	3.6	10.5	24.3	19.3	15.5	26.8	100.0
1999	3.2	10.2	23.3	18.4	16.3	28.6	100.0
2000	2.9	9.1	22.0	18.1	16.6	31.3	100.0
2001	2.7	8.0	20.8	17.2	16.3	35.0	100.0
2002	2.4	7.4	19.6	16.4	15.9	38.3	100.0
2003	2.3	6.9	18.8	15.7	15.4	40.9	100.0
2004	2.1	6.6	17.8	15.1	15.5	42.9	100.0
2005	2.0	6.4	17.1	14.6	15.4	44.5	100.0
2006	1.9	6.0	16.1	14.1	15.1	46.8	100.0
2007	2.0	5.2	14.0	13.0	13.9	51.9	100.0
2008	1.8	5.1	13.1	12.5	12.6	54.9	100.0
2009	1.8	4.9	13.0	12.4	12.3	55.6	100.0
2010	1.7	4.7	12.2	12.3	12.5	56.6	100.0
2011	1.6	4.3	11.2	11.9	12.5	58.5	100.0
2012	1.6	4.3	11.3	11.8	12.5	58.5	100.0

Source: USDA–NASS Milk Production, 1991–1992; USDA–NASS Milk Cows and Production – Final Estimates 1993–1997; March 2009; USDA–NASS Livestock Operations–Final Estimates, 1998–2007; USDA–NASS Farms, Land in Farms, and Livestock Operations, 2008–2012.
[1]These estimates include herds with 100 or more head.
[2]These estimates include herds with 200 or more head.

3. Milk production

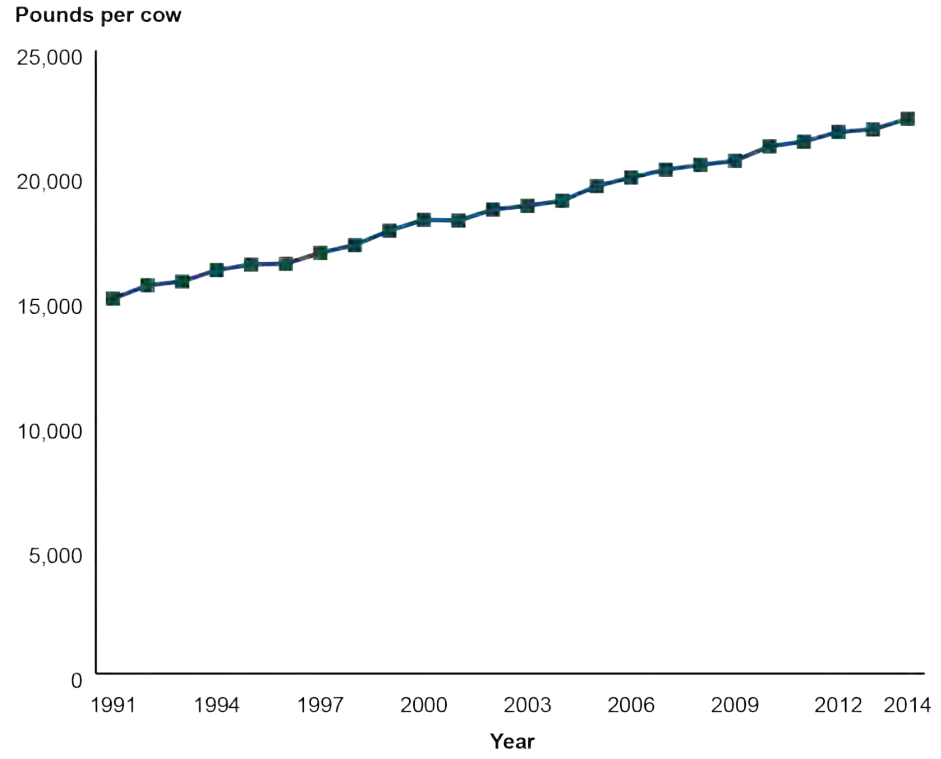
Milk production per cow has increased as much as 1 to 3 percent annually since 1991, with the exception of 2001. Milk production per cow was 22,249 pounds in 2014 compared to 15,031 pounds in 1991, a 48.0 percent increase.

A.3.a. Recent changes in U.S. milk production per cow, 1991–2014:

		Milk per Cow					
Year	**Average number of milk cows*** (1,000 head)	**Pounds per cow**	**Percent previous year**	**Percent of 1991**	**Percent of 1996**	**Percent of 2002**	**Percent of 2007**
1991	9,826	15,031	101.7	100.0			
1992	9,688	15,570	103.6	103.6			
1993	9,581	15,722	101.0	104.6			
1994	9,494	16,179	102.9	107.6			
1995	9,466	16,405	101.4	109.1			
1996	9,372	16,433	100.2	109.3	100.0		
1997	9,252	16,871	102.7	112.2	102.7		
1998	9,151	17,185	101.9	114.3	104.6		
1999	9,153	17,763	103.4	118.2	108.1		
2000	9,199	18,197	102.4	121.1	110.7		
2001	9,103	18,162	99.8	120.8	110.5		
2002	9,139	18,608	102.5	123.8	113.2	100.0	
2003	9,081	18,760	100.8	124.8	114.2	100.8	
2004	9,010	18,960	101.1	126.1	115.4	101.9	
2005	9,050	19,550	103.1	130.1	119.0	105.1	
2006	9,137	19,895	101.8	132.4	121.1	106.9	
2007	9,189	20,204	101.6	134.4	122.9	108.6	100.0
2008	9,314	20,397	101.0	135.7	124.1	109.6	101.0
2009	9,202	20,561	100.8	136.8	125.1	110.5	101.8
2010	9,123	21,142	102.8	140.7	128.7	113.6	104.6
2011	9,199	21,334	100.9	141.9	129.8	114.6	105.6
2012	9,237	21,722	101.8	144.5	132.2	116.7	107.5
2013	9,224	21,819	100.4	145.1	132.8	117.3	108.0
2014	9,261	22,249	102.0	148.0	135.4	119.6	110.1

Source: USDA–NASS Milk Cows and Production – Final Estimates, 1993–2012; USDA–NASS Milk Production, 1991–1992, 2013–2014.
*Average number during the year, excluding heifers not yet fresh.

Recent changes in U.S. milk production per cow,* 1991–2014



Source: USDA–NASS Milk Cows and Production – Final Estimates, 1993–2012; USDA–NASS Milk Production, 1991–1992, 2013–2014.
*Average number during the year, excluding heifers not yet fresh.

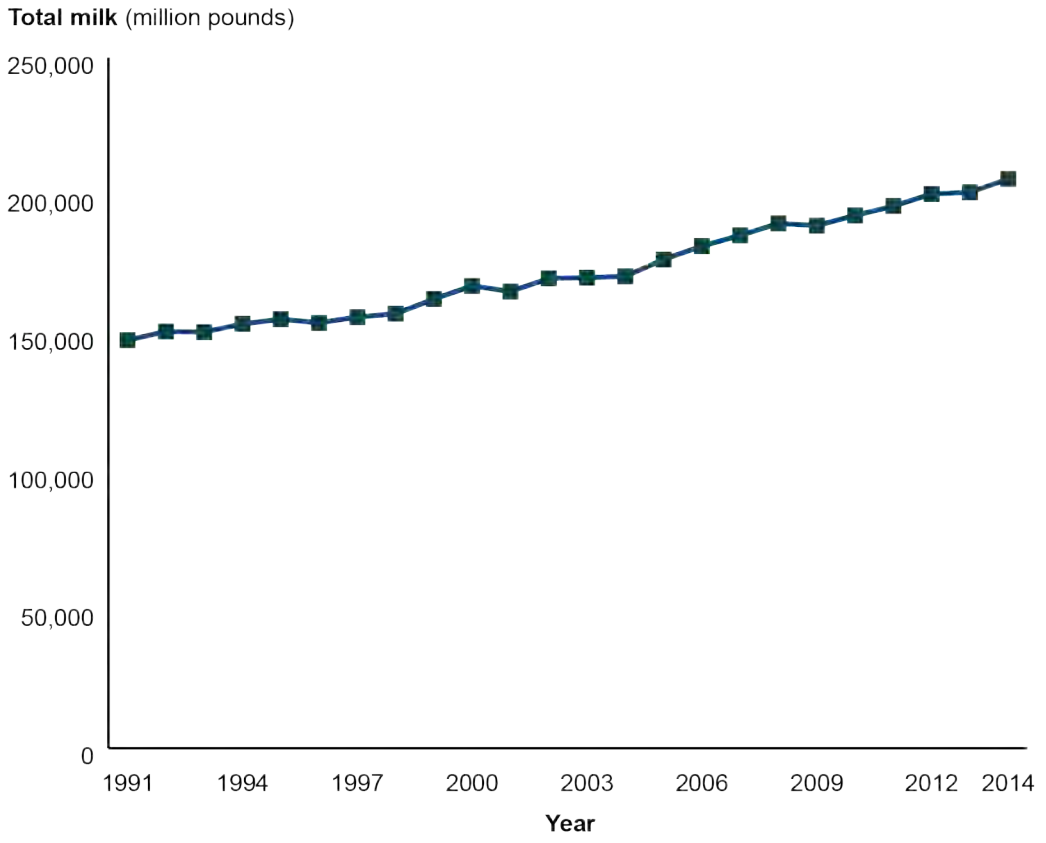
In 2014, total milk production was 206,048 million pounds compared with 147,697 million pounds in 1991. These numbers represent a 39.5 percent increase in milk production since 1991, while during the same period the number of U.S. milk cows decreased by more than 7 percent (table A.1.b).

A.3.b. Recent changes in U.S. total milk production, 1991–2014:

	Total Milk Production					
Year	**Total milk*** (million pounds)	**Percent previous year**	**Percent of 1991**	**Percent of 1996**	**Percent of 2002**	**Percent of 2007**
1991	147,697	100.0	100.0			
1992	150,847	102.1	102.1			
1993	150,636	99.9	102.0			
1994	153,602	102.0	104.0			
1995	155,292	101.1	105.1			
1996	154,006	99.2	104.3	100.0		
1997	156,091	101.4	105.7	101.4		
1998	157,262	100.8	106.5	102.1		
1999	162,589	103.4	110.1	105.6		
2000	167,393	103.0	113.3	108.7		
2001	165,332	98.8	111.9	107.4		
2002	170,063	102.9	115.1	110.4	100.0	
2003	170,348	100.2	115.3	110.6	100.2	
2004	170,832	100.3	115.7	110.9	100.5	
2005	176,931	103.6	119.8	114.9	104.0	
2006	181,782	102.7	123.1	118.0	106.9	
2007	185,654	102.1	125.7	120.5	109.2	100.0
2008	189,978	102.3	128.6	123.4	111.7	102.3
2009	189,202	99.6	128.1	122.9	111.3	101.9
2010	192,877	101.9	130.6	125.2	113.4	103.9
2011	196,255	101.8	132.9	127.4	115.4	105.7
2012	200,642	102.2	135.8	130.3	118.0	108.1
2013	201,260	100.3	136.3	130.7	118.3	108.4
2014	206,048	102.4	139.5	133.8	121.2	111.0

Source: USDA–NASS Milk Cows and Production – Final Estimates, 1993–2012; USDA–NASS Milk Production, 1991–1992, 2013–2014.
*Excluding milk nursed by calves.

Recent changes in U.S. total milk production,* 1991–2014



Source: USDA–NASS Milk Cows and Production – Final Estimates, 1993–2012; USDA–NASS Milk Production, 1991–1992, 2013–2014.
*Excluding milk nursed by calves.

4. Bulk-tank somatic cell counts

Bulk-tank somatic cell counts (BTSCCs) from 4 of the 10 U.S. Federal Milk Marketing Orders were analyzed from 1995 to 2014. Monthly BTSCCs were weighted based on the pounds of milk shipped, and then a geometric mean of all milk-weighted somatic cell counts (SCC) was calculated. BTSCCs from the four Federal Milk Marketing Orders have decreased over the last 20 years. Typically, BTSCCs spike during summer months and decline quickly during fall. BTSCCs have ranged from a high of 384,100 in August 1995 to a low of 177,000 in November 2012.

A.4. Milk-weighted bulk-tank somatic cell counts from Federal Milk Marketing Orders, 1995–2014

	Bulk Tank Somatic Cell Counts (x1,000 cells/mL)**, 1995–2014**						
Month	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
January	298.8	275.5	288.2	284.4	278.5	258.0	286.5
February	293.2	283.5	294.9	280.2	288.8	279.9	280.2
March	297.0	283.3	295.9	282.4	282.8	283.7	281.7
April	289.3	277.0	291.3	282.6	283.9	282.5	284.5
May	286.1	280.4	293.4	284.2	286.4	292.6	291.6
June	308.6	309.2	299.9	298.6	315.3	311.9	305.9
July	342.8	338.7	330.3	330.2	341.4	334.2	332.5
August	384.1	334.1	336.7	328.4	363.7	341.4	352.5
September	356.4	313.0	314.1	312.3	325.5	326.4	327.3
October	296.6	275.6	276.9	288.2	282.4	287.4	288.1
November	267.7	265.3	257.0	278.2	263.6	280.4	278.7
December	265.2	285.4	269.3	272.7	259.3	280.5	282.6
Annual			295	293	295	296	298

Source: Agricultural Marketing Service data summarized by NAHMS.

A.4. (continued) Milk-weighted bulk-tank somatic cell counts from Federal Milk Marketing Orders, 1995–2014

	Bulk Tank Somatic Cell Counts (x1,000 cells/mL)**, 1995–2014**						
Month	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
January	283.4	274.4	250.0	246.7	240.8	251.2	235.2
February	281.8	279.9	257.6	248.2	234.7	261.7	242.6
March	279.1	281.0	266.3	243.8	234.2	259.3	240.1
April	279.5	271.5	264.4	244.9	236.4	251.4	235.5
May	270.9	277.6	260.5	245.5	234.7	249.3	236.9
June	284.9	292.2	274.7	264.3	249.1	264.6	252.2
July	328.0	317.8	294.5	286.8	267.1	279.6	275.6
August	340.1	323.7	293.6	296.1	296.9	299.2	279.4
September	318.0	304.1	270.4	281.7	280.3	286.4	270.0
October	287.0	270.3	247.9	258.9	253.0	256.7	246.6
November	273.6	252.0	240.9	242.5	235.4	233.8	226.5
December	267.2	251.2	239.5	240.1	239.4	232.0	228.7
Annual	290	282	263	258	249	260	247

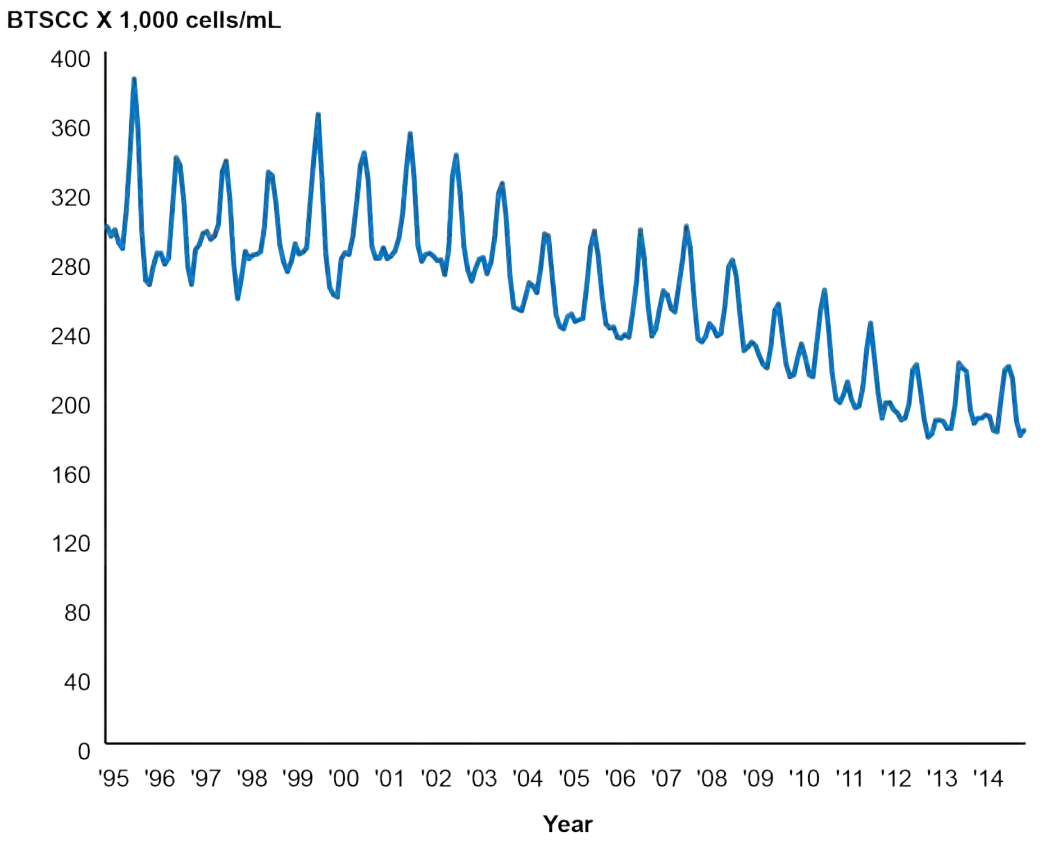
Source: Agricultural Marketing Service data summarized by NAHMS.

A.4. (continued) Milk-weighted bulk-tank somatic cell counts from Federal Milk Marketing Orders, 1995–2014

	Bulk Tank Somatic Cell Counts (x1,000 cells/mL)**, 1995–2014**					
Month	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
January	231.6	223.2	201.6	196.6	186.9	187.8
February	229.6	230.5	208.6	193.2	187.5	190.0
March	224.4	223.1	199.2	191.1	185.7	189.5
April	219.2	213.4	193.6	186.5	182.3	181.1
May	216.6	212.1	194.6	188.0	182.2	180.4
June	228.8	232.0	206.1	195.9	194.7	199.2
July	250.1	251.0	227.7	216.4	219.8	215.8
August	254.3	262.4	242.6	219.0	216.6	218.0
September	235.7	240.7	223.4	203.5	215.0	211.5
October	219.2	214.0	202.4	186.7	193.4	187.2
November	211.6	199.2	187.9	177.0	184.7	177.9
December	212.6	197.3	197.5	178.7	188.0	180.6
Annual	227	224	206	194	194	193

Source: Agricultural Marketing Service data summarized by NAHMS.

Monthly milk-weighted bulk-tank somatic cell counts from Federal Milk Marketing Orders, 1995–2014



Source: Agricultural Marketing Service data summarized by NAHMS.

5. Milk prices

From 1991 through 2014, milk prices paid to producers ranged from a low of $11.00 per hundred pounds during 4 months of 2003 to a high of $25.70 in September 2014. On average, milk prices from 1991 through 2006 ranged from $13.00 to $15.00 per hundred pounds, while milk prices from 2007 through 2014 ranged from $12.93 to $24.07 per hundred pounds. In general, milk prices decrease in mid-winter remain stable through most of the summer and rise during late summer and early fall.

A.5. Milk prices received by farmers, all milk 1991–2014:

Milk Prices[1] 1991–2014 ($)								
Month	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
January	11.70	13.50	12.50	13.70	12.60	14.00	13.40	14.70
February	11.70	12.90	12.30	13.50	12.60	13.80	13.50	14.70
March	11.40	12.50	12.20	13.50	12.70	13.70	13.50	14.40
April	11.30	12.60	12.60	13.40	12.30	13.90	13.20	14.00
May	11.30	12.80	12.90	12.80	12.30	14.30	12.70	13.30
June	11.40	13.20	13.00	12.60	12.10	14.80	12.20	14.10
July	11.80	13.40	12.80	12.20	12.00	15.40	12.10	14.20
August	12.40	13.50	12.40	12.40	12.40	15.90	12.70	15.50
September	12.80	13.50	12.80	12.80	12.80	16.50	13.10	16.70
October	13.50	13.40	13.10	13.00	13.40	16.40	14.10	17.70
November	13.90	13.10	13.60	13.10	14.00	15.20	14.70	17.80
December	13.80	12.80	13.50	12.80	13.90	14.30	14.80	18.00
Annual[2]	12.27	13.15	12.84	13.01	12.78	14.75	13.36	15.46
2010 Adjusted[3]	8.40	9.21	9.20	9.52	9.55	11.23	10.35	12.11

Source: USDA–NASS Agricultural Prices, 1991–2014.
[1]Per 100 pounds of milk.
[2]Prices producers received.
[3]Nominal prices adjusted for inflation. Using the Gross National Product: Implicit Price Deflator, Index 2010=100, Annual, Seasonally Adjusted found at https://fred.stlouisfed.org/series/GNPDEF#0

A.5. (continued) Milk prices received by farmers, all milk 1991–2014:

Milk Prices[1] 1991–2014 ($)								
Month	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
January	17.40	12.00	13.20	13.40	11.70	13.20	15.90	14.50
February	15.50	11.80	13.00	13.10	11.40	13.60	15.50	13.50
March	15.00	11.90	13.90	12.70	11.00	15.40	15.60	12.60
April	12.60	11.90	14.60	12.50	11.00	18.10	15.20	12.10
May	12.70	12.00	15.50	12.10	11.00	19.30	14.70	11.90
June	13.10	12.30	16.20	11.50	11.00	18.20	14.40	11.90
July	13.80	12.60	16.20	11.10	12.10	16.10	14.80	11.70
August	15.10	12.50	16.50	11.30	13.30	14.90	14.80	12.00
September	15.70	12.90	17.10	11.60	14.50	15.50	15.30	13.00
October	14.90	12.50	15.60	12.10	15.00	15.60	15.60	13.60
November	14.40	12.60	14.40	11.90	14.40	16.20	15.10	13.90
December	12.20	13.00	13.50	11.90	13.80	16.40	14.80	14.20
Annual[2]	14.38	12.40	15.04	12.18	12.55	16.13	15.19	12.96
2010 Adjusted[3]	11.42	10.07	12.49	10.27	10.78	14.22	13.81	12.14

Source: USDA–NASS Agricultural Prices, 1991–2014.

[1]Per 100 pounds of milk.
[2]Prices producers received.
[3]Nominal prices adjusted for inflation. Using the Gross National Product: Implicit Price Deflator, Index 2010=100, Annual,Seasonally Adjusted found at https://fred.stlouisfed.org/series/GNPDEF#0

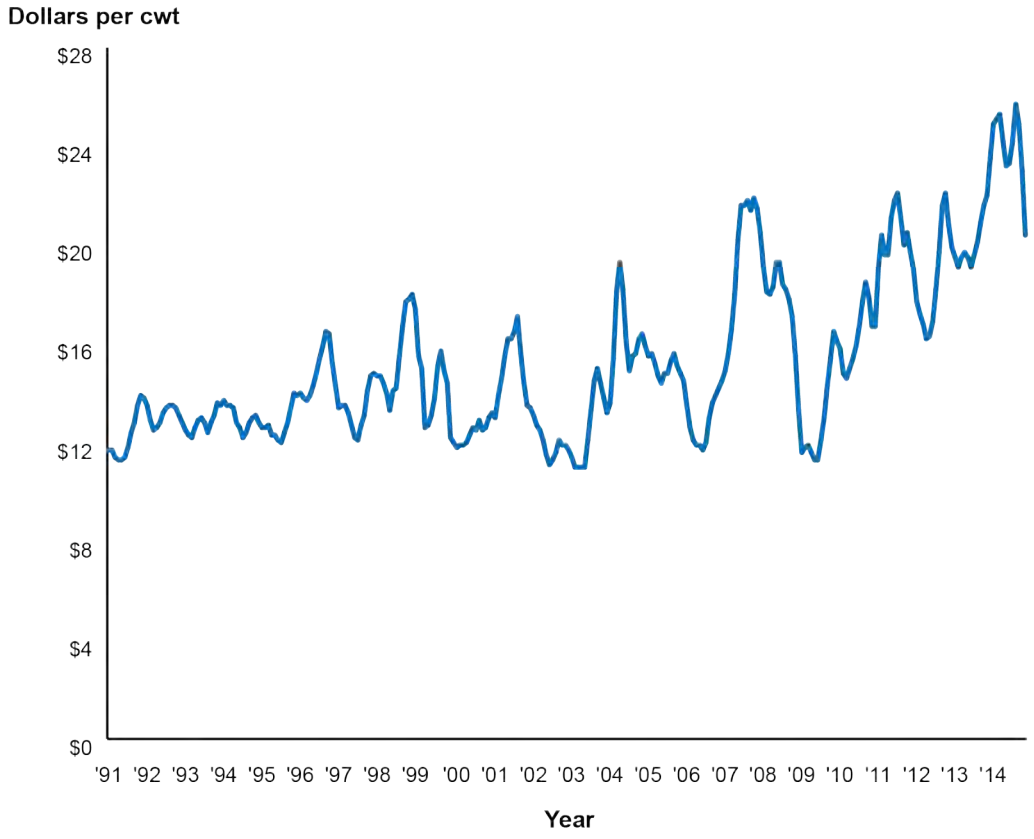
A.5. (continued) Milk prices received by farmers, all milk 1991–2014:

Milk Prices[1] 1991–2014 ($)								
Month	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
January	14.50	20.50	13.30	16.10	16.70	19.00	19.90	23.50
February	14.90	19.10	11.60	15.80	19.10	17.70	19.50	24.90
March	15.60	18.10	11.80	14.80	20.40	17.20	19.10	25.10
April	16.60	18.00	11.90	14.60	19.60	16.80	19.50	25.30
May	18.00	18.30	11.60	15.00	19.60	16.20	19.70	24.20
June	20.20	19.30	11.30	15.40	21.10	16.30	19.50	23.20
July	21.60	19.30	11.30	15.90	21.80	16.90	19.10	23.30
August	21.60	18.40	12.10	16.70	22.10	18.20	19.60	24.20
September	21.80	18.20	13.00	17.70	21.10	19.70	20.10	25.70
October	21.40	17.80	14.30	18.50	20.00	21.60	20.90	24.90
November	21.90	17.10	15.40	17.90	20.50	22.10	21.60	23.00
December	21.50	15.50	16.50	16.70	19.70	20.80	22.00	20.40
Annual[2]	19.21	18.45	12.93	16.35	20.24	18.56	20.11	24.07
2010 Adjusted[3]	18.48	18.10	12.78	16.35	20.66	19.31	21.29	25.96

Source: USDA–NASS Agricultural Prices, 1991–2014.

[1]Per 100 pounds of milk.
[2]Prices producers received.
[3]Nominal prices adjusted for inflation. Using the Gross National Product: Implicit Price Deflator, Index 2010=100, Annual, Seasonally Adjusted found at https://fred.stlouisfed.org/series/GNPDEF#0

Monthly milk prices* received by farmers, all milk 1991–2014



Source: USDA–NASS Agricultural Prices, 1991–2014.
*Per 100 pounds of milk.

6. Milk-cow prices

Cow prices were stable from 1991 through 1998, with prices averaging from $1,000 to $1,200 per cow. Since 1998, cow prices have varied more, with a low of $1,240 per cow in 1999 and a high of $2,120 in August–October 2014.

A.6. Milk-cow prices received by producers, 1991–2014:

	Milk–Cow Prices[1] ($)					
Year	Nov–Jan	Feb–Apr	May–Jul	Aug–Oct	Annual nominal dollars[2]	Adjusted 2010 dollars[3]
1991	1,100	1,090	1,090	1,100	1,100	753
1992	1,100	1,120	1,150	1,150	1,130	791
1993	1,140	1,160	1,170	1,170	1,160	832
1994	1,170	1,190	1,160	1,160	1,170	857
1995	1,150	1,140	1,130	1,090	1,130	845
1996	1,060	1,070	1,090	1,130	1,090	830
1997	1,090	1,110	1,100	1,090	1,100	852
1998	1,070	1,110	1,120	1,180	1,120	877
1999	1,250	1,240	1,280	1,380	1,280	1,017
2000	1,330	1,340	1,350	1,350	1,340	1,088
2001	1,320	1,400	1,590	1,700	1,500	1,245
2002	1,610	1,710	1,670	1,430	1,600	1,349
2003	1,380	1,300	1,310	1,380	1,340	1,151
2004	1,390	1,580	1,720	1,640	1,580	1,393
2005	1,620	1,770	1,830	1,870	1,770	1,610
2006	1,840	1,770	1,680	1,650	1,730	1,621
2007	1,660	1,730	1,950	2,020	1,830	1,761
2008	1,960	1,940	1,980	1,920	1,950	1,913
2009	1,630	1,390	1,280	1,240	1,390	1,374
2010	1,340	1,330	1,320	1,330	1,330	1,330
2011	1,300	1,420	1,480	1,480	1,420	1,450
2012	1,460	1,440	1,420	1,390	1,430	1,488
2013	1,370			1,410	1,380	1,461
2014	1,440	1,810	1,970	2,120	1,830	1,974

Source: USDA–NASS Agricultural Prices Summary,1991–2007; USDA–NASS Quick Stats Database, 2008–2014
[1]Cows that calved.
[2]Prices producers received.
[3]Nominal prices adjusted for inflation. Using the Gross National Product: Implicit Price Deflator, Index 2010=100, Annual, Seasonally Adjusted found at https://fred.stlouisfed.org/series/GNPDEF#0

7. Dairy-cow slaughter

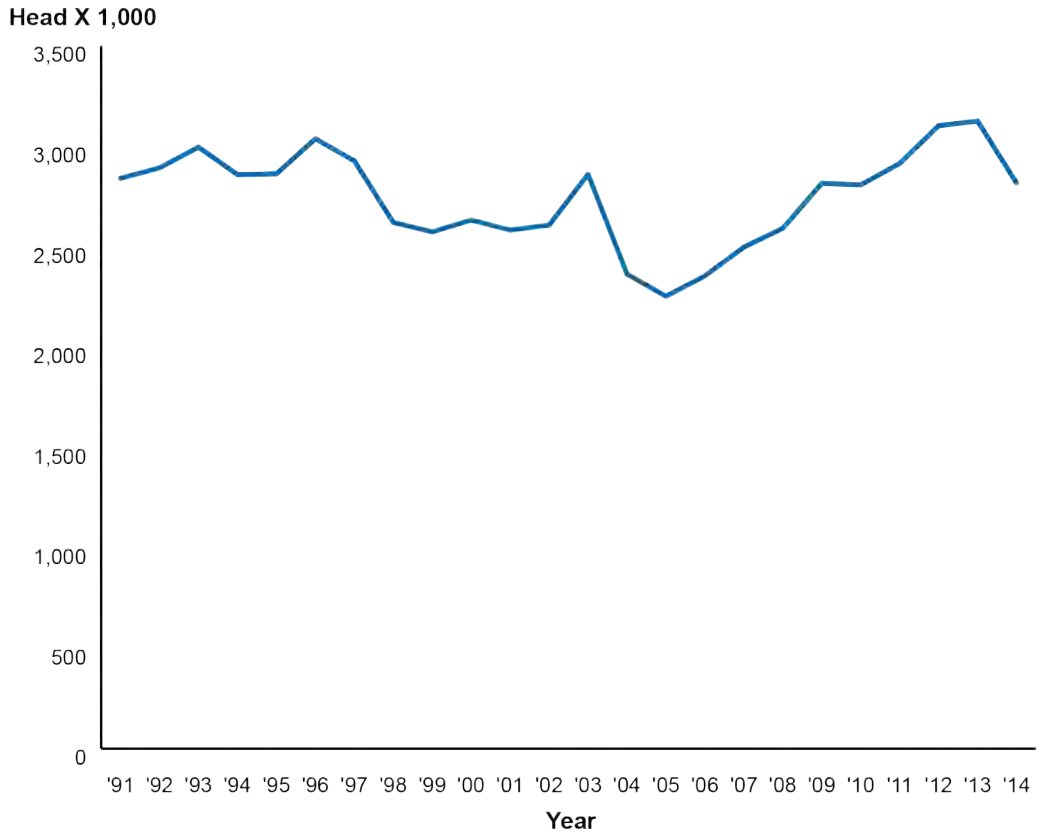
Approximately 2 to 3 million dairy cows have been slaughtered annually since 1991. The number of cows slaughtered as a percentage of January 1 inventory ranged from 25.0 to 33.9 percent.

A.7. Annual number of dairy cows slaughtered, 1991–2014:

	Dairy Cow Slaughter		
Year	1,000 head	Percent of January 1 cow inventory	Percent previous year
1991	2,840.0	28.5	106.3
1992	2,892.0	29.7	101.8
1993	2,994.8	31.0	103.6
1994	2,857.8	30.1	95.4
1995	2,861.7	30.2	100.1
1996	3,036.9	32.2	106.1
1997	2,926.2	31.4	96.4
1998	2,619.6	28.5	89.5
1999	2,573.3	28.2	98.2
2000	2,631.5	28.7	102.3
2001	2,581.9	28.2	98.1
2002	2,606.9	28.6	101.0
2003	2,859.9	31.3	109.7
2004	2,362.7	26.3	82.6
2005	2,252.1	25.0	95.3
2006	2,353.5	25.9	104.5
2007	2,496.9	27.4	106.1
2008	2,591.2	28.0	103.8
2009	2,815.3	30.2	108.6
2010	2,807.2	30.9	99.7
2011	2,914.2	31.8	103.8
2012	3,101.5	33.6	106.4
2013	3,124.9	33.9	100.8
2014	2,815.6	30.6	90.1

Source: USDA – NASS Livestock Slaughter Annual Summary, 1991–2014.

Annual number of dairy cows slaughtered, 1991–2014



Source: USDA – NASS Livestock Slaughter Annual Summary, 1991–2014.

8. Value of production

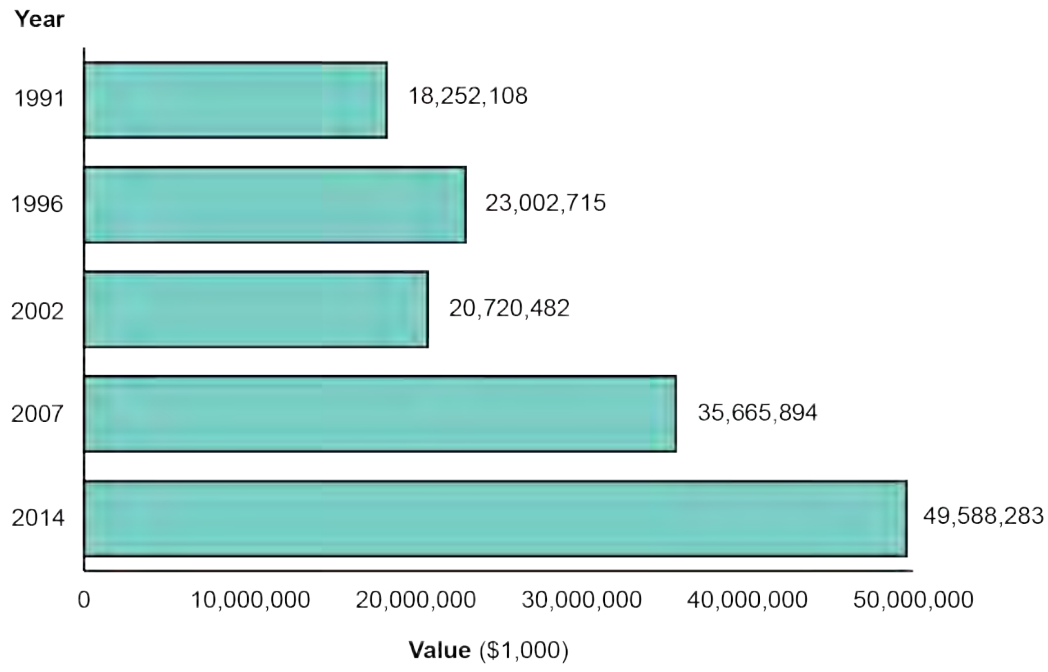
In 2014, milk sales accounted for 27.0 percent of the value of select U.S. commodities (cattle, milk, poultry, swine, sheep and wool, catfish and trout, and honey) compared with 24.7 percent in 1991; however, because dairy cows, bulls, and steers are marketed as cattle, the percentage of value assigned to the entire dairy industry accounted for more than 27.0 percent of the 2014 U.S. commodity value.

A.8. Value of production for selected U.S. commodities, 1991–2014 study years:

	Year									
	1991		1996		2002		2007		2014	
Commodity	Value ($1,000)	Pct.	Value ($1,000)	Pct.	Value ($1,000)	Pct.	Value ($1,000)	Pct.	Value ($1,000)	Pct.
Cattle	29,399,329	39.7	22,034,934	27.7	27,097,532	34.7	35,973,068	30.4	60,141,507	32.7
Milk	18,252,108	24.7	23,002,715	28.9	20,720,482	26.5	35,665,894	30.1	49,588,283	27.0
Poultry[1]	14,722,890	19.9	21,863,414	27.5	20,504,687	26.3	32,235,659	27.2	48,472,262	26.3
Swine	11,067,121	15.0	11,902,326	15.0	8,690,923	11.1	13,468,332	11.4	24,184,000	13.1
Sheep and wool	403,813	0.5	479,956	0.6	335,635	0.4	393,183	0.3	844,688	0.5
Catfish and trout[2]					476,902	0.6	542,449	0.5	454,387	0.2
Honey	122,830	0.2	177,166	0.2	228,338	0.3	159,763	0.1	386,933	0.2
Total	73,968,091	100.0	79,460,513	100.0	78,054,499	100.0	118,437,948	100.0	183,987,597	100.0

Source: USDA – NASS Meat Animals Production, Disposition, and Income, 1991-2014; USDA – NASS Milk Disposition and Income – Final Estimates, 1991 – 2014; USDA – NASS Poultry Production and Value, April 2016; USDA – NASS Poultry Production and Value – Final Estimates, 1991-2007; USDA – NASS Catfish Production, 2002-2014; USDA – NASS Trout Production, 2002-2014; USDA – NASS Honey – Final Estimates, 1991-2007; USDA – NASS Honey, March 2016.
[1]Includes boilers, eggs, turkeys, and chickens (value of sales).
[2]Total of sales for trout (excluding eggs), and catfish (foodsize), broodfish, stocker, and fingerling sales.

Value of production for milk, 1991–2014



Source: USDA – NASS Milk Disposition and Income – Final Estimates, 1991–2014.

Note: The following tables describe changes in the U.S. dairy industry by State from 1991 to 2014, based on USDA–NASS data. The tables also identify which States were in the five NAHMS national dairy studies: the National Dairy Heifer Evaluation Project (NDHEP) 1991, Dairy 1996, Dairy 2002, Dairy 2007, and Dairy 2014.

B. Dairy Industry Changes by State

1. Milk-cow inventory

Since 1991, the number of dairy cows has increased in Arizona, California, Colorado, Idaho, Indiana, Kansas, Michigan, Nevada, New Mexico, Oregon, Texas, Utah, and Washington. In contrast, the number of dairy cows in Alabama, Arkansas, Louisiana, and Mississippi decreased by the largest percentage, but these States represented less than 5 percent of the overall dairy cow population. In 2014, California had the largest number of dairy cows (1.78 million) followed by Wisconsin (1.27 million) and New York (615,000).

B.1. Changes in U.S. milk cow inventories by State:

	Number of Milk Cows that Calved (1,000 head) January								
State	1991[1]	1996[2]	2002[3]	2007[4]	2014[5]	2014 as percent of 1991	2014 as percent of 1996	2014 as percent of 2002	2014 as percent of 2007
Alabama	43*	32	20	13	9	20.9	28.1	45.0	69.2
Alaska	1.1	0.8	1.2	0.6	0.3	27.3	37.5	25.0	50.0
Arizona	96	118	140	175	193	201.0	163.6	137.9	110.3
Arkansas	69	58	33	19	8	11.6	13.8	24.2	42.1
California	1,150*	1,320*	1,620*	1,790*	1,780*	154.8	134.8	109.9	99.4
Colorado	77*	82	93*	115	140*	181.8	170.7	150.5	121.7
Connecticut	33*	31	24	19	19	57.6	61.3	79.2	100.0
Delaware	9	10	9	7	4.7	52.2	47.0	52.2	67.1
Florida	185*	155*	152*	130	123	66.5	79.4	80.9	94.6
Georgia	113*	98	86	75	80	70.8	81.6	93.0	106.7
Hawaii	11	10	7	3.8	2.2	20.0	22.0	31.4	57.9
Idaho	185*	245*	377*	502*	565*	305.4	230.6	149.9	112.5
Illinois	171*	145*	115*	103	95	55.6	65.5	82.6	92.2
Indiana	155*	140*	154*	166*	178*	114.8	127.1	115.6	107.2
Iowa	275*	245*	205*	210*	205*	74.5	83.7	100.0	97.6
Kansas	98	83	96	110	136	138.8	163.9	141.7	123.6
Kentucky	195	160*	125*	93*	68*	34.9	42.5	54.4	73.1
Louisiana	80	72	54	30	15	18.8	20.8	27.8	50.0

[1]USDA–NASS Cattle – Final Estimates 1989–1993, January 1995.
[2]USDA–NASS Cattle – Final Estimates 1994–1998, January 1999.
[3]USDA–NASS Cattle – Final Estimates 1999–2003, April 2004.
[4]USDA–NASS Cattle – Final Estimates 2004–2008, March 2009.
[5]USDA–NASS Cattle, January 2015.
*NAHMS participating States.

B.1. (continued) Changes in U.S. milk cow inventories by State:

Number of Milk Cows that Calved
(1,000 head) **January**

State	1991[1]	1996[2]	2002[3]	2007[4]	2014[5]	2014 as percent of 1991	2014 as percent of 1996	2014 as percent of 2002	2014 as percent of 2007
Maine	41*	40	38	32	30	73.2	75.0	78.9	93.8
Maryland	101*	91	81	60	50	49.5	54.9	61.7	83.3
Massachusetts	31*	27	21	15.5	12	38.7	44.4	57.1	77.4
Michigan	339*	326*	299*	327*	381*	112.4	116.9	127.4	116.5
Minnesota	690*	585*	500*	455*	460*	66.7	78.6	92.0	101.1
Mississippi	63	53	34	22	13	20.6	24.5	38.2	59.1
Missouri	220	185*	140*	114*	90*	40.9	48.6	64.3	78.9
Montana	24	20	19	18	14	58.3	70.0	73.7	77.8
Nebraska	95*	70	68	60	53	55.8	75.7	77.9	88.3
Nevada	20	23	25	27	29	145.0	126.1	116.0	107.4
New Hampshire	21*	20	18	15	13.5	64.3	67.5	75.0	90.0
New Jersey	25	23	13	10.5	7	28.0	30.4	53.8	66.7
New Mexico	89	195*	290*	340*	323	362.9	165.6	111.4	95.0
New York	750*	700*	675*	628*	615*	82.0	87.9	91.1	97.9
North Carolina	101*	84	66	48	45	44.6	53.6	68.2	93.8
North Dakota	85	63	42	30	17	20.0	27.0	40.5	56.7
Ohio	330*	285*	260*	274*	267*	80.9	93.7	102.7	97.4
Oklahoma	100	94	84	70	45	45.0	47.9	53.6	64.3
Oregon	100*	95*	105	115	124	124.0	130.5	118.1	107.8
Pennsylvania	676*	636*	588*	550*	530*	78.4	83.3	90.1	96.4
Rhode Island	2.5*	2.1	1.4	1.1	0.9	36.0	42.9	64.3	81.8
South Carolina	34	26	20	17	16	47.1	61.5	80.0	94.1
South Dakota	137	115	87	81	95	69.3	82.6	109.2	117.3
Tennessee	170*	120*	90*	67	46	27.1	38.3	51.1	68.7
Texas	390	400*	315*	380*	440*	112.8	110.0	139.7	115.8
Utah	80	90	93	86	95	118.8	105.6	102.2	110.5
Vermont	164*	157*	154*	140*	132*	80.5	84.1	85.7	94.3
Virginia	141*	128	120*	100*	93*	66.0	72.7	77.5	93.0
Washington	241*	260*	247*	235*	266*	110.4	102.3	107.7	113.2
West Virginia	24	21	16	13	9	37.5	42.9	56.3	69.2
Wisconsin	1,725*	1,475*	1,280*	1,245*	1,270*	73.6	86.1	99.2	102.0
Wyoming	10	6	5	7	6	60.0	100.0	120.0	85.7
U.S.	9,966	9,420	9,106	9,145	9,209	92.4	97.8	101.1	100.7
NAHMS participating States total	8,106	7,829	7,799	7,533	7,480	92.3	95.5	95.9	99.3

[1]USDA–NASS Cattle – Final Estimates 1989–1993, January 1995.
[2]USDA–NASS Cattle – Final Estimates 1994–1998, January 1999.
[3]USDA–NASS Cattle – Final Estimates 1999–2003, April 2004.
[4]USDA–NASS Cattle – Final Estimates 2004–2008, March 2009.
[5]USDA–NASS Cattle, January 2015.
*NAHMS participating States.

2. Number of U.S. dairy operations

NOTE: Data for 1991-2007 was derived from annual survey data, while 2012 data were taken from the Census of Agriculture. These two data collection methods are different; therefore, making direct comparisons to 2012 and previous years is not recommended.

The number of dairy operations in all States has decreased since 1991. In 2012, Wisconsin had the highest number of dairy operations (11,543), followed by Pennsylvania (7,829) and New York (5,427). California reported 1,931 operations but had the highest number of dairy cows, demonstrating a large number of cows per herd.

B.2.a. Changes in number of U.S. dairy operations, by State:

	Number of Operations[1] with Milk Cows				
State	**1991[2]**	**1996[3]**	**2002[4]**	**2007[5]**	**2012[6]**
Alabama	1,100*	480	200	160	219
Alaska	30	30	30	30	28
Arizona	500	280	250	180	239
Arkansas	2,000	1,500	550	340	100
California	4,200*	2,900*	2,400*	2,200*	1,931*
Colorado	1,400*	900	750*	450	517*
Connecticut	500*	350	290	270	242
Delaware	160	140	110	80	77
Florida	1,000*	700*	500*	420	425
Georgia	1,400*	1,050	660	640	348
Hawaii	80	60	30	15	12
Idaho	1,900*	1,400*	950*	810*	934*
Illinois	3,000*	2,500*	1,800*	1,200	1,149
Indiana	4,500*	3,700*	2,600*	2,000*	2,401*
Iowa	7,000*	4,800*	3,200*	2,400*	1,810*
Kansas	2,300	1,500	1,100	780	858
Kentucky	5,500	3,800*	2,600*	2,300*	1,564*
Louisiana	1,800	1,000	550	300	121
Maine	1,100*	750	550	480	581
Maryland	1,600*	1,100	900	660	573
Massachusetts	800*	500	330	310	278
Michigan	6,000*	4,400*	3,200*	2,700*	2,409*
Minnesota	15,000*	11,000*	7,200*	5,100*	4,746*
Mississippi	1,300	700	450	180	184
Missouri	6,900	4,800*	3,400*	2,600*	2,451*
Montana	1,600	800	600	390	397

[1]An operation is any place having one or more dairy cows, excluding cows used to nurse calves, on hand at any time during the year
[2]USDA–NASS, Milk Final Estimates 1988-92.
[3]NASS, Milk Cows and Production Final Estimates 1993-97, January 1999.
[4]NASS, Livestock Operations, Final Estimates 1998-2002, April 2004.
[5]NASS, Farms, Land in Farms, and Livestock Operations, 2006 Summary, February 2007.
[6]USDA–NASS, Milk Production, February 2016.
*NAHMS participating States

B.2.a. (continued) Changes in number of U.S. dairy operations, by State:

	Number of Operations[1] with Milk Cows				
State	**1991[2]**	**1996[3]**	**2002[4]**	**2007[5]**	**2012[6]**
Nebraska	2,700*	1,600	1,000	490	559
Nevada	260	200	130	60	56
New Hampshire	400*	350	250	220	251
New Jersey	450	350	180	150	127
New Mexico	1,300	700*	500*	270*	410
New York	12,200*	9,200*	7,200*	5,700*	5,427*
North Carolina	1,800*	1,200	860	460	571
North Dakota	2,100	1,400	760	400	243
Ohio	8,900*	6,500*	5,000*	3,700*	4,008*
Oklahoma	3,000	2,300	1,600	980	756
Oregon	1,900*	1,200*	800	600	686
Pennsylvania	14,500*	11,300*	9,800*	8,300*	7,829*
Rhode Island	60*	40	30	40	30
South Carolina	800	350	220	110	193
South Dakota	3,300	2,200	1,200	660	689
Tennessee	3,500*	2,300*	1,400*	1,200	979
Texas	5,300	3,800*	1,900*	1,300*	985*
Utah	1,500	900	700	450	477
Vermont	2,600*	2,100*	1,500*	1,200*	1,075*
Virginia	2,800*	1,800	1,500*	1,200*	1,168*
Washington	3,000*	1,700*	950*	820*	798*
West Virginia	2,000	1,000	500	370	438
Wisconsin	33,000*	27,000*	17,800*	14,200*	11,543*
Wyoming	600	350	260	120	206
U.S.	180,640	130,980	91,240	69,995	64,098
NAHMS participating States total	137,860	105,800	76,150	56,800	51,596

[1]An operation is any place having one or more dairy cows, excluding cows used to nurse calves, on hand at any time during the year

[2]USDA–NASS, Milk Final Estimates 1988-92.
[3]NASS, Milk Cows and Production Final Estimates 1993-97, January 1999.
[4]NASS, Livestock Operations, Final Estimates 1998-2002, April 2004.
[5]NASS, Farms, Land in Farms, and Livestock Operations, 2006 Summary, February 2007.
[6]USDA–NASS, Milk Production, February 2016.
*NAHMS participating States

As was the case with all dairy operations, the number of licensed dairy herds decreased from 2002 to 2014 in every State. Since 2002, more than 29,000 licensed dairy herds (39.5 percent of 2002 operations) have gone out of business.

B.2.b. Changes in U.S. licensed dairy herds by State:

Number of U.S. Licensed Dairy Herds

State	2002[1]	2007[2]	2014[3]	2014 as percent of 2002	2014 as percent of 2007
Alabama	120	70	40	33.3	57.1
Alaska	10	5	2	20.0	40.0
Arizona	160	120	100	62.5	83.3
Arkansas	320	170	75	23.4	44.1
California	2,030*	1,960*	1,485*	73.2	75.8
Colorado	180*	170	120*	66.7	70.6
Connecticut	210	150	130	61.9	86.7
Delaware	95	50	40	42.1	80.0
Florida	210*	150	130	61.9	86.7
Georgia	380	280	230	60.5	82.1
Hawaii	10	5	2	20.0	40.0
Idaho	815*	665*	530*	65.0	79.7
Illinois	1,340*	1,060	690	51.5	65.1
Indiana	2,150*	1,660*	1,265*	58.8	76.2
Iowa	2,760*	2,130*	1,370*	49.6	64.3
Kansas	565	435	315	55.8	72.4
Kentucky	1,835*	1,120*	720*	39.2	64.3
Louisiana	380	210	120	31.6	57.1
Maine	430	340	280	65.1	82.4
Maryland	735	585	450	61.2	76.9
Massachusetts	250	180	150	60.0	83.3
Michigan	3,040*	2,440*	1,950*	64.1	79.9
Minnesota	6,775*	5,070*	3,605*	53.2	71.1
Mississippi	300	170	85	28.3	50.0
Missouri	2,110*	1,720*	1,230*	58.3	71.5
Montana	120	85	70	58.3	82.4

[1]USDA–NASS, Licensed Dairy Herds, February 2004.

[2]USDA–NASS, Milk Production, February 2009.

[3]USDA–NASS, Milk Production, February 2016.

*NAHMS participating States

B.2.b. (continued) Changes in U.S. licensed dairy herds by State:

Number of U.S. Licensed Dairy Herds

State	2002[1]	2007[2]	2014[3]	2014 as percent of 2002	2014 as percent of 2007
Nebraska	540	350	190	35.2	54.3
Nevada	35	25	20	57.1	80.0
New Hampshire	170	130	120	70.6	92.3
New Jersey	140	110	70	50.0	63.6
New Mexico	160*	170*	150	93.8	88.2
New York	6,930*	5,770*	4,950*	71.4	85.8
North Carolina	420	310	250	59.5	80.6
North Dakota	510	290	100	19.6	34.5
Ohio	4,100*	3,430*	2,810*	68.5	81.9
Oklahoma	440	320	170	38.6	53.1
Oregon	350	310	250	71.4	80.6
Pennsylvania	9,240*	8,010*	6,810*	73.7	85.0
Rhode Island	20	15	15	75.0	100.0
South Carolina	120	80	80	66.7	100.0
South Dakota	860	540	255	29.7	47.2
Tennessee	860*	590	370	43.0	62.7
Texas	890*	700*	440*	49.4	62.9
Utah	405	280	210	51.9	75.0
Vermont	1,480*	1,120*	880*	59.5	78.6
Virginia	940*	745*	630*	67.0	84.6
Washington	660*	530*	480*	72.7	90.6
West Virginia	170	110	75	44.1	68.2
Wisconsin	17,300*	14,170*	10,290*	59.5	72.6
Wyoming	40	25	10	25.0	40.0
U.S.	74,110	59,130	44,809	60.5	75.8
NAHMS participating States total	65,805	51,410	39,565	61.4	77.0

[1]USDA–NASS, Licensed Dairy Herds, February 2004.

[2]USDA–NASS, Milk Production, February 2009.

[3]USDA–NASS, Milk Production, February 2016.

*NAHMS participating States

3. Average herd size of U.S. dairies

Data for average dairy herd size in 2014 were unavailable because NASS only reports dairy operations in Census years. Average dairy herd sizes in 2007 ranged from 20 cows in Alaska to 1,333 in New Mexico. The U.S. average dairy herd size in 2007 was 130.4 cows, more than double the average in 1991 (53.9 cows).

B.3. Changes in U.S. average dairy herd size by State:

	Average Herd Size[1] (number of milk cows)			
State	**1991**	**1996**	**2002**	**2007**
Alabama	39.1*	66.7	100.0	81.3
Alaska	26.7	26.7	40.0	20.0
Arizona	192.0	421.4	560.0	972.2
Arkansas	34.5	38.7	60.0	55.9
California	276.2*	455.2*	675.0*	813.6*
Colorado	55.0*	91.1	124.0*	255.6
Connecticut	66.0*	88.6	82.8	70.4
Delaware	56.3	71.4	81.8	87.5
Florida	179.0*	221.4*	304.0*	309.5
Georgia	75.0*	93.3	130.3	117.2
Hawaii	125.0	166.7	233.3	253.3
Idaho	93.7*	175.0*	396.8*	619.8*
Illinois	56.7*	58.0*	63.9*	85.8
Indiana	32.2*	37.8*	59.2*	83.0*
Iowa	38.6*	51.0*	64.1*	87.5*
Kansas	41.3	55.3	87.3	141.0
Kentucky	33.6	42.1*	48.1*	40.4*
Louisiana	43.9	72.0	98.2	100.0
Maine	37.3*	53.3	69.1	66.7
Maryland	59.4*	82.7	90.0	90.9
Massachusetts	38.8*	54.0	63.6	50.0
Michigan	55.3*	74.1*	93.4*	120.0*
Minnesota	44.0*	53.2*	69.4*	89.2*
Mississippi	46.2	75.7	75.6	122.2
Missouri	30.4	38.5*	41.2*	43.8*
Montana	15.0	25.0	31.7	46.2
Nebraska	33.3*	43.8	68.0	122.4
Nevada	76.9	115.0	192.3	450.0
New Hampshire	52.5*	57.1	72.0	65.9
New Jersey	53.3	65.7	72.2	70.0
New Mexico	77.7	278.6*	580.0*	1,333.3*

[1]Average herd size = NASS published number of dairy operations/following-year January 1 milk cow inventory.
*NAHMS participating States.

B.3. (continued) Changes in U.S. average dairy herd size by State:

	Average Herd Size[1] (number of milk cows)			
State	**1991**	**1996**	**2002**	**2007**
New York	60.7*	76.1*	93.8*	110.2*
North Carolina	55.0*	70.0	76.7	104.3
North Dakota	38.1	45.0	55.3	77.5
Ohio	36.0*	43.8*	52.0*	74.1*
Oklahoma	32.3	40.9	52.5	71.4
Oregon	52.6*	79.2*	131.3	191.7
Pennsylvania	45.7*	56.3*	60.0*	66.3*
Rhode Island	40.0*	52.5	46.7	27.5
South Carolina	41.3	74.3	90.9	154.5
South Dakota	40.0	52.3	72.5	122.7
Tennessee	47.1*	52.2*	64.3*	55.8
Texas	72.6	105.3*	165.8*	266.9*
Utah	50.7	100.0	132.9	191.1
Vermont	62.7*	74.8*	102.7*	116.7*
Virginia	50.0*	71.1	80.0*	83.3*
Washington	79.3*	152.9*	260.0*	286.6*
West Virginia	11.5	21.0	32.0	35.1
Wisconsin	50.0*	54.6*	71.9*	87.7*
Wyoming	15.0	17.1	19.2	58.3
U.S.	53.9	71.9	99.8	130.4
NAHMS avg.	57.4	74.0	102.4	132.6

[1]Average herd size = NASS published number of dairy operations/following-year January 1 milk cow inventory.
*NAHMS participating States.

4. Milk production per cow

Milk production per cow has increased in every State except Alaska since 1991. In 2014, New Mexico had the highest milk production per cow at 25,093 pounds. In addition, the following States reported per-cow milk production higher than 24,000 pounds: Arizona (24,347), Colorado (24,951), Idaho (24,127), Michigan (24,638), and Washington (24,117) in 2014. The overall U.S. average of per-cow milk production was 22,258 pounds in 2014, up 48.1 percent from the 15,031 pounds reported in 1991.

B.4. Changes in milk production per cow, by State:

	Per-Cow Milk Production (pounds)								
State	**1991[1]**	**1996[2]**	**2002[3]**	**2007[4]**	**2014[5]**	**2014 as percent of 1991**	**2014 as percent of 1996**	**2014 as percent of 2002**	**2014 as percent of 2007**
Alabama	12,707*	13,563	13,850	15,154	13,625	107.2	100.5	98.4	89.9
Alaska	13,300	16,875	13,600	14,667	11,667	87.7	69.1	85.8	79.5
Arizona	18,032	20,446	23,333	23,260	24,347	135.0	119.1	104.3	104.7
Arkansas	11,687	12,054	12,281	12,941	13,714	117.3	113.8	111.7	106.0
California	18,534*	19,161*	21,277*	22,440*	23,785*	128.3	124.1	111.8	106.0
Colorado	17,338*	19,440	21,590*	22,932	24,951*	143.9	128.3	115.6	108.8
Connecticut	15,848*	16,633	18,625	19,211	20,158	127.2	121.2	108.2	104.9
Delaware	14,130	14,433	16,667	16,618	20,146	142.6	139.6	120.9	121.2
Florida	13,933*	15,391*	15,387*	16,832	20,382	146.3	132.4	132.5	121.1
Georgia	13,523*	15,320	17,294	18,169	20,790	153.7	135.7	120.2	114.4
Hawaii	13,056	13,723	14,667	12,241	13,591	104.1	99.0	92.7	111.0
Idaho	16,399*	18,496*	21,018*	22,513*	24,127*	147.1	130.4	114.8	107.2
Illinois	14,936*	16,050*	17,835*	18,612	19,681	131.8	122.6	110.4	105.7
Indiana	15,439*	15,471*	17,603*	20,307*	21,865*	141.6	141.3	124.2	107.7
Iowa	15,095*	15,701*	18,201*	20,085*	22,444*	148.7	142.9	123.3	111.7
Kansas	12,680	14,634	18,972	19,882	22,064	174.0	150.8	116.3	111.0
Kentucky	11,231	12,157*	13,230*	13,889*	15,905*	141.6	130.8	120.2	114.5
Louisiana	11,675	12,145	12,063	12,034	13,600	116.5	112.0	112.7	113.0
Maine	14,786*	15,805	17,730	17,788	20,000	135.3	126.5	112.8	112.4
Maryland	14,480*	15,080	16,062	18,121	19,740	136.3	130.9	122.9	108.9
Massachusetts	15,000*	16,296	17,190	17,000	17,923	119.5	110.0	104.3	105.4
Michigan	15,690*	16,969*	20,332*	22,761*	24,638*	157.0	145.2	121.2	108.2
Minnesota	14,354*	16,192*	17,368*	18,817*	19,841*	138.2	122.5	114.2	105.4
Mississippi	12,098	12,902	14,059	15,429	14,462	119.5	112.1	102.9	93.7
Missouri	13,451	13,423*	14,204*	14,982*	15,539*	115.5	115.8	109.4	103.7
Montana	13,750	15,350	18,944	18,500	21,500	156.4	140.1	113.5	116.2
Nebraska	13,913*	15,217	17,418	18,220	22,130	159.1	145.4	127.1	121.5
Nevada	17,500	18,800	20,040	20,481	23,793	136.0	126.6	118.7	116.2

[1]USDA–NASS, Milk Final Estimates 1988–1992.
[2]USDA–NASS, Milk Cows and Production Final Estimates 1993–1997, May 1999.
[3]USDA–NASS, Milk Production, February 2004.
[4]USDA–NASS, Milk Cows and Production Final Estimates 2003–2007, April 2007.
[5]USDA–NASS, Milk Production, February 2015.
*NAHMS participating States.

B.4. (continued) Changes in milk production per cow, by State:

	Per-Cow Milk Production (pounds)								
State	**1991[1]**	**1996[2]**	**2002[3]**	**2007[4]**	**2014[5]**	**2014 as percent of 1991**	**2014 as percent of 1996**	**2014 as percent of 2002**	**2014 as percent of 2007**
New Hampshire	15,143*	16,200	18,222	19,333	20,143	133.0	124.3	110.5	104.2
New Jersey	14,160	13,500	18,154	16,800	18,143	128.1	134.4	99.9	108.0
New Mexico	19,561	19,246*	20,983*	21,958*	25,093	128.3	130.4	119.6	114.3
New York	15,005*	16,396*	18,101*	19,303*	22,330*	148.8	136.2	123.4	115.7
North Carolina	15,424*	15,951	17,766	19,188	20,891	135.4	131.0	117.6	108.9
North Dakota	12,622	12,968	14,825	15,310	20,250	160.4	156.2	136.6	132.3
Ohio	14,446*	15,516*	17,080*	18,109*	20,318*	140.6	130.9	119.0	112.2
Oklahoma	12,354	13,245	15,560	16,580	17,425	141.0	131.6	112.0	105.1
Oregon	16,590*	17,290*	18,360	19,417	20,605	124.2	119.2	112.2	106.1
Pennsylvania	15,263*	16,536*	18,419*	19,422*	20,157*	132.1	121.9	109.4	103.8
Rhode Island	14,333*	15,600	16,357	16,455	19,000	132.6	121.8	116.2	115.5
South Carolina	12,273	14,654	18,200	17,889	16,375	133.4	111.7	90.0	91.5
South Dakota	12,309	13,161	14,988	19,306	21,742	176.6	165.2	145.1	112.6
Tennessee	11,863*	13,932*	14,943*	15,857	16,304	137.4	117.0	109.1	102.8
Texas	14,036	15,416*	16,719*	18,982*	22,268*	158.6	144.4	133.2	117.3
Utah	15,975	17,000	17,914	20,376	22,968	143.8	135.1	128.2	112.7
Vermont	14,683*	16,468*	17,552*	18,079*	20,197*	137.6	122.6	115.1	111.7
Virginia	14,614*	14,325	15,891*	17,530*	19,140*	131.0	133.6	120.4	109.2
Washington	18,814*	20,541*	22,753*	23,239*	24,117*	128.2	117.4	106.0	103.8
West Virginia	11,739	12,600	15,188	15,000	15,556	132.5	123.5	102.4	103.7
Wisconsin	14,140*	15,442*	17,367*	19,310*	21,869*	154.7	141.6	125.9	113.3
Wyoming	12,563	13,394	14,409	18,831	21,583	171.8	161.1	149.8	114.6
U.S.	15,031	16,433	18,608	20,204	22,258	148.1	135.4	119.6	110.2

[1]USDA–NASS, Milk Final Estimates 1988–1992.
[2]USDA–NASS, Milk Cows and Production Final Estimates 1993–1997, May 1999.
[3]USDA–NASS, Milk Production, February 2004.
[4]USDA–NASS, Milk Cows and Production Final Estimates 2003–2007, April 2007.
[5]USDA–NASS, Milk Production, February 2015.
*NAHMS participating States.

Section II: Changes in World Dairy Production

Note: Tables in this section were comprised from data collected by USDA's Foreign Agricultural Service.

A. General Trends

1. Milk-cow inventory

In 2014, India had 50.5 million milk cows, more than any other nation in the world. China showed the largest increase in number of milk cows from 1991 to 2014 (approximately 1.5 to 8.4 million, respectively). The former Soviet Union had the largest decrease in number of milk cows from 1991 to 2014 (approximately 28.9 to 10.6 million, respectively). Total milk cow numbers for these selected countries have increased 1.6 percent since 1991.

A.1. Changes in milk-cow inventories in selected countries:

		Number of Milk Cows (1,000 head)								
Continent/country		**1991**	**1995***	**2002**	**2007**	**2014**	**2014 as percent of 1991**	**2014 as percent of 1995**	**2014 as percent of 2002**	**2014 as percent of 2007**
North America	Canada	1,410	1,244	1,084	995	955	67.7	76.8	88.1	96.0
	Mexico	6,440	6,440	6,800	6,010	6,350	98.6	98.6	93.4	105.7
	United States	9,965	9,420	9,106	9,129	9,208	92.4	97.7	101.1	100.9
	Subtotal	*17,815*	*17,104*	*16,990*	*16,134*	*16,513*	92.7	96.5	97.2	102.3
South America	Argentina	2,000	2,350	2,150	2,150	1,826	91.3	77.7	84.9	84.9
	Brazil	15,500	17,500	15,600	15,925	16,825	108.5	96.1	107.9	105.7
	Subtotal	*17,500*	*19,850*	*16,990*	*18,075*	*18,651*	106.6	94.0	109.8	103.2
European Union[1]	*Subtotal*	*25,392*[2]	*22,434*[2]	*25,747*[3]	*24,178*[4]	*23,468*[4]	92.4	104.6	91.1	97.1
Eastern Europe	Poland	4,707	3,715	[3]	[4]	[4]				
	Romania	1,600	1,778	1,550	[4]	[4]				
	Subtotal	*6,307*	*5,493*	*27,297*	*[4]*	*[4]*				
Former Soviet Union	Russia	20,557	18,400	12,200	9,910	8,050	39.2	43.8	66.0	81.2
	Ukraine	8,378	7,818	4,918	3,221	2,509	29.9	32.1	51.0	77.9
	Subtotal	*28,935*	*26,218*	*17,118*	*13,131*	*10,559*	36.5	40.3	61.7	80.4

Source: USDA-FAS Dairy: World Markets and Trade. Based upon counselor and attaché reports, official statistics, and results of office research.

[1]Based on deliveries.

[2]EU-15 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, U.K.

[3]EU-25 includes Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, U.K.

[4]EU-27 includes Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, U.K.

[5]Ending June 30 of year shown.

[6]Ending May 31 of year shown.

*1996 data not available.

A.1. (continued) Changes in milk-cow inventories in selected countries:

Number of Milk Cows (1,000 head)

Continent/country		1991	1995*	2002	2007	2014	2014 as percent 1991	2014 as percent 1995*	2014 as percent 2002	2014 as percent of 2007
South Asia	India	30,700	33,000	36,000	38,000	50,500	164.5	153.0	140.3	132.9
	Subtotal	*30,700*	*33,000*	*36,000*	*38,000*	*50,500*	164.5	153.0	140.3	132.9
Asia	China	1,459	2,252	3,420	8,755	8,400	575.7	373.0	245.6	95.9
	Japan	1,081	1,034	966	871	773	71.5	74.8	80.0	88.7
	Subtotal	*2,540*	*3,286*	*4,386*	*9,626*	*9,173*	361.1	279.2	209.1	95.3
Oceania	Australia[5]	1,629	1,786	2,369	1,800	1,647	101.1	92.2	69.5	91.5
	New Zealand[6]	2,723	2,994	3,749	4,163	5,176	190.1	172.9	138.1	124.3
	Subtotal	*4,352*	*4,780*	*6,118*	*5,963*	*6,823*	156.8	142.7	111.5	114.4
Total		133,541	132,165	125,659	125,107	135,687	101.6	102.7	108.0	108.5

Source: USDA-FAS Dairy: World Markets and Trade. Based upon counselor and attaché reports, official statistics, and results of office research.

[1]Based on deliveries.

[2]EU-15 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, U.K.

[3]EU-25 includes Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, U.K.

[4]EU-27 includes Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, U.K.

[5]Ending June 30 of year shown.

[6]Ending May 31 of year shown.

*1996 data not available.

2. Milk production

The European Union produced the most milk in 2014 at 146.5 million metric tons (metric ton=1,000 kilograms/2,200 pounds), a 19.1 percent increase since 1991. China showed the largest increase in production with a 680 percent increase from 1991 to 2014, which is not surprising considering the nation's large increase in cow numbers. Milk production in 2014 as a percentage of 2007 increased as much as 41.1 percent (India) and decreased as much as 10.4 percent (China). Milk production over all selected countries was approximately 469.5 million metric tons in 2014, an increase of about 92 million metric tons since 1991.

A.2. Changes in milk production in selected countries:

		Milk Production (1,000 metric tons)								
Continent/country		**1991**	**1995**	**2002**	**2007**	**2014**	**2014 as percent of 1991**	**2014 as percent of 1995**	**2014 as percent of 2002**	**2014 as percent of 2007**
North America	Canada	7,790	7,920	7,964	8,212	8,437	108.3	106.5	105.9	102.7
	Mexico	10,200	7,399	9,560	10,657	11,464	112.4	154.9	119.9	107.6
	United States	66,994	70,440	77,139	84,211	93,462	139.5	132.7	121.2	111.0
	Subtotal	*84,984*	*85,759*	*94,663*	*103,080*	*113,363*	133.4	132.2	119.8	110.0
South America	Argentina	6,400	8,500	8,500	9,550	11,326	177.0	133.2	133.2	118.6
	Brazil	14,200	18,375	22,635	26,750	25,489	179.5	138.7	112.6	95.3
	Subtotal	*20,600*	*26,875*	*31,135*	*36,300*	*36,815*	178.7	137.0	118.2	101.4
European Union[1]	*Subtotal*	*122,961*[2]	*121,740*[2]	*131,040*[3]	*132,604*[4]	*146,500*[4]	119.1	120.3	111.8	110.5
Eastern Europe	Poland	14,504	11,420	[3]	[4]	[4]				
	Romania	4,391	5,885	5,150	[4]	[4]				
	Subtotal	*18,895*	*17,305*	*5,150*	*[4]*	*[4]*				
Former Soviet Union	Russia	51,971	39,300	33,500	32,200	30,499	58.7	77.6	91.0	94.7
	Ukraine	22,409	17,181	13,860	11,997	11,152	49.8	64.9	80.5	93.0
	Subtotal	*74,380*	*56,481*	*47,360*	*44,197*	*41,651*	56.0	73.7	87.9	94.2

Source: USDA-FAS Dairy: World Markets and Trade. Based upon counselor and attaché reports, official statistics, and results of office research.

[1]Based on deliveries.

[2]EU-15 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, U.K.

[3]EU-25 includes Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, U.K.

[4]EU-27 includes Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, U.K

[5]Year ending June 30 of year shown.

[6]Year ending May 31 of year shown.

A.2. (continued) Changes in milk production in selected countries:

		Milk Production (1,000 metric tons)								
Continent/country		**1991**	**1995**	**2002**	**2007**	**2014**	**2014 as percent of 1991**	**2014 as percent of 1995**	**2014 as percent of 2002**	**2014 as percent of 2007**
European Union[1]	*Subtotal*	*122,961*[2]	*121,740*[2]	*131,040*[3]	*132,604*[4]	*146,500*[4]	119.1	120.3	111.8	110.5
Eastern Europe	Poland	14,504	11,420	[3]	[4]	[4]				
	Romania	4,391	5,885	5,150	[4]	[4]				
	Subtotal	*18,895*	*17,305*	*5,150*	[4]	[4]				
Former Soviet Union	Russia	51,971	39,300	33,500	32,200	30,499	58.7	77.6	91.0	94.7
	Ukraine	22,409	17,181	13,860	11,997	11,152	49.8	64.9	80.5	93.0
	Subtotal	*74,380*	*56,481*	*47,360*	*44,197*	*41,651*	56.0	73.7	87.9	94.2
South Asia	India	28,200	32,500	36,200	42,890	60,500	214.5	186.2	167.1	141.1
	Subtotal	*28,200*	*32,500*	*36,200*	*42,890*	*60,500*	214.5	186.2	167.1	141.1
Asia	China	4,646	5,764	12,998	35,252	31,599	680.1	548.2	243.1	89.6
	Japan	8,260	8,382	8,385	8,007	7,334	88.8	87.5	87.5	91.6
	Subtotal	*12,906*	*14,146*	*21,383*	*43,259*	*38,933*	301.7	275.2	182.1	90.0
Oceania	Australia[5]	6,578	8,433	11,608	9,500	9,798	149.0	116.2	84.4	103.1
	New Zealand[6]	8,122	9,684	13,925	15,918	21,893	269.6	226.1	157.2	137.5
	Subtotal	*14,700*	*18,117*	*25,533*	*25,418*	*31,691*	215.6	174.9	124.1	124.7
Total		377,626	372,923	392,467	427,748	469,453	124.3	125.9	119.6	109.7

Source: USDA-FAS Dairy: World Markets and Trade. Based upon counselor and attaché reports, official statistics, and results of office research.

[1]Based on deliveries.

[2]EU-15 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, U.K.

[3]EU-25 includes Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, U.K.

[4]EU-27 includes Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, U.K

[5]Year ending June 30 of year shown.

[6]Year ending May 31 of year shown.

Section III: Management, NAHMS Population Estimates

Note: The 1991-92 NDHEP study included only herds with 30 or more milk cows, while the Dairy 1996, Dairy 2002, Dairy 2007, and Dairy 2014 studies included operations with one or more milk cows. Many population estimates from studies prior to 2014 in this report have been updated to restrict the population of operations represented to 30 or more dairy cows. For a more detailed description, see the Methodology section (pg. 276).

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

Table cells are grayed out when there is no estimate available due primarily to changes in question design among study years. Grayed out is equivalent to not applicable/available.

A. Dairy Herd Information and Management Practices

1. Operation type

The majority of operations and cows during 2007 and 2014 were managed conventionally. The percentage of grazing operations doubled from 2007 to 2014 (3.1 and 6.7 percent, respectively), but the percentage of cows on grazing operations was 1.7 percent in both study years. The percentage of organic operations increased from 1.7 percent in 2007 to 7.4 percent in 2014, while the percentage of cows on organic operations increased from 1.2 percent in 2007 to 4.5 percent in 2014.

A.1.a. Percentage of operations and percentage of cows on these operations by operation type:

	Percent Operations				Percent Cows*			
	Dairy 2007		Dairy 2014		Dairy 2007		Dairy 2014	
Operation type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Conventional	63.9	(1.4)	58.8	(1.7)	82.2	(0.9)	85.2	(1.3)
Grazing	3.1	(0.6)	6.7	(1.0)	1.7	(0.4)	1.7	(0.4)
Combination of conventional and grazing and other	31.1	(1.3)	26.5	(1.6)	14.9	(0.8)	8.5	(0.7)
Organic	1.7	(0.4)	7.4	(1.0)	1.2	(0.3)	4.5	(1.1)
Other	0.2	(0.1)	0.6	(0.4)	0.0	(0.0)	0.1	(0.1)
Total	100.0		100.0		100.0		100.0	

Population: Operations with one or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

The operation and cow rolling herd average (RHA) milk production was higher in 2014 than in 2007. RHA milk production at both the operation and the cow level was higher on conventional operations than on any other operation type.

A.1.b. Operation average and cow average RHA milk production (lb/cow) by operation type:

	RHA Milk Production							
	Operation Average				Cow Average			
	Dairy 2007		Dairy 2014		Dairy 2007		Dairy 2014	
Operation type	**RHA production** (lb/cow)	**Std. error**	**RHA production** (lb/cow)	**Std. error**	**RHA production** (lb/cow)	**Std. error**	**RHA production** (lb/cow)	**Std. error**
Conventional	20,253	(135)	21,862	(188)	22,182	(126)	24,622	(153)
Grazing	15,146	(608)	14,513	(983)	15,903	(457)	19,259	(1,763)
Combination of conventional and grazing and other	17,577	(212)	17,815	(351)	18,690	(217)	19,604	(448)
Organic	15,266	(714)	14,758	(709)	16,369	(728)	18,409	(1,543)
All	19,175	(112)	19,932	(183)	21,483	(115)	23,830	(160)

Population: Operations with one or more dairy cows.

2. Record-keeping systems

The use of computerized records for both on- and off- farm record keeping systems increased from 1996 to 2014; however, the majority of operations used handwritten records from 1996 to 2014.

A.2.a. Percentage of operations by type of record-keeping system used for individual animals:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
System	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
On-farm computer record system	15.1	(0.8)	19.4	(0.9)	19.4	(0.9)	30.8	(1.4)
Off-farm computer record system	9.9	(0.8)	5.0	(0.5)	4.9	(0.5)	16.9	(1.2)
Any computer record system	22.7	(1.0)	22.8	(1.0)	22.7	(1.0)	42.6	(1.6)
Handwritten, such as a ledger or notebook	80.7	(1.0)	74.3	(1.1)	73.5	(1.2)	76.5	(1.4)
Other system	6.0	(0.7)	4.1	(0.5)	4.4	(0.6)	3.2	(0.7)
Any	100.0	(0.0)	95.2	(0.6)	95.1	(0.7)	95.0	(0.8)

Population: Operations with one or more dairy cows.

In 2014, 29.8 percent of operations that kept computerized records on individual animals primarily used DairyComp 305®, whether or not the records were kept on- or off-farm. A higher percentage of operations used PCDART and DHI-Plus® in 2014 than in 2002, but the percentage of cows remained relatively unchanged. The use of "other" computerized record systems has decreased since 2002.

A.2.b. For operations that used computer record systems either on- or off-farm (table A.2.a), percentage of operations (and percentage of cows on these operations) by primary record-keeping system used:

	Percent Operations						Percent Cows*					
	Dairy 2002		Dairy 2007		Dairy 2014		Dairy 2002		Dairy 2007		Dairy 2014	
Primary computer record-keeping system	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
DairyComp 305	20.3	(1.7)	36.0	(2.3)	29.8	(1.8)	48.6	(1.9)	60.4	(2.0)	64.7	(2.0)
PCDART	13.0	(1.4)	18.7	(1.7)	21.5	(1.9)	10.3	(0.8)	10.2	(0.9)	12.9	(1.4)
DHI-Plus	13.5	(1.7)	14.6	(1.7)	24.9	(2.2)	13.7	(1.3)	15.8	(1.7)	12.4	(1.3)
DairyPlan	2.6	(0.6)			2.2	(0.6)	2.5	(0.5)			2.0	(0.6)
DairyQuest	7.2	(1.2)			2.1	(0.7)	6.6	(0.9)			1.9	(0.5)
Other	43.4	(2.6)	30.7	(2.4)	19.6	(2.0)	18.2	(1.4)	13.5	(1.3)	6.0	(0.7)
Total	100.0		100.0		100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. To match 2014 estimates, estimates from prior studies were recalculated to include only operations with 30 or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

More than one-half of operations (56.3 percent) participated in the Dairy Herd Improvement Association (DHIA) in 2014. The percentages of operations participating in DHIA were higher in 2014 than in 1996 and 2002.

A.2.c. Percentage of operations that participated in the Dairy Herd Improvement Association program:

Percent Operations									
NDHEP 1991		Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
57.5	(1.8)	49.9	(1.2)	49.4	(1.4)	51.5	(1.5)	56.3	(1.7)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

3. Identification

Individual-animal identification (ID) provides an animal with its own unique ID. The percentage of operations that used “any” individual-animal ID has not changed since 1996 and remains close to 95 percent. The use of ear tags and collars as individual-animal ID has decreased since 1996, while the use of electronic ID has increased from 0.2 percent of operations in 1996 to 8.2 percent in 2014.

A.3.a. Percentage of operations by type of **individual-animal** ID used on at least some dairy cows:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Individual ID type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Ear tags	85.7	(0.9)	90.0	(0.9)	91.9	(0.8)	80.2	(1.4)
Collars	22.8	(1.0)	18.2	(1.1)	13.1	(1.0)	7.4	(1.0)
Photographs or sketches	19.6	(1.0)	15.0	(1.0)	14.4	(1.1)		
Branding (all methods)	5.7	(0.5)	5.5	(0.5)	4.9	(0.5)	4.0	(0.4)
Electronic ID	0.2	(0.1)	0.1	(0.1)	4.3	(0.4)	8.2	(0.8)
Tattoos (other than for brucellosis)	6.8	(0.6)	9.2	(0.8)	8.1	(0.7)		
Other	8.2	(0.7)	9.8	(0.8)	9.9	(0.9)	6.5	(0.9)
Any	97.6	(0.4)	96.6	(0.6)	96.9	(0.6)	94.9	(0.8)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

With herd ID, all animals in the herd have the same ID, such as a farm name. The use of herd ID increased from 36.2 percent of operations in 2002 to 45.4 percent in 2014. Ear tags continue to be the most widely used form of herd ID; in 2014, 31.9 percent of operations, accounting for 46.2 percent of cows, used herd ID. The percentage of cows with electronic herd ID increased from less than 1 percent in 2002 to 32.6 percent in 2014. Most electronic herd ID tags can be used for individual-animal ID, herd ID, or both.

A.3.b. Percentage of operations and percentage of cows, by type of **herd** ID used:

	Percent Operations						Percent Cows*					
	Dairy 2002		Dairy 2007		Dairy 2014		Dairy 2002		Dairy 2007		Dairy 2014	
Herd ID type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Ear tags	30.9	(1.1)	36.7	(1.4)	31.9	(1.6)	41.9	(1.2)	41.3	(1.5)	46.2	(2.1)
Electronic ID	0.1	(0.0)	2.1	(0.3)	9.1	(0.8)	0.4	(0.2)	4.0	(0.6)	32.6	(2.2)
Branding (all methods)	4.2	(0.4)	3.4	(0.4)	4.7	(0.4)	18.4	(1.1)	19.0	(1.5)	24.1	(1.8)
Tattoos (other than for brucellosis)	3.3	(0.4)	2.6	(0.4)	7.9	(0.9)	3.8	(0.5)	4.7	(0.8)	12.4	(1.6)
Collars	4.4	(0.6)	3.0	(0.5)			3.9	(0.5)	2.9	(0.5)		
Other	3.0	(0.4)	1.6	(0.4)	5.2	(0.8)	2.9	(0.4)	1.7	(0.4)	4.1	(1.0)
Any	36.2	(1.2)	40.6	(1.4)	45.4	(1.7)	54.1	(1.1)	54.4	(1.5)	70.6	(1.6)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.
*As a percentage of January 1 dairy cow inventory.

4. Breed and registration

Although Holsteins are the primary breed on the majority of U.S. dairy operations, the percentage of operations with Holsteins was lower in 2014 compared with previous years. Alternatively, the percentages of operations with Jerseys or 'other' breeds were higher in 2014 than in previous years.

A.4.a. Percentage of operations by primary breed:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Breed	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Holstein	93.0	(0.8)	92.4	(0.7)	92.2	(0.7)	82.0	(1.5)
Jersey	4.1	(0.6)	3.8	(0.5)	3.5	(0.4)	9.1	(1.1)
Ayrshire	0.3	(0.1)	0.3	(0.1)	0.3	(0.1)	0.7	(0.3)
Brown Swiss	0.4	(0.2)	0.9	(0.2)	0.9	(0.3)	1.1	(0.3)
Guernsey	1.7	(0.4)	1.1	(0.3)	0.9	(0.3)	1.0	(0.5)
Milking shorthorn							0.6	(0.4)
Other	0.5	(0.2)	1.5	(0.4)	2.2	(0.5)	5.7	(0.9)
Total	100.0		100.0		100.0		100.0	

Population: Operations with one or more dairy cows.

The percentage of operations that had no registered dairy cows has remained the same since 2002.

A.4.b. Percentage of operations by percentage of dairy cows registered with a breed association:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Percent dairy cows registered	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0	65.5	(1.2)	71.6	(1.2)	71.7	(1.3)	71.9	(1.6)
0.1 to 9.9	6.7	(0.6)	5.3	(0.6)	5.6	(0.6)	5.5	(0.8)
10.0 to 49.9	10.3	(0.7)	8.1	(0.7)	6.5	(0.7)	5.2	(0.7)
50.0 to 74.9	4.4	(0.6)	3.2	(0.4)	2.1	(0.4)	2.7	(0.5)
75.0 to 99.9	5.5	(0.6)	4.2	(0.5)	5.2	(0.6)	3.5	(0.7)
100	7.6	(0.7)	7.6	(0.7)	8.9	(0.8)	11.2	(1.2)
Total	100.0		100.0		100.0		100.0	

Population: Operations with one or more dairy cows.

5. Quality assurance programs

The percentage of operations that participated in any quality assurance program increased slightly from 2002 to 2007 and remained the same from 2007 to 2014. A lower percentage of operations participated in a local milk cooperative/processor sponsored program in 2014 than in 2007 (35.2 and 42.2 percent, respectively), and a higher percentage of operations participated in a national industry sponsored program in 2014 than in 2007 and 2002.

A.5. Percentage of operations that participated in the following type(s) of quality assurance programs, by type of program:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Program type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
State sponsored	7.8	(0.6)	8.8	(0.7)	9.3	(0.9)
Local milk cooperative/ processor sponsored	35.2	(1.3)	42.2	(1.4)	35.2	(1.6)
National industry sponsored	2.8	(0.4)	3.1	(0.4)	9.1	(0.9)
Other	2.8	(0.4)	2.0	(0.3)	4.0	(0.7)
Any	40.6	(1.3)	47.3	(1.4)	45.9	(1.7)

Population: Operations with one or more dairy cows.

B. Productivity

1. Rolling herd average milk production

The operation average rolling herd average (RHA) milk production increased each study year from 1996 to 2014. The RHA for primarily Holstein herds increased from 16,925 lb/cow in 1996 to 20,889 lb/cow in 2014.

B.1.a. Operation average RHA milk production (lb/cow):

Operation Average RHA Milk Production

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Population	Avg.	Std. error	Avg.	Std. error	Avg.	Std. error	Avg.	Std. error
All cows	16,587	(100)	18,235	(103)	19,175	(112)	19,932	(183)
Primarily Holsteins*	16,925	(99)	18,590	(102)	19,482	(115)	20,889	(174)

Population: Operations with one or more dairy cows.
*Operations where Holsteins accounted for 50 percent or more of the January 1 cow inventory.

The cow average RHA milk production increased from 18,198 lb/cow in 1996 to 23,830 lb/cow in 2014. The 2014 NAHMS estimate of 23,830 lb/cow is slightly higher than the NASS estimate of 22,249 lb/cow reported for milk production per cow in section I, table A.3.a of this report, likely due to differences in study populations. Herds of primarily Holstein cows showed a similar increase in the cow average RHA milk production since 1996 and was 24,297 lb/cow in 2014.

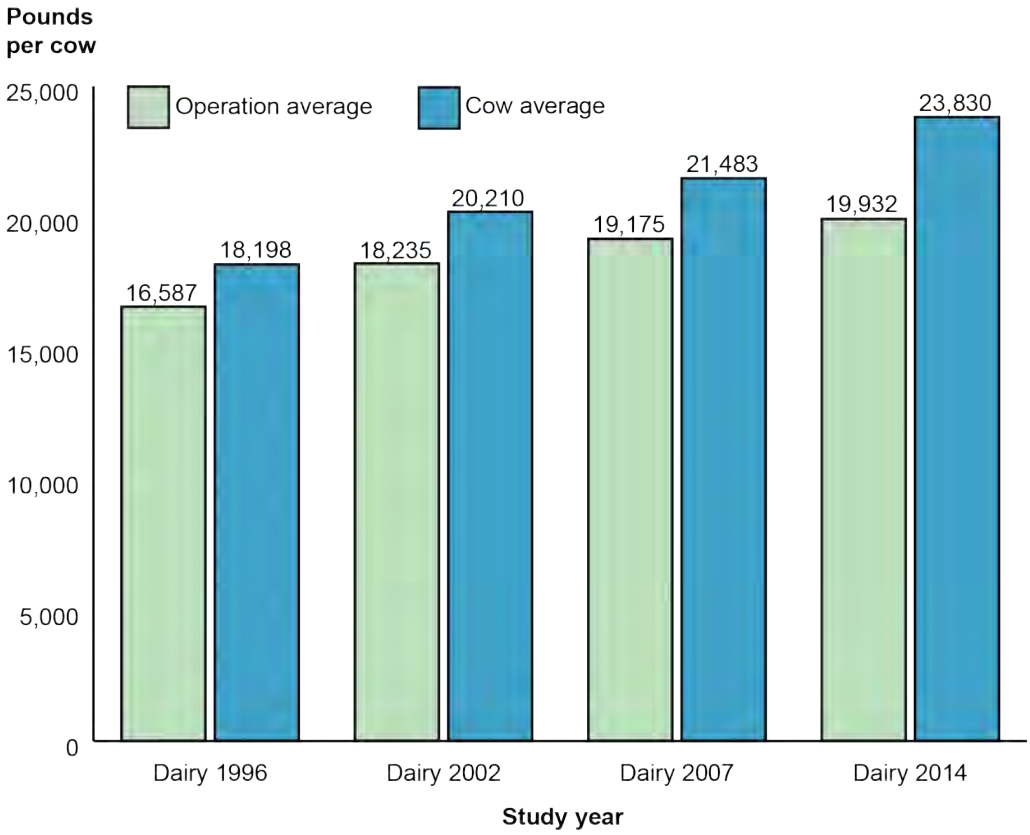
B.1.b. Cow average RHA milk production (lb/cow):

Cow Average RHA Milk Production

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Population	Avg.	Std. error	Avg.	Std. error	Avg.	Std. error	Avg.	Std. error
All cows	18,198	(79)	20,210	(80)	21,483	(115)	23,830	(160)
Primarily Holsteins*	18,442	(78)	20,467	(79)	21,807	(114)	24,297	(161)

Population: Operations with one or more dairy cows.
*Operations where Holsteins accounted for 50 percent or more of the January 1 cow inventory.

Operation average and cow average RHA milk production for all cows



Population: Operations with 1 or more dairy cows.

2. Age at first calving

The operation average age of heifers at first calving decreased by about one month from 1991 to 2014, while the heifer average age at first calving decreased two months during the same time period.

B.2. Average age of heifers at first calving (months):

	Average Age at First Calving (mo)									
	NDHEP 1991		**Dairy 1996**		**Dairy 2002**		**Dairy 2007**		**Dairy 2014**	
Parameter	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Operation average	25.9	(0.1)	25.8	(0.1)	25.4	(0.1)	25.2	(0.1)	25.0	(0.1)
Heifer average	25.8	(0.1)	25.5	(0.1)	25.0	(0.1)	24.5	(0.1)	23.8	(0.1)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

3. Days dry

Both the operation average and the cow average number of days that cows were dry remained constant from 1991 to 2002 but decreased by about 4 days starting in 2007.

B.3. Operation average and cow average number of days dry:

	Average Days Dry									
	NDHEP 1991		Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Parameter	Avg.	Std. error	Avg.	Std. error	Avg.	Std. error	Avg.	Std. error	Avg.	Std. error
Operation average	61.1	(0.5)	60.4	(0.3)	60.6	(0.3)	57.7	(0.3)	57.1	(0.3)
Cow average	61.5	(0.3)	61.7	(0.4)	61.9	(0.2)	58.4	(0.3)	57.3	(0.3)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

4. Calving interval

The operation average and cow average calving intervals have decreased slightly from 2007 to 2014 but not back to 1991 intervals.

B.4. Operation average and cow average number of months between calving:

	Average Calving Interval (mo)									
	NDHEP 1991		**Dairy 1996**		**Dairy 2002**		**Dairy 2007**		**Dairy 2014**	
Parameter	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Operation average	12.8	(0.0)	12.9	(0.0)	13.3	(0.0)	13.3	(0.0)	13.1	(0.0)
Cow average	12.9	(0.0)	13.0	(0.0)	13.4	(0.0)	13.3	(0.0)	13.0	(0.0)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

C. Heifer Management

1. Source of heifers

Although the percentage of operations that raised their heifers on-site decreased slightly from 2002 to 2014, more than 90 percent of operations still raise their own heifers. The percentage of heifers born and raised on-site has followed a similar pattern, with the majority still being raised on-site during the same period; however, the percentage of heifers born and raised on-site decreased substantially from 2007 to 2014, likely due to the threefold increase in the percentage of heifers that were born on-site but raised off-site from 2002 to 2014.

C.1. Percentage of operations and percentage of dairy heifers, by source of heifers:

	Percent Operations						Percent Heifers*					
	Dairy 2002		Dairy 2007		Dairy 2014		Dairy 2002		Dairy 2007		Dairy 2014	
Heifer source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Born and raised on-site	98.1	(0.3)	96.3	(0.4)	91.8	(0.7)	90.4	(0.8)	87.2	(1.2)	72.8	(1.9)
Born on-site but raised off-site	3.9	(0.4)	5.4	(0.5)	12.4	(0.9)	7.4	(0.8)	11.8	(1.2)	25.7	(1.9)
Born off-site	5.4	(0.6)	5.8	(0.7)	7.0	(0.9)	2.2	(0.4)	1.0	(0.2)	1.5	(0.3)
Total							100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.
*As a percentage of January 1 dairy heifer inventory.

2. Colostrum management

Calves on large operations received their first feeding of colostrum 2.1 hours following birth in 2014 compared with 2.8 hours in 2007. No other changes were observed in operation average hours at first feeding.

C.2.a. Operation average number of hours following birth that the majority of heifer calves received their first feeding of colostrum, by herd size:

	Operation Average Hours			
	Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Small (30 to 99)	3.4	(0.2)	3.8	(0.2)
Medium (100 to 499)	3.3	(0.1)	3.9	(0.2)
Large (500 or more)	2.8	(0.2)	2.1	(0.1)
All operations	3.3	(0.1)	3.6	(0.1)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

Calves received their first feeding of colostrum from a bucket, bottle, or an esophageal feeder on a higher percentage of operations in 2014 compared with operations in any of the previous study years. Alternatively, a much lower percentage of operations allowed heifer calves to get their first feeding of colostrum through nursing in 2014 compared with operations in any of the previous study years.

C.2.b. Percentage of operations by method normally used to provide heifer calves with their first feeding of colostrum:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014*	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Hand-fed from bucket or bottle	62.5	(1.2)	64.8	(1.3)	59.2	(1.4)	86.0	(1.2)
Hand-fed using esophageal feeder	3.6	(0.4)	4.4	(0.5)	4.3	(0.5)	7.6	(0.7)
Any hand-fed	66.1	(1.2)	69.2	(1.2)	63.5	(1.4)	93.6	(1.0)
First nursing (suckling)	33.5	(1.2)	30.5	(1.2)	36.3	(1.4)	6.4	(1.0)
No colostrum	0.4	(0.2)	0.3	(0.1)	0.2	(0.1)		
Total	100.0		100.0		100.0		100.0	

Population: Operations with one or more dairy cows.
*Question variation: In 2014, received any colostrum, not just their first feeding of colostrum

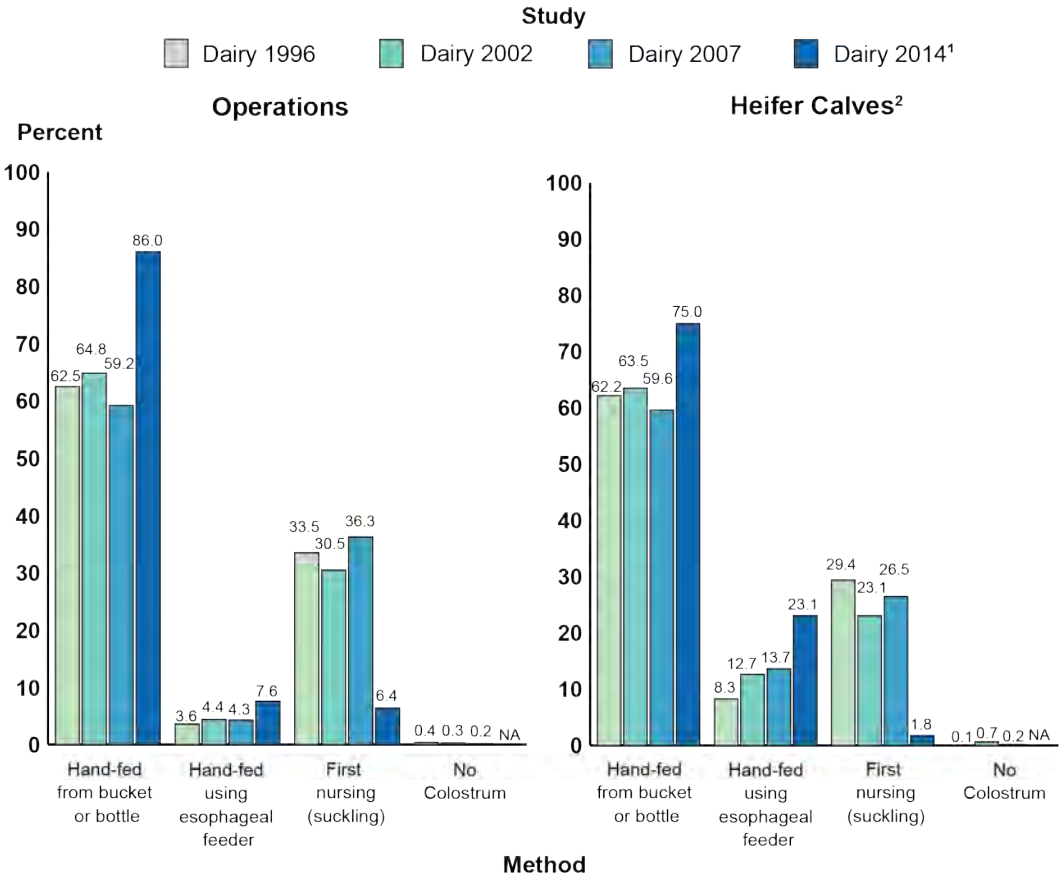
A higher percentage of heifer calves were hand-fed their first feeding of colostrum from an esophageal feeder, or bucket or bottle in 2014 compared with calves in previous study years. A much lower percentage of calves received their first feeding of colostrum via nursing in 2014 compared with calves in the previous study years.

C.2.c. Percentage of heifer calves by method normally used to provide heifer calves with their first feeding of colostrum:

	Percent Heifer Calves[1]							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014[2]	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Hand-fed from bucket or bottle	62.2	(1.3)	63.5	(1.2)	59.6	(1.6)	75.0	(1.8)
Hand-fed using esophageal feeder	8.3	(1.0)	12.7	(0.9)	13.7	(1.2)	23.1	(1.8)
Any hand-fed	70.5	(1.1)	76.2	(1.0)	73.3	(1.3)	98.1	(0.3)
First nursing (suckling)	29.4	(1.1)	23.1	(1.0)	26.5	(1.3)	1.8	(0.3)
No colostrum	0.1	(0.1)	0.7	(0.3)	0.2	(0.1)		
Total	100.0		100.0		100.0		100.0	

Population: Operations with one or more dairy cows.
[1]As a percentage of heifer calves born alive.
[2]Question variation: In 2014, received any colostrum, not just their first feeding of colostrum.

Percentage of operations and percentage of heifer calves by method normally used to provide calves with their first feeding of colostrum



Population: Operations with 1 or more dairy cows.
[1]Question variation: In 2014, received any colostrum, not just their first feeding of colostrum.
[2]As a percentage of dairy heifer calves born alive.

The percentage of operations by method used to provide heifer calves their first feeding of colostrum did not differ, when comparing operations with 30 or more cows with operations with one or more cows (table C.2.b.).

C.2.d. Percentage of operations by method normally used to provide heifer calves their first feeding of colostrum:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014*	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Hand-fed from bucket or bottle	65.4	(1.1)	66.2	(1.3)	61.5	(1.4)	86.7	(1.1)
Hand-fed using esophageal feeder	3.8	(0.4)	4.7	(0.5)	4.8	(0.5)	8.7	(0.8)
Any hand-fed	69.1	(1.1)	70.8	(1.2)	66.3	(1.4)	95.4	(0.7)
First nursing (suckling)	30.7	(1.1)	28.9	(1.2)	33.5	(1.4)	4.6	(0.7)
No colostrum	0.1	(0.1)	0.2	(0.1)	0.2	(0.1)		
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more cows. Estimates from all studies were recalculated to only include operations with 30 or more cows to serve as a proper reference value for future tables in this section.
*Question variation: In 2014, received any colostrum, not just their first feeding of colostrum.

The percentage of heifer calves by method normally used to provide heifer calves with first feeding of colostrum did not differ, when comparing operations with 30 or more cows with operations with one or more cows (table C.2.c).

C.2.e. Percentage of heifer calves by method normally used to provide heifer calves with their first feeding of colostrum:

	Percent Heifer Calves[1]							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014[2]	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Hand-fed from bucket or bottle	62.5	(1.4)	63.5	(1.3)	59.9	(1.6)	74.7	(1.8)
Hand-fed using esophageal feeder	8.5	(1.0)	12.9	(0.9)	13.9	(1.2)	23.5	(1.8)
Any hand-fed	71.0	(1.2)	76.4	(1.0)	73.8	(1.4)	98.2	(0.3)
First nursing (suckling)	28.8	(1.2)	22.8	(1.0)	26.0	(1.4)	1.8	(0.3)
No colostrum	0.1	(0.1)	0.8	(0.3)	0.2	(0.1)		
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from all studies were recalculated to only include operations with 30 or more dairy cows to serve as a proper reference value for future tables in this section.
[1]As a percentage of heifer calves born alive.
[2]Question variation: In 2014, received any colostrum, not just their first feeding of colostrum.

Measuring colostrum immunoglobulins (Ig)—and thereby colostrum quality —is an important component of any colostrum management program. There has been a dramatic increase in the percentage of operations, across all herd sizes, which have evaluated colostrum quality since 2002. There has been an almost 10-fold increase in the percentage of all operations estimating Ig levels in colostrum from 2002 to 2014 – 5.8 to 53.3 percent.

C.2.f. For operations that hand-fed colostrum (table C.2.d), percentage of operations that estimated immunoglobulin (Ig) levels of the colostrum or evaluated its quality, by herd size:

Percent Operations

	Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30 to 99)	2.4	(0.6)	7.9	(1.4)	45.5	(2.7)
Medium (100 to 499)	10.6	(1.5)	19.1	(2.3)	57.0	(2.8)
Large (500 or more)	32.2	(2.8)	46.4	(3.3)	83.6	(1.9)
All operations	5.8	(0.6)	13.4	(1.1)	53.3	(1.8)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

Pooling colostrum is generally not recommended because of issues related to reduced quality and increased pathogen exposure. Across all herd sizes, a lower percentage of operations pooled colostrum in 2014 than in 2002.

C.2.g. For operations that normally hand-fed colostrum (table C.2.d), percentage of operations that pooled colostrum, by herd size:

Percent Operations

	Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30 to 99)	23.1	(1.5)	17.0	(1.8)	11.5	(1.7)
Medium (100 to 499)	37.4	(2.0)	26.0	(2.4)	27.9	(2.5)
Large (500 or more)	70.6	(2.4)	56.9	(3.1)	46.1	(2.2)
All operations	28.4	(1.2)	22.1	(1.4)	20.3	(1.3)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to include only operations with 30 or more dairy cows to match 2014 estimates.

The percentages of operations by methods used to store colostrum have remained consistent since 2002. Not storing colostrum (e.g., feeding colostrum to the calf immediately after collecting it from the dam) was the primary method used by the highest percentage of operations, across study years.

C.2.h. For operations that hand-fed colostrum (table C.2.d), percentage of operations by primary method of storing colostrum:

Percent Operations

	Dairy 2002		Dairy 2007		Dairy 2014	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Stored without refrigeration	4.8	(0.8)	3.9	(0.8)	2.9	(0.6)
Stored in refrigerator	9.0	(0.8)	11.7	(1.0)	10.2	(0.9)
Stored in freezer	30.7	(1.5)	29.9	(1.7)	35.9	(1.6)
Other	0.4	(0.2)	0.0	(—)	0.2	(0.1)
Not stored	55.1	(1.6)	54.6	(1.9)	50.7	(1.7)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

Treating colostrum with heat reduces pathogens and leads to increased absorption of immunoglobulins. A higher percentage of medium, large, and all operations heat-treated colostrum in 2014 than in 2007 and 2002.

C.2.i. For operations that hand-fed colostrum (table C.2.d), percentage of operations that heat-treated colostrum, by herd size:

Percent Operations

	Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30 to 99)	0.3	(0.2)	0.3	(0.2)	1.6	(0.6)
Medium (100 to 499)	0.8	(0.3)	0.9	(0.4)	6.7	(1.3)
Large (500 or more)	3.6	(0.9)	6.4	(1.6)	24.0	(1.8)
All operations	0.5	(0.2)	0.9	(0.2)	5.6	(0.6)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

The percentage of operations by amount of colostrum normally fed to calves in their first 24 hours remained relatively unchanged from 1996 to 2007; however, the percentage of operations that fed calves 4 or more quarts of colostrum in their first 24 hours almost tripled from 2007 to 2014 (31.3 to 87.5 percent of operations, respectively).

C.2.j. For operations that hand-fed colostrum (table C.2.d), percentage of operations by amount of colostrum normally fed during the first 24 hours:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Amount (qt)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
2 or less	20.1	(1.1)	20.9	(1.4)	23.5	(1.6)	8.8	(1.0)
More than 2 but less than 4	45.5	(1.5)	47.5	(1.7)	45.2	(1.9)	3.8	(0.7)
4 or more	34.3	(1.5)	31.6	(1.5)	31.3	(1.7)	87.5	(1.2)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

The percentage of heifer calves hand-fed 4 or more quarts of colostrum more than doubled in 2014 compared with previous study years.

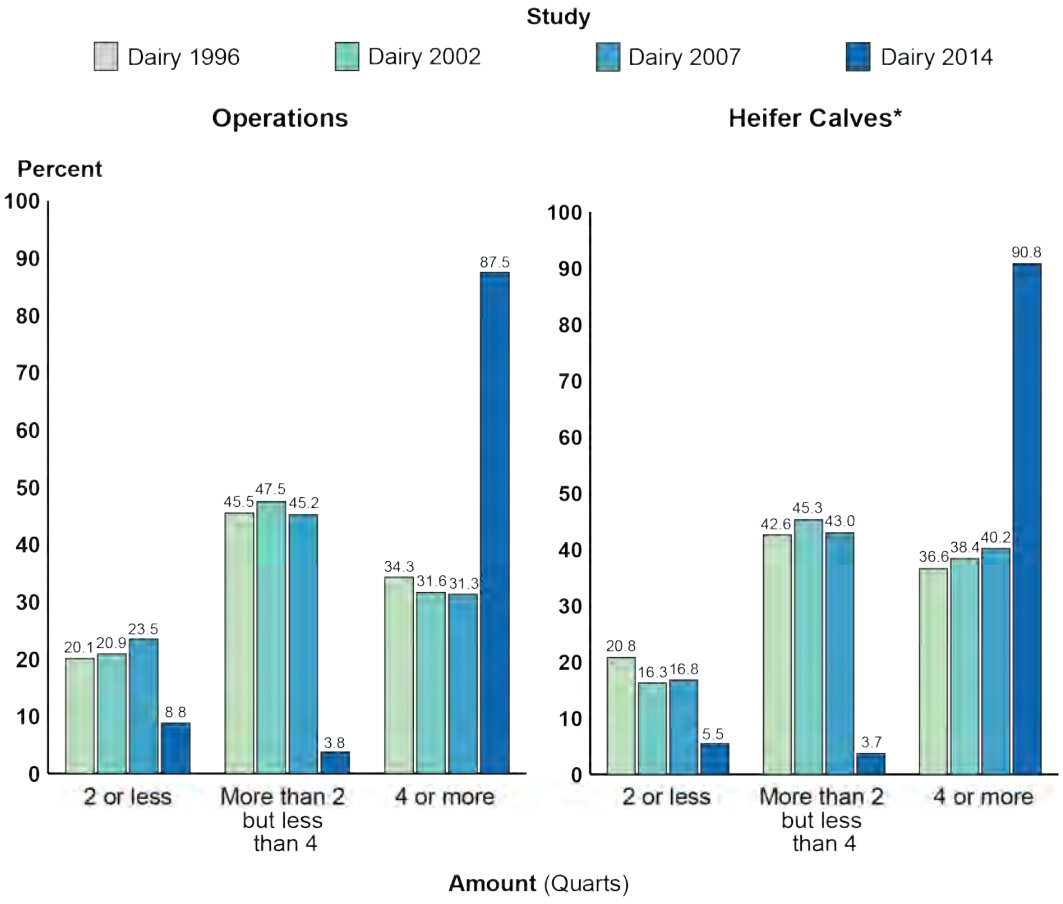
C.2.k. For operations that hand-fed colostrum (table C.2.d), percentage of heifer calves by amount of colostrum normally fed during the first 24 hours:

Percent Heifer Calves*

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Amount (qt)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
2 or less	20.8	(1.6)	16.3	(1.1)	16.8	(1.4)	5.5	(0.8)
More than 2 but less than 4	42.6	(1.8)	45.3	(1.6)	43.0	(2.1)	3.7	(0.7)
4 or more	36.6	(1.7)	38.4	(1.5)	40.2	(2.1)	90.8	(1.0)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.
*As a percentage of dairy heifer calves born alive.

For operations that hand-fed colostrum, percentage of operations and percentage of heifer calves by amount of colostrum normally fed during the first 24 hours



Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.
*As a percentage of dairy heifer calves born alive.

The percentage of operations that routinely monitored serum proteins in newborn heifer calves to assess passive transfer status increased from 2.1 percent in 2007 to 6.2 percent in 2014. The percentage of heifers on operations that routinely monitored serum proteins increased from 12.6 to 35.3 percent during the same period. The percentage of heifer calves on large operations that monitored passive transfer serum proteins increased from 24.4 percent of calves in 2007 to 53.9 percent of calves in 2014.

C.2.l. Percentage of operations that routinely monitored serum proteins as a measure of passive transfer status in newborn heifer calves, and percentage of heifer calves on those operations, by herd size:

	Percent Operations				Percent Heifer Calves*			
	Dairy 2007		Dairy 2014		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (fewer than 100)	1.1	(0.4)	2.0	(0.8)	1.0	(0.3)	1.3	(0.6)
Medium (100 to 499)	2.4	(0.6)	5.5	(1.2)	3.7	(0.9)	6.8	(1.7)
Large (500 or more)	14.5	(1.7)	38.3	(2.3)	24.4	(2.8)	53.9	(3.0)
All operations	2.1	(0.3)	6.2	(0.6)	12.6	(1.4)	35.3	(2.1)

Population: Operations with one or more dairy cows.
*As a percentage of dairy heifer calves born alive.

3. Housing

From 2002 to 2014, the majority of operations primarily used individual housing for preweaned heifers. A lower percentage of operations used tie stalls or stanchions for preweaned housing in 2014 compared with 2007 (5.2 and 8.9 percent, respectively). Interestingly, a lower percentage of operations reported that preweaned heifers were not housed on the operation in 2014 than in 2002 (3.2 and 9.5 percent, respectively).

C.3.a. Percentage of operations by primary housing type used for **preweaned** heifers:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Housing type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Individual outside hutch/pen	58.1	(1.4)	67.9	(1.3)	37.9	(1.6)
Individual inside hutch/pen in heated calf barn					6.7	(0.8)
Individual inside hutch/pen in unheated calf barn					25.1	(1.6)
Tie stall or stanchion			8.9	(0.8)	5.2	(0.8)
Pasture			0.6	(0.2)	1.6	(0.5)
Freestall with no access to open/dry lot	2.1	(0.4)	2.7	(0.5)	1.3	(0.4)
Freestall with access to open/dry lot					1.7	(0.5)
Open/dry lot without barn or shed*			0.6	(0.2)	0.3	(0.2)
Open/dry lot with barn or shed					2.3	(0.7)
Multiple-animal inside area/barn	30.3	(1.3)	14.2	(1.1)	14.7	(1.3)
Not housed on operation	9.5	(0.8)	4.7	(0.5)	3.2	(0.4)
Other			0.4	(0.2)		
Total	100.0		100.0		100.0	

Population: Operations with one or more dairy cows.
*With or without shade structures

In 2014, 32.7 percent of operations housed weaned heifers in a multiple-animal inside area/barn, down from 78.7 percent of operations in 2002. A higher percentage of operations in 2014 than in 2007 and 2002 primarily used individual housing for weaned heifers. A lower percentage of operations in 2014 than in 2007 housed weaned heifers on pasture (6.0 and 10.8 percent, respectively). A lower percentage of operations in 2014 than in 2007 did not house weaned heifers (2.9 and 7.7 percent of operations, respectively).

C.3.b. Percentage of operations by primary housing type used for **weaned** heifers:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Housing type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Individual outside hutch/pen	4.9	(0.6)	5.3	(0.7)	1.4	(0.4)
Individual inside hutch/pen in heated calf barn					1.7	(0.4)
Individual inside hutch/pen in unheated calf barn					9.6	(1.2)
Tie stall or stanchion	6.8	(0.7)	5.9	(0.7)	5.7	(0.9)
Pasture			10.8	(0.9)	6.0	(0.9)
Freestall with no access to open/dry lot	5.8	(0.6)	12.1	(0.9)	5.5	(0.8)
Freestall with access to open/ dry lot					7.0	(0.9)
Open/dry lot without barn or shed*			22.9	(1.1)	5.6	(0.8)
Open/dry lot with barn or shed					21.9	(1.4)
Multiple-animal inside area/barn	78.7	(1.1)	34.6	(1.4)	32.7	(1.6)
Not housed on operation	3.8	(0.4)	7.7	(0.7)	2.9	(0.5)
Other			0.7	(0.2)		
Total	100.0		100.0		100.0	

Population: Operations with one or more dairy cows.
*With or without shade structures

4. Nutrition

A lower percentage of operations in 2014 than in 2007 fed preweaned heifers any milk replacer in (49.9 and 68.6 percent of operations, respectively). This decrease was due to a lower percentage of operations feeding medicated milk replacer in 2014 than in previous study years. Unpasteurized milk (saleable or nonsaleable) was fed by a higher percentage of operations in 2014 than in 2007 (55.7 and 47.8 percent, respectively); however, both of these percentages are lower than the 86.2 percent of operations that fed unpasteurized milk in 2002. The percentage of operations that fed preweaned heifers pasteurized milk ranged from 1.0 percent in 2002, 4.0 percent in 2007, and 7.4 percent in 2014. A combination of milk and milk replacer was fed by a lower percentage of operations in 2014 than in 2007 (14.1 and 20.9 percent, respectively).

C.4.a. Percentage of operations by liquid diet fed to preweaned heifers:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Liquid diet	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Nonmedicated milk replacer			12.7	(0.9)	16.4	(1.3)
Medicated milk replacer	55.7	(1.3)	57.5	(1.4)	37.6	(1.7)
Any milk replacer			68.6	(1.3)	49.9	(1.8)
Unpasteurized milk*	86.2	(0.9)	47.8	(1.4)	55.7	(1.8)
Pasteurized milk*	1.0	(0.2)	4.0	(0.4)	7.4	(0.8)
Acidified milk*					1.7	(0.5)
Combination of milk* and milk replacer			20.9	(1.1)	14.1	(1.2)
Other			2.9	(0.5)	1.4	(0.6)

Population: Operations with one or more dairy cows.
*Saleable or nonsaleable/waste

The percentage of small, medium, and all operations that fed heifer calves medicated milk replacers decreased from 2002 to 2014.

C.4.b. Percentage of operations that fed preweaned heifer calves a medicated milk replacer, by herd size:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (fewer than 100)	54.4	(1.6)	55.2	(1.8)	33.6	(2.3)
Medium (100 to 499)	64.1	(1.9)	68.2	(2.1)	49.2	(2.8)
Large (500 or more)	37.7	(2.5)	43.6	(3.1)	33.5	(2.6)
All operations	55.7	(1.3)	57.5	(1.4)	37.6	(1.7)

Population: Operations with one or more dairy cows.

A lower percentage of preweaned heifer calves on small, medium, and all operations were fed medicated milk replacer in 2014 than in 2007.

C.4.c. Percentage of preweaned heifer calves on operations that fed a medicated milk replacer, by herd size:

	Percent Heifer Calves*			
	Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (fewer than 100)	57.9	(1.8)	41.3	(2.7)
Medium (100 to 499)	63.0	(2.2)	50.0	(3.2)
Large (500 or more)	36.4	(3.0)	35.3	(3.6)
All operations	49.9	(1.5)	40.4	(2.2)

Population: Operations with one or more dairy cows.
*As a percentage of dairy heifer calves born alive.

All milk replacer medications, with the exception of lasalocid and decoquinate, were fed by a lower percentage of operations in 2014 than in 2007. While the percentage of operations that used lasalocid increased from 3.2 percent in 2002 to 12.6 percent in 2014, the percentage of operations that used oxytetracycline in combination with neomycin decreased from 28.5 percent in 2007 to 8.9 percent in 2014.

C.4.d. Percentage of operations that fed preweaned heifer calves a medicated milk replacer, by medication used:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Milk-replacer medication	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Lasalocid	3.2	(0.4)	4.1	(0.5)	12.6	(1.2)
Decoquinate	12.8	(0.9)	10.8	(0.9)	11.4	(1.2)
Oxytetracycline in combination with neomycin (OxyNEO)	25.6	(1.2)	28.5	(1.3)	8.9	(0.9)
Oxytetracycline (OTC)	13.7	(0.8)	12.6	(0.9)	4.8	(0.8)
Chlortetracycline (CTC)	7.1	(0.7)	6.9	(0.7)	1.6	(0.4)
Other	3.6	(0.5)	3.1	(0.5)	1.3	(0.3)

Population: Operations with one or more dairy cows.

There were no differences from 2007 to 2014 in the operation average days of age at which preweaned heifers were first offered water. Water was first offered to preweaned heifers at an earlier age on large operations than on small and medium operations.

C.4.e. Operation average age (days) of preweaned heifers when first offered water, by herd size:

	Operation Average Age (days)			
	Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Small (fewer than 100)	16.3	(0.7)	19.0	(1.0)
Medium (100 to 499)	13.3	(0.8)	15.4	(1.1)
Large (500 or more)	8.2	(0.9)	7.8	(1.0)
All operations	15.3	(0.6)	17.3	(0.7)

Population: Operations with one or more dairy cows.

On average, preweaned heifers on small operations in 2014 were older than preweaned heifers in 2007 when first offered starter grain (12.3 and 8.9 days of age, respectively). The operation average age at which starter grain was offered to preweaned heifers was also higher for all operations in 2014 (10.8 days) than in 2007 (8.5 days).

C.4.f. Operation average age (days) of preweaned heifers when first offered starter grain or other concentrates, by herd size:

	Operation Average Age (days)			
	Dairy 2007		**Dairy 2014**	
Herd size (number dairy cows)	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Small (fewer than 100)	8.9	(0.3)	12.3	(0.9)
Medium (100 to 499)	7.5	(0.4)	8.0	(0.4)
Large (500 or more)	7.8	(0.7)	6.3	(0.3)
All operations	8.5	(0.3)	10.8	(0.6)

Population: Operations with one or more dairy cows.

Across herd sizes, the operation average ages of preweaned heifers when first offered hay or other roughages was higher in 2014 than 2007.

C.4.g. Operation average age (days) of preweaned heifers when first offered hay or other roughages, by herd size:

	Operation Average Age (days)			
	Dairy 2007		**Dairy 2014**	
Herd size (number dairy cows)	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Small (fewer than 100)	22.1	(0.7)	31.1	(1.6)
Medium (100 to 499)	30.9	(1.1)	43.1	(1.7)
Large (500 or more)	40.0	(1.9)	58.1	(1.7)
All operations	24.5	(0.6)	36.0	(1.2)

Population: Operations with one or more dairy cows.

5. Weaning

The operation average age of heifer calves at weaning increased from 8.0 weeks in 2002 to 9.0 weeks in 2014.

C.5. Average age of heifers at weaning (weeks):

	Average Age (wk)							
	Dairy 1996		**Dairy 2002**		**Dairy 2007**		**Dairy 2014**	
Parameter	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Operation average	8.4	(0.1)	8.0	(0.1)	8.2	(0.1)	9.0	(0.2)
Heifer average	8.7	(0.1)	8.4	(0.1)	8.6	(0.1)	8.7	(0.1)

Population: Operations with one or more dairy cows.

6. Vaccination and other preventive practices

A lower percentage of operations administered any vaccines to heifers in 2014 compared with all other study years. The percentages of operations that vaccinated heifers for specific diseases varied from 1991 to 2014. Many vaccines used for diseases such as bovine viral diarrhea (BVD), infectious bovine rhinotracheitis (IBR), parainfluenza Type 3 (PI3), and bovine respiratory syncytial virus (BRSV) were used by a higher percentage of operations in 2014 than in 1991. The vaccine for *Histophilus somni* was used by a higher percentage of operations in 1996, 2002, and 2007 than in 1991 or 2014. Brucellosis vaccination has shown the largest decrease in use since 1991: 66.8 percent of operations used the vaccine in 1991 compared with 6.4 percent in 2014. One reason for the decrease in brucellosis vaccine may be due to recent guidance issued by USDA's Veterinary Services, which oversees the nation's Brucellosis Eradication Program, recommending that the vaccine should only be used in at-risk populations, such as in the Greater Yellowstone Area. The use of *Salmonella* vaccine has also decreased with 8.6 percent of operations using it in 2014 compared with 23.8 percent in 2007.

C.6.a. Percentage of operations that normally vaccinated preweaned, weaned, or pregnant heifers against the following diseases:

	Percent Operations									
	NDHEP 1991		Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Disease	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Infectious bovine rhinotracheitis (IBR)	60.6	(2.1)	72.5	(1.2)	70.2	(1.3)	74.3	(1.3)	70.4	(1.7)
Bovine viral diarrhea (BVD)	58.4	(2.1)	75.3	(1.1)	75.6	(1.2)	77.8	(1.3)	69.1	(1.7)
Parainfluenza Type 3 (PI3)	57.6	(2.1)	65.6	(1.2)	63.5	(1.3)	63.9	(1.4)	66.5	(1.7)
Bovine respiratory syncytial virus (BRSV)	44.0	(2.1)	63.7	(1.2)	61.2	(1.4)	68.4	(1.4)	64.5	(1.8)
Leptospirosis	56.1	(2.2)	71.7	(1.2)	69.0	(1.3)	71.1	(1.4)	54.2	(1.8)
Clostridia (blackleg/ malignant edema)	20.7	(1.4)	33.9	(1.1)	34.1	(1.2)	37.2	(1.3)	28.5	(1.4)
E. coli mastitis			19.5	(1.0)	22.7	(1.1)	26.3	(1.2)	21.6	(1.3)
*Histophilus somni**	14.7	(1.4)	40.9	(1.2)	33.5	(1.3)	36.1	(1.4)	10.2	(1.0)

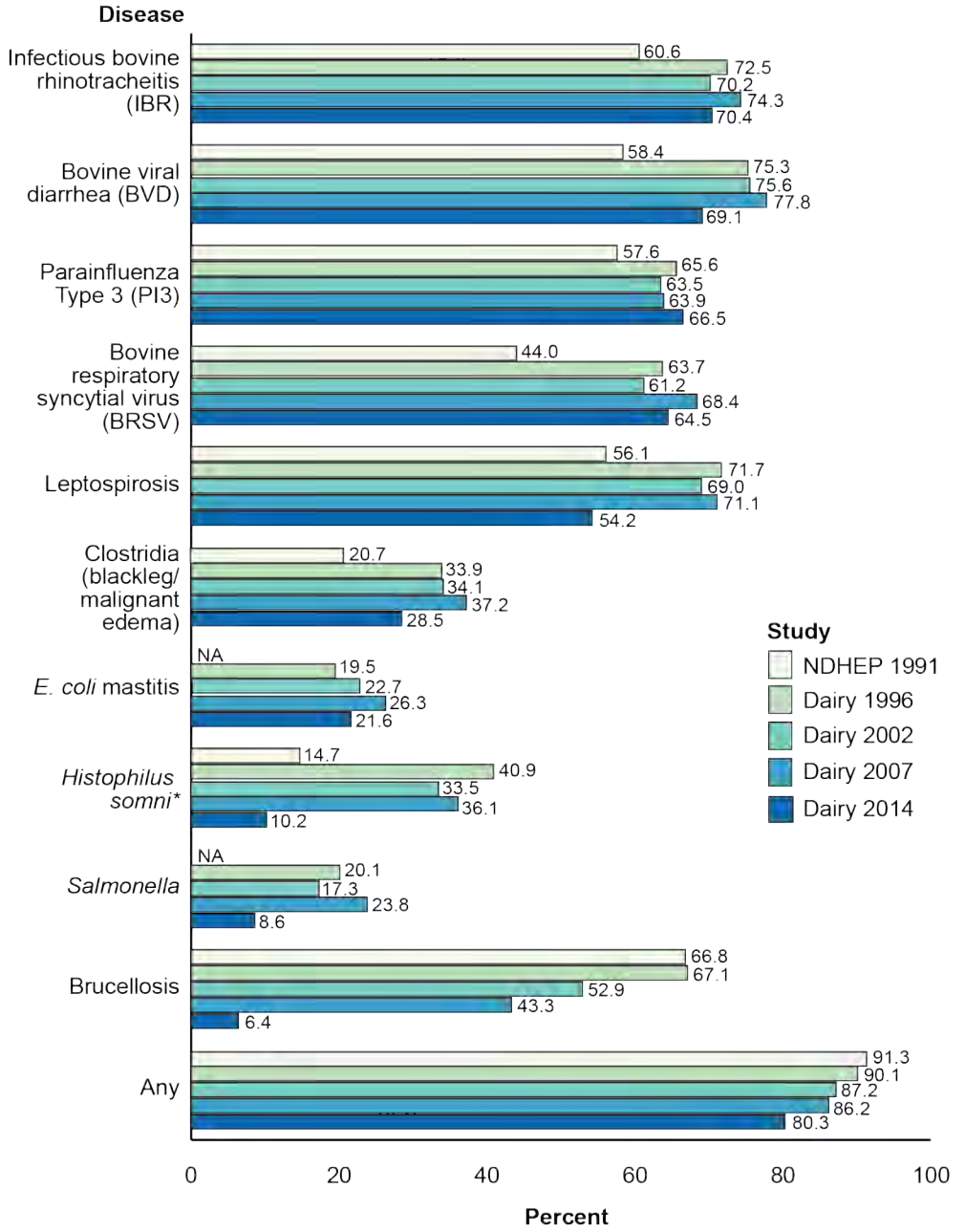
Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.
*Previously known as *Haemophilus somnus*

C.6.a. (continued) Percentage of operations that normally vaccinated preweaned, weaned, or pregnant heifers against the following diseases:

	Percent Operations									
	NDHEP 1991		Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Disease	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Salmonella			20.1	(1.0)	17.3	(1.0)	23.8	(1.2)	8.6	(0.8)
Brucellosis	66.8	(1.9)	67.1	(1.1)	52.9	(1.3)	43.3	(1.4)	6.4	(0.8)
Mycobacterium avium subspecies *paratuberculosis* (Johne's disease)			5.8	(0.6)	4.2	(0.5)	5.2	(0.6)	1.1	(0.3)
Neospora					3.6	(0.5)	7.1	(0.7)		
Other			8.1	(0.7)	7.5	(0.7)	6.8	(0.7)		
Any	91.3	(1.3)	90.1	(0.8)	87.2	(1.0)	86.2	(1.1)	80.3	(1.5)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.
*Previously known as *Haemophilus somnus*

Percentage of operations that normally vaccinated preweaned, weaned, or pregnant heifers against the following diseases



Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.
*Previously known as *Haemophilus somnus*

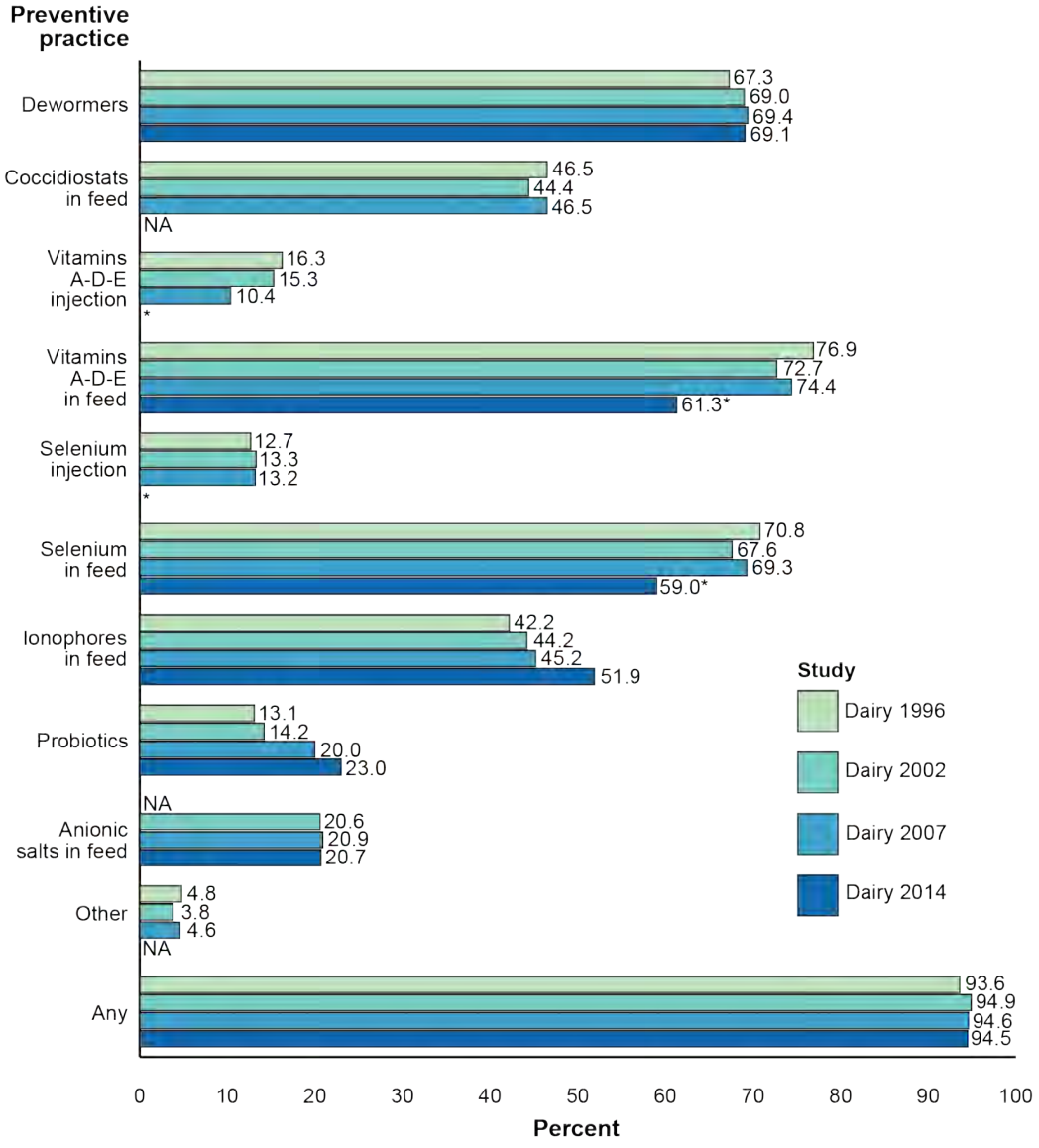
Across all study years, more than 90 percent of operations used at least one preventive practice for heifers. The percentages of operations that used any preventive practices for heifers remained consistent from 1996 to 2014. The use of ionophores increased from 42.2 percent of operations in 1996 to 51.9 percent in 2014. A higher percentage of operations used probiotics for heifers in 2007 and 2014 than in 1996 and 2002.

C.6.b. Percentage of operations by preventive practices normally used for heifers:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Preventive practice	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Dewormers	67.3	(1.3)	69.0	(1.2)	69.4	(1.3)	69.1	(1.6)
Coccidiostats in feed	46.5	(1.2)	44.4	(1.3)	46.5	(1.4)		
Vitamins A-D-E injection	16.3	(1.0)	15.3	(1.0)	10.4	(0.7)	61.3*	(1.8)
Vitamins A-D-E in feed	76.9	(1.1)	72.7	(1.2)	74.4	(1.2)		
Selenium injection	12.7	(0.8)	13.3	(0.9)	13.2	(0.9)	59.0*	(1.8)
Selenium in feed	70.8	(1.2)	67.6	(1.3)	69.3	(1.3)		
Ionophores in feed (e.g., Rumensin®, Bovatec®)	42.2	(1.2)	44.2	(1.3)	45.2	(1.4)	51.9	(1.8)
Probiotics	13.1	(0.9)	14.2	(0.9)	20.0	(1.1)	23.0	(1.5)
Anionic salts in feed			20.6	(1.1)	20.9	(1.1)	20.7	(1.4)
Other	4.8	(0.6)	3.8	(0.5)	4.6	(0.7)		
Any	93.6	(0.7)	94.9	(0.6)	94.6	(0.7)	94.5	(0.8)

Population: Operations with one or more dairy cows.
*Vitamins A-D-E injection/Vitamins A-D-E in feed were combined in 2014 as were selenium injection/selenium in feed.

Percentage of operations by preventive practices normally used for heifers



Population: Operations with 1 or more dairy cows.
*Vitamins A-D-E injection/Vitamins A-D-E in feed were combined in 2014 as was Selenium injection/Selenium in feed.

There were no changes from 2007 to 2014 in the percentage of all operations that routinely tested heifer calves for BVD. A higher percentage of large operations tested heifers for BVD compared with small and medium operations in both study years, whether or not the operations had 1 or more cows or 30 or more.

C.6.c. Percentage of operations that routinely tested heifer calves for BVD:

Percent Operations

	Dairy 2007				Dairy 2014			
Herd size (number dairy cows)	**Pct.[1]**	**Std. error**	**Pct.[2]**	**Std. error**	**Pct.[1]**	**Std. error**	**Pct.[2]**	**Std. error**
Small (fewer than 100)	1.9	(0.5)	1.8	(0.5)	1.6	(0.6)	1.0	(0.5)
Medium (100 to 499)	6.7	(1.1)	6.7	(1.1)	4.6	(1.2)	4.6	(1.2)
Large (500 or more)	21.2	(2.4)	21.2	(2.4)	26.0	(2.0)	26.0	(2.0)
All operations	4.0	(0.4)	4.2	(0.5)	4.7	(0.5)	4.9	(0.5)

Population: Operations with 1 or more dairy cows and operations with 30 or more dairy cows. Estimates from all studies were recalculated to only include operations with 30 or more dairy cows to serve as a proper reference value for future tables in this section.
[1]One or more cows.
[2]30 or more cows.

There were no changes from 2007 to 2014 in the percentage of operations by method routinely used for BVD testing.

C.6.d. For operations that routinely tested heifer calves for BVD (table C.6.c), percentage of operations by testing method used:

Percent Operations

	Dairy 2007		Dairy 2014	
Testing method	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Individual ear notch	68.6	(5.7)	48.7	(5.3)
Pooled ear notch	9.1	(3.2)	21.9	(4.3)
Individual blood sample	18.0	(5.1)	22.6	(5.8)
Pooled blood sample	3.4	(1.5)	13.5	(3.6)
Other	7.0	(2.6)	5.7	(3.6)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

D. Heifer Health

1. Calves born alive

The percentage of calves born alive decreased from 93.4 percent in 1996 to 85.9 percent in 2007 and increased to 89.8 percent in 2014. Calves born dead in the dairy industry traditionally include calves that were born alive but died within 48 hours of birth, and the 2007 and 2014 surveys were modified to include calves that died within 48 hours of birth.

D.1. Percentage of calves born alive and dead:

	Percent Calves							
	Dairy 1996[1]		Dairy 2002[1]		Dairy 2007[2]		Dairy 2014[2]	
Calf Status	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Born alive	93.4	(0.5)	88.6	(0.5)	85.9	(0.6)	89.8	(1.0)
Born dead	6.6	(0.5)	11.4	(0.5)	14.1	(0.6)	10.2	(1.0)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.
[1]As a percentage of January 1 dairy cow inventory.
[2]As a percentage of total calves born in the previous year. Born-dead estimates include calves that died within 48 hours of birth.

2. Morbidity

A higher percentage of preweaned heifers were affected with diarrhea or other digestive problems in 2007 (23.9 percent) than in 2002 (15.3 percent). There were no other differences by study year in the percentages of preweaned heifers affected with or treated for the following disease or disorders. Diarrhea or other digestive problems and respiratory disease affected approximately 20 and 10 percent of preweaned heifers, respectively.

D.2.a. Percentage of **preweaned** heifers affected with the following diseases or disorders during the previous 12 months and percentage treated with antimicrobials:

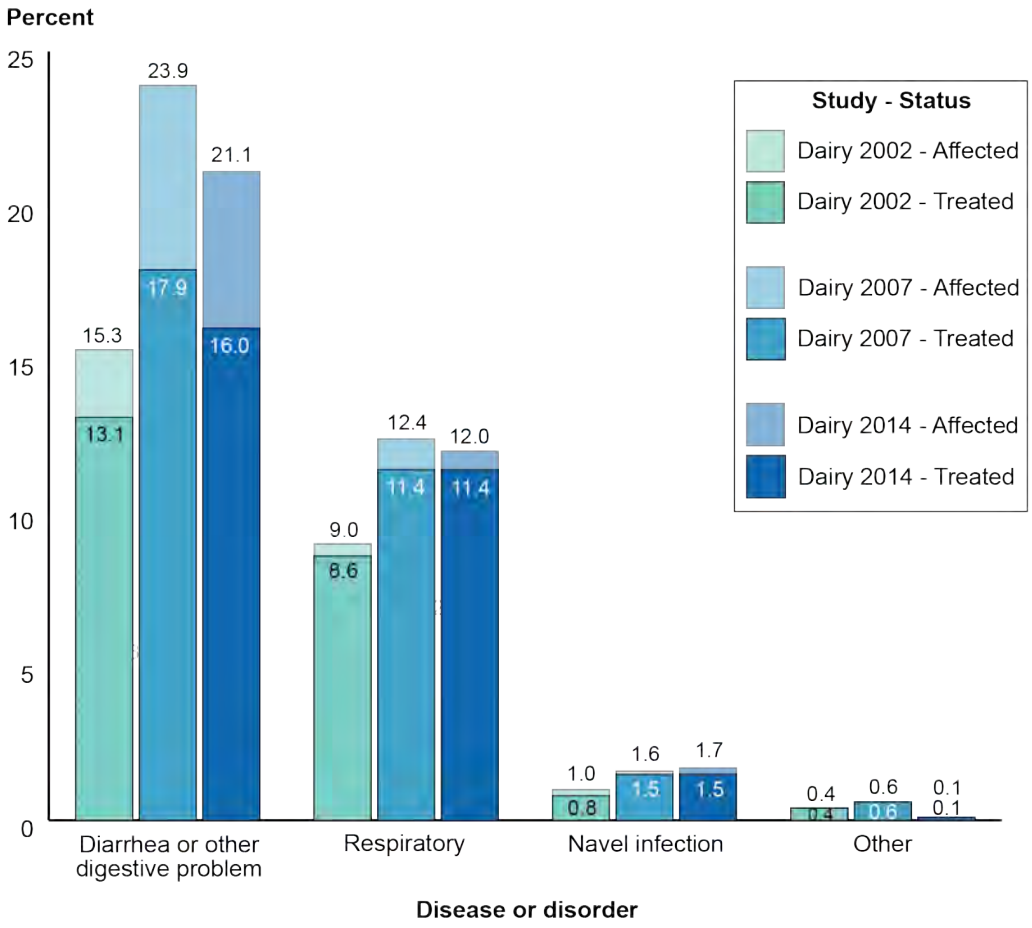
Percent Preweaned Heifers[1]

	Affected						Treated					
	Dairy 2002		Dairy 2007		Dairy 2014[2]		Dairy 2002		Dairy 2007		Dairy 2014[2]	
Disease or disorder	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Diarrhea or other digestive problem	15.3	(0.9)	23.9	(1.9)	21.1	(2.0)	13.1	(0.8)	17.9	(1.7)	16.0	(2.0)
Respiratory	9.0	(0.5)	12.4	(1.3)	12.0	(1.4)	8.6	(0.5)	11.4	(1.3)	11.4	(1.3)
Navel infection	1.0	(0.1)	1.6	(0.2)	1.7	(0.3)	0.8	(0.1)	1.5	(0.2)	1.5	(0.2)
Other	0.4	(0.1)	0.6	(0.2)	0.1	(0.1)	0.4	(0.1)	0.6	(0.2)	0.1	(0.0)

Population: Operations with 30 or more dairy cows.

[1]As a percentage of dairy heifer calves born alive.
[2]Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.

Percentage of preweaned heifers[1] affected with the following diseases or disorders during the previous 12 months and percentage treated with antimicrobials



Population: Operations with 30 or more dairy cows.
[1]As a percentage of dairy heifer calves born alive.
[2]Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.

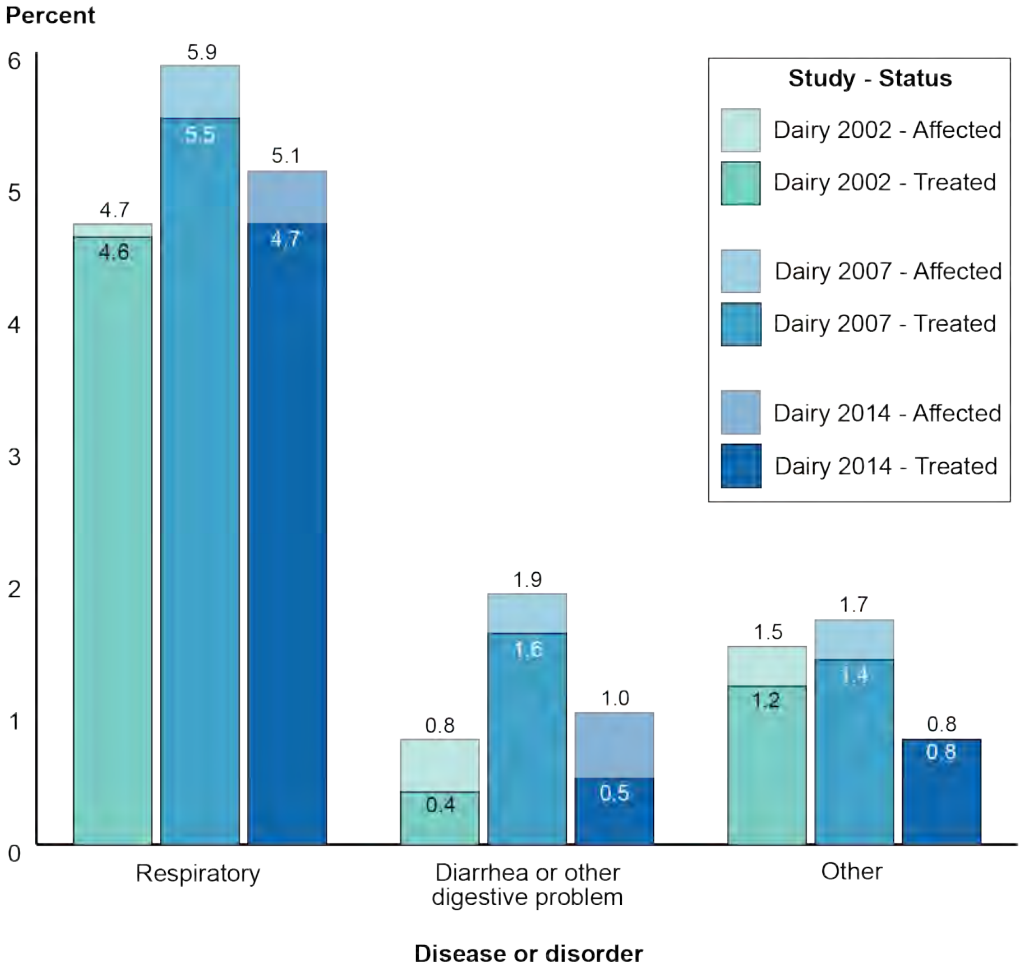
The percentages of weaned heifers affected with or treated for the disease or disorders listed in the table below remained constant from 2002 to 2014. Respiratory disease affected the highest percentage of weaned heifers, regardless of study year.

D.2.b. Percentage of **weaned** heifers affected with the following diseases or disorders during the previous 12 months and percentage treated with antimicrobials:

	Percent Weaned Heifers*											
	Affected						Treated					
	Dairy 2002		Dairy 2007		Dairy 2014		Dairy 2002		Dairy 2007		Dairy 2014	
Disease or disorder	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Respiratory	4.7	(0.3)	5.9	(0.5)	5.1	(0.6)	4.6	(0.3)	5.5	(0.5)	4.7	(0.5)
Diarrhea or other digestive problem	0.8	(0.2)	1.9	(0.7)	1.0	(0.3)	0.4	(0.2)	1.6	(0.7)	0.5	(0.3)
Other	1.5	(0.2)	1.7	(0.6)	0.8	(0.3)	1.2	(0.2)	1.4	(0.6)	0.8	(0.3)

Population: Operations with 30 or more dairy cows.
*As a percentage of weaned heifer inventory on January 1.

Percentage of weaned heifers* affected with the following diseases or disorders during the previous 12 months and percentage treated with antimicrobials



Population: Operations with 30 or more dairy cows.
*As a percentage of weaned heifer inventory on January 1.

3. Mortality

A higher percentage of operations had deaths in preweaned heifers than in weaned heifers in 1996 through 2007. A higher percentage of operations had deaths in weaned heifers in 2014 than in any other study year.

D.3.a. Percentage of operations that had any deaths in the following heifer classes:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Heifer class	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Preweaned	74.5	(1.1)	73.9	(1.3)	75.8	(1.4)	80.3	(3.8)
Weaned	45.3	(1.2)	46.1	(1.3)	45.6	(1.4)	66.6	(4.1)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

Deaths in preweaned heifer were highest in 1996 at 11.0 percent and have since decreased to 6.4 percent in 2014. Deaths in weaned heifers also decreased from 3.2 percent in 1996 and stabilized around 2.6 percent from 2002 to 2014.

D.3.b. Number of preweaned and weaned heifer deaths, as a percentage of heifers born alive:

Percent Heifers

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Heifer class	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Preweaned	11.0	(0.4)	8.6	(0.2)	7.8	(0.2)	6.4	(0.8)
Weaned	3.2	(0.1)	2.7	(0.1)	2.6	(0.1)	2.7	(0.3)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

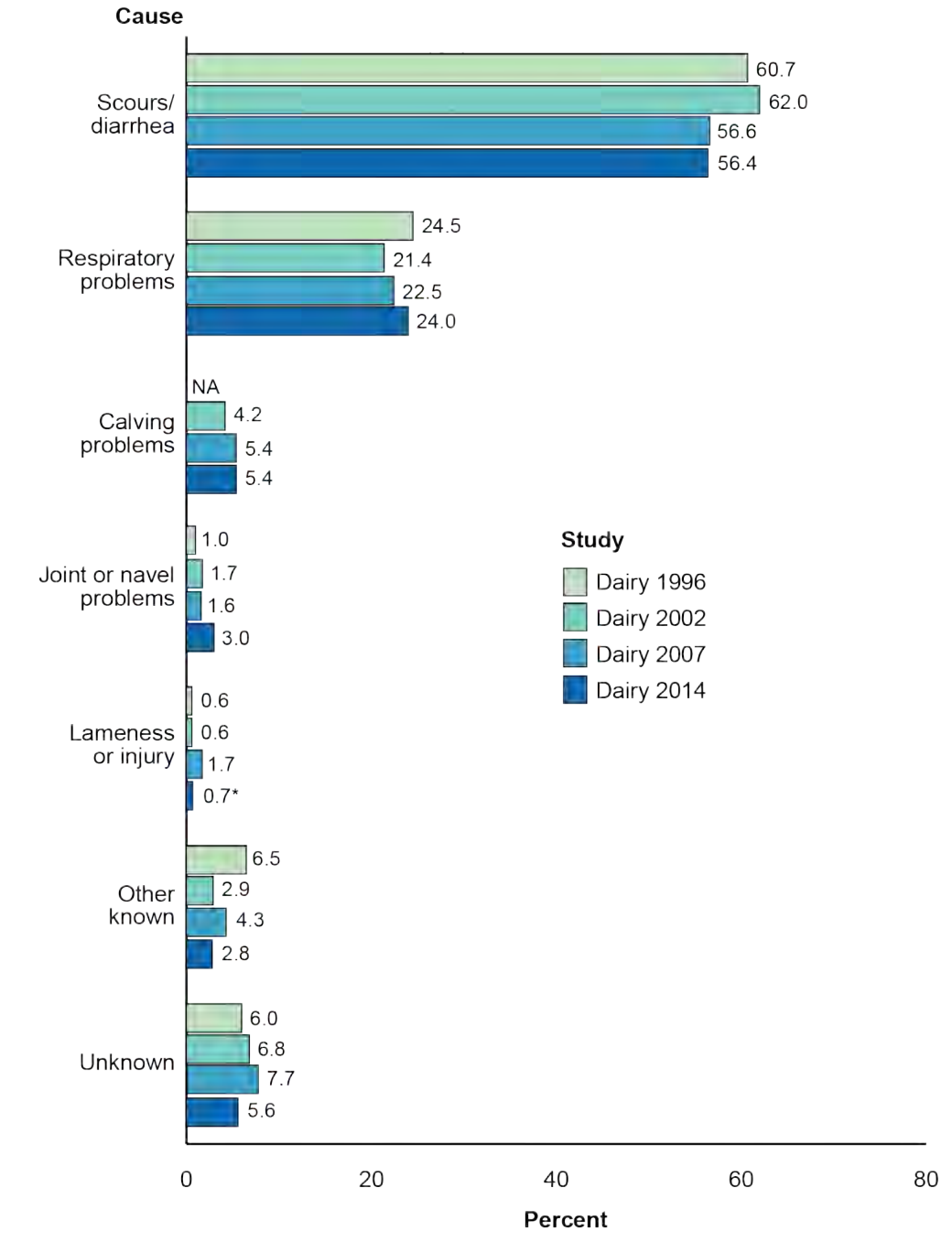
Scours/diarrhea and respiratory disease have accounted for about three-fourths of all deaths in preweaned heifers since 1996. The majority of deaths in preweaned heifers were caused by scours in all study years.

D.3.c. Percentage of deaths in **preweaned** heifers, by cause:

	Percent Heifer Deaths							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Cause	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Scours/ diarrhea	60.7	(1.2)	62.0	(1.1)	56.6	(1.3)	56.4	(3.3)
Respiratory problems	24.5	(1.0)	21.4	(0.9)	22.5	(0.9)	24.0	(2.2)
Calving problems			4.2	(0.6)	5.4	(0.7)	5.4	(1.6)
Joint or navel problems	1.0	(0.1)	1.7	(0.2)	1.6	(0.3)	3.0	(0.7)
Trauma							2.2*	(0.6)
Lameness or injury	0.6	(0.1)	0.6	(0.1)	1.7	(0.3)	0.7*	(0.2)
Lack of coordination/ severe depression	0.4	(0.1)	0.4	(0.1)	0.3	(0.1)		
Poison	0.3	(0.1)	0.1	(0.0)	0.0	(0.0)		
Other known	6.5	(1.2)	2.9	(0.4)	4.3	(0.7)	2.8	(0.8)
Unknown	6.0	(0.9)	6.8	(0.8)	7.7	(0.9)	5.6	(1.2)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.
*Question variation: In 2014, a new category, trauma, was created, and injury was removed from the lameness or injury category.

Percentage of deaths in preweaned heifers by cause



Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.
*Question variation: In 2014, a new category, trauma, was created, and injury was removed from the lameness or injury category.

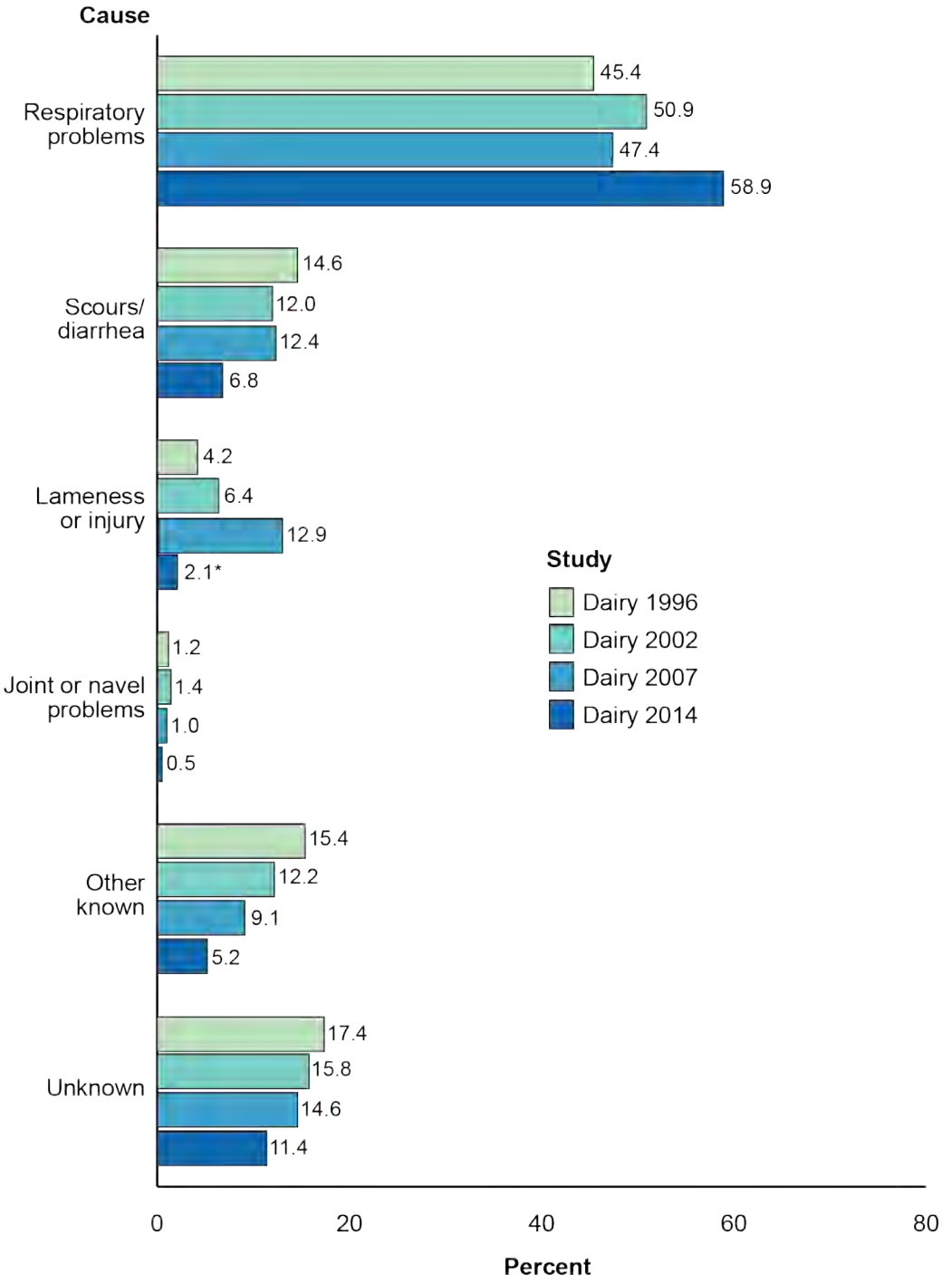
In contrast to scours/diarrhea as the primary cause of death in preweaned heifers, respiratory disease was the leading cause of death in weaned heifers across all study years and the percentage of deaths due to respiratory disease has increased since 1996. Scours/diarrhea was responsible for a lower percentage of deaths in weaned heifers in 2014 than in previous study years. Other known causes of death in weaned heifers have decreased since 1996, while the percentage of unknown deaths has remained stable over the same period.

D.3.d. Percentage of **weaned** heifer deaths, by cause:

	Percent Heifer Deaths							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Cause	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Respiratory problems	45.4	(2.2)	50.9	(1.6)	47.4	(1.8)	58.9	(4.2)
Trauma							13.5*	(1.9)
Scours/ diarrhea	14.6	(1.7)	12.0	(1.0)	12.4	(1.0)	6.8	(1.5)
Lameness or injury	4.2	(0.5)	6.4	(0.6)	12.9	(1.0)	2.1*	(0.7)
Calving problems							1.6	(0.6)
Joint or navel problems	1.2	(0.5)	1.4	(0.3)	1.0	(0.3)	0.5	(0.2)
Lack of coordination/ severe depression	0.5	(0.2)	0.3	(0.1)	0.7	(0.2)		
Poison	1.2	(0.4)	1.1	(0.4)	1.9	(0.9)		
Other known	15.4	(2.4)	12.2	(1.2)	9.1	(0.9)	5.2	(1.5)
Unknown	17.4	(1.3)	15.8	(1.1)	14.6	(1.2)	11.4	(2.3)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.
*Question variation: In 2014, a new category, trauma, was created and injury was removed from the lameness or injury category.

Percentage of deaths in weaned heifers by cause



Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.
*Question variation: In 2014, a new category, trauma, was created, and injury was removed from the lameness or injury category.

In 2007 and 2014, about 10 percent of operations with deaths in preweaned or weaned heifers performed necropsies on the heifers.

D.3.e. For operations with at least one death in preweaned or weaned heifers (table D.3.a), percentage of operations that performed any necropsies on the heifers to determine cause of death:

Percent Operations

Dairy 2007		Dairy 2014	
Pct.	Std. error	Pct.	Std. error
10.8	(0.9)	11.3	(1.9)

Population: Operations with 30 or more dairy cows.

On operations that performed necropsies, less than 5 percent of heifer deaths were necropsied to determine cause of death in 2007 and 2014.

D.3.f. For operations with at least one death in preweaned or weaned heifers, percentage of dead heifers that were necropsied to determine cause of death:

Percent Heifer Deaths Necropsied

Dairy 2007		Dairy 2014	
Pct.	Std. error	Pct.	Std. error
3.7	(0.4)	4.6	(1.3)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

4. Carcass disposal

Across all study years, the highest percentages of operations used rendering, burial, and composting to dispose of dead preweaned and weaned heifers. Composting was used to dispose of dead heifers by a higher percentage of operations in 2007 and 2014 than in 2002.

D.4. For operations with at least one death in preweaned or weaned heifers (table D.3.a), percentage of operations by primary method used to dispose of dead heifer calves:

Percent Operations

	Dairy 2002		Dairy 2007		Dairy 2014			
					Pre-weaned		Weaned	
Method of disposal	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Rendered	44.9	(1.3)	38.3	(1.3)	27.2	(3.5)	40.0	(4.4)
Buried	35.7	(1.3)	31.2	(1.4)	27.3	(4.2)	24.6	(4.6)
Composted	10.2	(0.8)	24.2	(1.2)	29.4	(3.9)	23.7	(4.0)
Left for wildlife					13.4	(3.3)	7.6	(2.6)
Burned/ incinerated	2.6	(0.4)	1.7	(0.4)	1.9	(0.8)	1.9	(0.9)
Landfill	2.1	(0.3)	1.9	(0.3)	0.6	(0.4)	1.5	(0.7)
Other	4.5	(0.6)	2.7	(0.5)	0.1	(0.1)	0.8	(0.5)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

E. Dairy Cow Management

1. Housing

Tie stalls or stanchions was the primary housing type used for lactating cows on a lower percentage of operations in 2014 (38.9 percent) than in 2007 (49.2 percent) and 2002 (52.5 percent). Freestall housing for lactating cows was used by a higher percentage of operations in 2014 than in previous study years. A higher percentage of operations used an open/dry lot to house lactating cows in 2014 than in 2007 (7.3 and 4.6 percent, respectively). A multiple-animal inside area was used by a higher percentage of operations in 2014 than in 2007 (6.4 and 3.4 percent, respectively).

E.1.a. Percentage of operations by primary housing type used for **lactating** cows:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Housing type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Individual pen, either inside or outside, heated or unheated	0.6	(0.2)	0.1	(0.1)	0.0	(—)
Tie stall or stanchion	52.5	(1.1)	49.2	(1.3)	38.9	(1.7)
Pasture			9.9	(0.8)	7.5	(1.0)
Freestall with or without access to open/dry lot	30.8	(1.0)	32.6	(1.1)	39.6	(1.5)
Open/dry lot with or without barn or shed[1]			4.6	(0.5)	7.3	(0.8)
Multiple-animal inside area/ barn	11.2	(0.8)	3.4	(0.6)	6.4	(0.9)
None/Not housed on operation	4.9[2]	(0.4)	0.0	(—)	0.3[3]	(0.2)
Other			0.2	(0.1)		
Total	100.0		100.0		100.0	

Population: Operations with one or more dairy cows.
[1]With or without shade structures.
[2]No housing structure provided, presumably on pasture.
[3]No lactating cows on the operation.

During summer, a lower percentage of operations routinely allowed lactating cows to access outside concrete alleyways or pens in 2014 (6.3 percent) than in 2007 (12.8 percent). Also in summer, a higher percentage of operations in 2014 (21.2 percent) did not allow outside access to lactating cows than in 2007 (13.1 percent).

The changes observed in the percentage of operations that allowed lactating cows outside access during summer were also observed during winter. In addition, in winter, a higher percentage of operations in 2014 allowed lactating cows access to open/dry lot or barnyard than in 2007 (42.8 and 28.9 percent, respectively).

E.1.b. Percentage of operations by primary outside area that **lactating** cows routinely had access to during the summer and winter:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Primary outside area*	Pct.	Std. error	Pct.	Std. error
Summer				
Pasture	50.9	(2.7)	50.4	(1.7)
Concrete alleyway or pen	12.8	(1.6)	6.3	(0.8)
Open/dry lot or barnyard	20.8	(2.2)	21.4	(1.3)
No outside access	13.1	(1.7)	21.2	(1.3)
Other	2.4	(0.8)	0.7	(0.2)
Total	100.0		100.0	
Winter				
Pasture	9.4	(1.5)	7.8	(0.9)
Concrete alleyway or pen	35.0	(2.8)	11.5	(1.1)
Open/dry lot or barnyard	28.9	(2.7)	42.8	(1.7)
No outside access	25.2	(2.3)	35.5	(1.6)
Other	1.5	(0.6)	2.5	(0.6)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from 2014 were recalculated to only include operations with 30 or more cows to match previous study estimates.
*Areas without permanent roof structures but may have permanent shade structure.

Pasture was used as primary housing for dry cows by a lower percentage of operations in 2014 than in 2007 (11.3 and 20.5 percent, respectively). A higher percentage of operations used freestalls (29.8 percent) or open/dry lot (29.2 percent) as primary housing for dry cows in 2014 than in 2007 (22.8 and 18.7 percent, respectively).

E.1.c. Percentage of operations by primary housing type used for **dry** (nonlactating) cows:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Housing type	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Individual pen, either inside or outside, heated or unheated	1.0	(0.3)	0.0	(—)
Tie stall or stanchion	23.3	(1.3)	18.2	(1.5)
Pasture	20.5	(1.1)	11.3	(1.1)
Freestall with or without access to open/dry lot	22.8	(1.1)	29.8	(1.5)
Open/dry lot with or without barn or shed*	18.7	(1.0)	29.2	(1.5)
Multiple-animal inside area/barn	12.9	(0.9)	11.1	(1.2)
Not housed on operation	0.2	(0.1)	0.4	(0.3)
Other	0.6	(0.2)		
Total	100.0		100.0	

Population: Operations with one or more dairy cows.
*With or without shade structures.

There were no changes from 2007 to 2014 in the percentages of operations by primary outside area that dry cows had access to in summer. In winter, a lower percentage of operations in 2014 (9.4 percent) used a concrete alleyway or pen as the primary outside area for dry cows than in 2007 (24.1 percent). A higher percentage of operations in 2014 than in 2007 (51.0 and 34.2 percent, respectively) used an open/dry lot or barnyard as the primary outside area for dry cows.

E.1.d. Percentage of operations by primary outside area that **dry** (nonlactating) cows routinely had access to during the summer and winter:

Percent Operations

	Dairy 2007		Dairy 2014	
Primary outside area*	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Summer				
Pasture	67.2	(2.5)	61.9	(1.6)
Concrete alleyway or pen	5.7	(1.1)	4.4	(0.7)
Open/dry lot or barnyard	18.5	(2.0)	22.9	(1.3)
No outside access	6.5	(1.2)	10.4	(0.9)
Other	2.1	(0.8)	0.4	(0.2)
Total	100.0		100.0	
Winter				
Pasture	18.4	(2.2)	13.3	(1.2)
Concrete alleyway or pen	24.1	(2.4)	9.4	(1.0)
Open/dry lot or barnyard	34.2	(2.7)	51.0	(1.7)
No outside access	18.5	(2.1)	24.4	(1.5)
Other	4.8	(1.3)	2.0	(0.5)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from 2014 were recalculated to only include operations with 30 or more cows to match previous study estimates.
*Areas without permanent roof structures but may have permanent shade structure.

Maternity housing was used by a higher percentage of operations in 2007 and 2014 than in 1996 and 2002, and these changes were mainly due to the increased adoption of maternity housing on small operations.

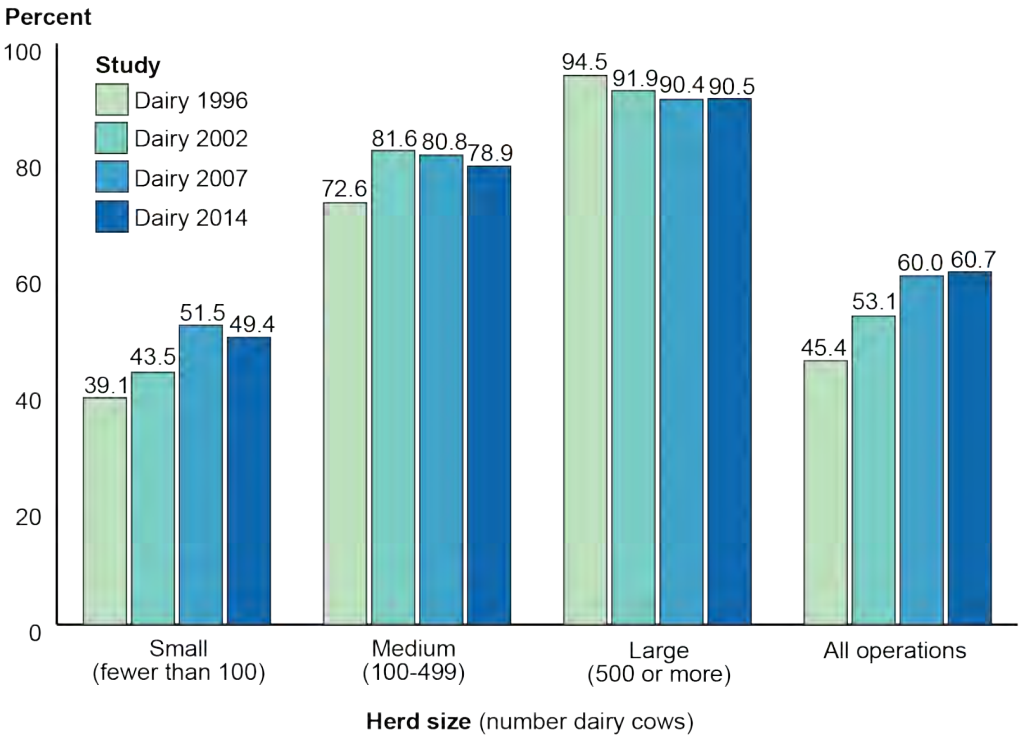
E.1.e. Percentage of operations in which housing for maternity cows was separate from housing for lactating cows, by herd size:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (fewer than 100)	39.1	(1.3)	43.5	(1.6)	51.5	(1.7)	49.4	(2.4)
Medium (100 to 499)	72.6	(2.1)	81.6	(1.7)	80.8	(1.8)	78.9	(2.4)
Large (500 or more)	94.5	(1.8)	91.9	(1.5)	90.4	(2.0)	90.5	(1.5)
All operations	45.4	(1.2)	53.1	(1.3)	60.0	(1.3)	60.7	(1.7)

Population: Operations with one or more dairy cows.

Percentage of operations in which housing for maternity cows was separate from housing used for lactating cows, by herd size



Population: Operations with 1 or more dairy cows.

The percentage of all operations that separated close-up dry cows from other dry cows decreased from 63.9 percent in 2002 to 52.8 percent in 2014. The same trend was also seen in each herd size category. The percentage of operations that separated close-up cows from other dry cows increased as herd size increased during each study year.

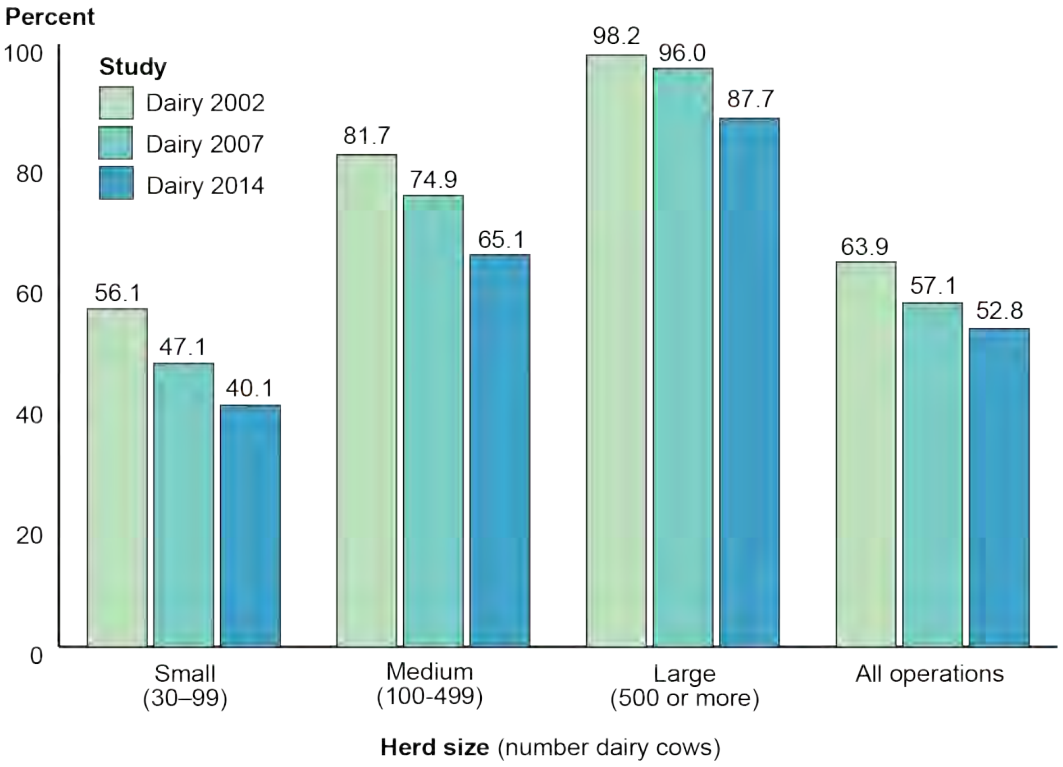
E.1.f. Percentage of operations that separated close-up cows from other dry cows, by herd size:

Percent Operations

Herd size (number dairy cows)	**Dairy 2002**		**Dairy 2007**		**Dairy 2014**	
	Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30 to 99)	56.1	(2.8)	47.1	(3.9)	40.1	(2.5)
Medium (100 to 499)	81.7	(2.3)	74.9	(3.7)	65.1	(2.7)
Large (500 or more)	98.2	(1.2)	96.0	(2.1)	87.7	(1.8)
All operations	63.9	(2.1)	57.1	(2.9)	52.8	(1.7)

Population: Operations with 30 or more dairy cows. Estimates from 2014 were recalculated to only include operations with 30 or more cows to match previous study estimates.

Percentage of operations that separated close-up cows from other dry cows, by herd size



Population: Operations with 30 or more dairy cows. Estimates from 2014 were recalculated to only include operations with 30 or more cows to match previous study estimates.

The percentage of operations that provided any cooling method for lactating cows during summer increased from 94.0 percent in 2007 to 98.7 percent in 2014.

A higher percentage of operations provided dry cows with sprinklers or misters in 2014 than in 2007 (10.7 and 4.6 percent, respectively). Similarly, fans were provided to dry cows on a higher percentage of operations in 2014 (49.7 percent) than in 2007 (36.0 percent). As was observed with lactating cows, a higher percentage of operations provided any cooling methods to dry cows in 2014 compared with 2007 (94.8 and 77.5 percent, respectively).

E.1.g. Percentage of operations by cooling method used for lactating cows and dry cows during summer:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Cow cooling method	Pct.	Std. error	Pct.	Std. error
Lactating cows				
Covered structure/building (e.g., barn, shed)			82.6	(1.3)
Shade (other than covered structure/building)	44.5	(2.8)	42.0	(1.7)
Sprinklers or misters	20.3	(1.9)	25.2	(1.3)
Fans	74.3	(2.4)	75.7	(1.5)
Tunnel ventilation	22.9	(2.6)	19.8	(1.5)
Other	5.0	(1.3)	1.8	(0.5)
Any	94.0	(1.1)	98.7	(0.4)
Dry cows				
Covered structure/building (e.g., barn, shed)			72.5	(1.5)
Shade (other than covered structure/building)	55.4	(2.7)	51.8	(1.8)
Sprinklers or misters	4.6	(1.2)	10.7	(0.8)
Fans	36.0	(2.8)	49.7	(1.7)
Tunnel ventilation	8.7	(1.9)	10.9	(1.2)
Other	5.6	(1.5)	1.2	(0.4)
Any	77.5	(2.2)	94.8	(0.7)

Population: Operations with 30 or more dairy cows.

2. Bedding type

Straw and/or hay was the bedding type used for lactating cows during the previous 90 days by the highest percentage of operations across all study years, although its use has decreased since 1996. Sand was used for bedding in the previous 90 days by 26.0 percent of operations in 2014 compared with 11.2 percent in 1996. Composted/ dried manure was used as bedding on a higher percentage of operations in 2014 than in previous study years. The percentages of operations that used mattresses, shredded newspaper, or 'other' bedding during the previous 90 days decreased from 2007 to 2014.

The highest percentage of lactating cows (37.7 percent) were bedded with composted/ dried manure during the previous 90 days in 2014, and its use has more than tripled since 1996 (9.0 percent of lactating cows). Sand as bedding was also used for a large percentage of cows (34.6 percent) in 2014, and its use more than doubled since 1996 (15.3 percent of cows). From 2007 to 2014, a lower percentage of cows were bedded on sawdust (31.2 and 20.6 percent, respectively) or mattresses (20.1 and 12.7 percent, respectively).

E.2.a. Percentage of operations (and percentage of cows on these operations) by type of bedding used for **lactating** cows during the previous 90 days:

	Percent Operations								Percent Cows[1]							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014[2]		Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014[2]	
Bedding type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Straw and/or hay	66.9	(1.5)	54.0	(2.0)	54.1	(2.7)	47.1	(1.7)	47.7	(1.5)	35.6	(1.5)	33.4	(2.8)	27.3	(1.6)
Sawdust/ wood products	27.9	(1.5)	35.0	(1.9)	35.0	(2.6)	34.1	(1.6)	27.3	(1.3)	32.1	(1.5)	31.2	(2.8)	20.6	(1.4)
Sand	11.2	(1.0)	18.1	(1.5)	21.9	(2.0)	26.0	(1.4)	15.3	(1.3)	21.3	(1.6)	30.3	(2.6)	34.6	(1.8)
Rubber mats	27.0	(1.6)	25.8	(2.0)	30.2	(2.7)	23.5	(1.6)	18.8	(1.2)	15.0	(1.2)	18.5	(2.1)	12.5	(1.3)
Mattresses	4.7	(0.6)	17.4	(1.5)	23.7	(2.4)	15.9	(1.3)	7.0	(0.8)	18.1	(1.2)	20.1	(1.9)	12.7	(1.1)
Corn cobs and stalks	12.8	(1.3)	10.5	(1.4)	11.0	(1.9)	11.4	(1.2)	10.1	(1.1)	6.6	(0.8)	5.7	(1.0)	6.3	(1.0)
Composted/ dried manure[3]	2.4	(0.4)	2.3	(0.4)	3.9	(0.5)	8.1	(0.6)	9.0	(1.4)	12.7	(1.5)	24.2	(2.6)	37.7	(1.8)

Population: Operations with 30 or more dairy cows.

[1]As a percentage of January 1 dairy cow inventory.
[2]Question variation: In 2014 asked about bedding used during 2013 rather than in previous 90 days.
[3]Question variation: In 1996 and 2002, dried manure was not an option but composted manure was an option.

E.2.a. (continued) Percentage of operations (and percentage of cows on these operations) by type of bedding used for **lactating** cows during the previous 90 days:

	Percent Operations								Percent Cows[1]							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014[2]		Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014[2]	
Bedding type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Waterbeds					1.7	(0.8)	2.1	(0.5)					2.3	(1.0)	2.4	(0.5)
Shredded newspaper	6.7	(0.9)	7.9	(1.2)	5.2	(1.2)	2.1	(0.6)	5.7	(0.7)	5.4	(0.7)	3.1	(0.7)	1.0	(0.3)
Rubber tires	1.0	(0.3)	1.3	(0.4)	1.6	(0.6)			1.6	(0.5)	1.7	(0.4)	1.1	(0.4)		
Shells/hulls			1.8	(0.4)							5.9	(1.1)				
Other	3.7	(0.8)	5.0	(1.0)	11.7	(1.9)	3.8	(0.6)	4.8	(1.0)	6.8	(1.1)	13.3	(2.5)	8.4	(1.2)
Any	95.2	(0.5)	93.2	(0.8)	97.0	(0.8)	97.6	(0.4)	87.5	(1.3)	85.8	(1.6)	94.9	(1.9)	97.9	(0.5)

Population: Operations with 30 or more dairy cows.

[1]As a percentage of January 1 dairy cow inventory.

[2]Question variation: In 2014 asked about bedding used during 2013 rather than in previous 90 days.

[3]Question variation: In 1996 and 2002, dried manure was not an option but composted manure was an option.

The only change observed in primary bedding type for lactating cows during the previous 90 days was that a higher percentage of operations used rubber mats in 2014 than in 2007 (6.1 and 1.6 percent, respectively).

E.2.b. Percentage of operations and percentage of cows on these operations by **primary** bedding type used for **lactating** cows during the previous 90 days:

	Percent Operations				Percent Cows[1]			
	Dairy 2007		Dairy 2014[2]		Dairy 2007		Dairy 2014[2]	
Primary bedding type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Straw and/or hay	36.2	(2.8)	29.7	(1.6)	19.9	(2.5)	13.7	(1.1)
Sand	17.5	(1.9)	21.9	(1.3)	24.4	(2.6)	30.1	(1.7)
Sawdust/wood products	20.5	(2.2)	21.9	(1.4)	15.5	(1.6)	11.3	(0.8)
Rubber mats	1.6	(0.7)	6.1	(0.9)	0.8	(0.4)	2.1	(0.4)
Composted/dried manure	3.7	(0.5)	5.9	(0.4)	23.6	(2.6)	32.6	(1.8)
Mattresses	5.5	(1.6)	5.0	(0.8)	2.5	(0.7)	2.8	(0.4)
Corn cobs and stalks	2.6	(1.0)	3.7	(0.7)	1.1	(0.4)	1.3	(0.3)
Waterbeds	0.5	(0.4)	1.0	(0.3)	1.1	(0.8)	1.0	(0.3)
Shredded newspaper	0.9	(0.4)	0.2	(0.1)	0.5	(0.2)	0.1	(0.1)
Rubber tires	0.0	(—)			0.0	(—)		
Other	8.0	(1.6)	1.6	(0.4)	5.4	(1.2)	2.4	(0.7)
None	3.1	(0.8)	3.0	(0.5)	5.1	(1.9)	2.6	(0.5)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
[1]As a percentage of January 1 dairy cow inventory.
[2]Question variation – 2014 asked about bedding used during 2013 rather than in previous 90 days.

A higher percentage of operations in 2014 (7.7 percent) used composted/dried manure to bed dry cows during the previous 90 days compared with operations 2007 (4.8 percent).

A higher percentage of dry cows in 2014 (35.7 percent) were bedded with composted/dried manure during the previous 90 days than in 2007 (23.5 percent). The percentage of dry cows bedded on sand increased from 19.0 percent in 2007 to 26.3 percent in 2014. Alternatively, the percentage of dry cows bedded with sawdust/wood products and straw decreased from 28.2 percent in 2007 to 16.7 percent in 2014.

E.2.c. Percentage of operations and percentage of cows on these operations by type of bedding used for **dry** cows during the previous 90 days:

	Percent Operations				Percent Cows[1]			
	Dairy 2007		Dairy 2014[2]		Dairy 2007		Dairy 2014[2]	
Bedding type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Composted/dried manure	4.8	(0.8)	7.7	(0.6)	23.5	(2.9)	35.7	(1.8)
Corn cobs and stalks	18.5	(2.2)	23.9	(1.4)	10.7	(1.3)	12.6	(1.1)
Mattresses	10.6	(1.8)	7.6	(1.0)	9.5	(1.4)	6.8	(0.9)
Rubber mats	15.2	(2.2)	11.6	(1.2)	11.8	(2.3)	6.7	(1.1)
Rubber tires	1.0	(0.5)			0.7	(0.3)		
Sand	14.4	(1.7)	17.3	(1.2)	19.0	(2.0)	26.3	(1.6)
Sawdust/wood products	25.2	(2.3)	23.7	(1.5)	28.2	(2.6)	16.7	(1.3)
Shredded newspaper	3.6	(1.1)	1.6	(0.5)	2.5	(0.8)	1.1	(0.3)
Straw and/or hay	62.2	(2.7)	54.2	(1.7)	47.2	(3.2)	35.3	(1.8)
Waterbeds	0.3	(0.3)	0.7	(0.3)	0.4	(0.3)	0.8	(0.3)
Other	9.5	(1.7)	3.1	(0.6)	12.4	(2.5)	7.4	(1.2)
Any	92.5	(1.4)	94.6	(0.7)	92.7	(1.9)	94.7	(0.8)

Population: Operations with 30 or more dairy cows.
[1]As a percentage of January 1 dairy cow inventory.
[2]Question variation – 2014 asked about bedding used during 2013 rather than in previous 90 days.

A higher percentage of operations in 2014 than in 2007 primarily used corn cobs and stalks as bedding for dry cows during the previous 90 days (15.6 and 8.6 percent, respectively).

In 2014, a lower percentage of dry cows were bedded primarily on sawdust/wood products during the previous 90 days than in 2007 (7.6 and 14.4 percent of dry cows, respectively).

E.2.d. Percentage of operations and percentage of cows on these operations by **primary** bedding type used for **dry** cows during the previous 90 days:

	Percent Operations				Percent Cows[1]			
	Dairy 2007		Dairy 2014[2]		Dairy 2007		Dairy 2014[2]	
Primary bedding type	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Composted/ dried manure	3.7	(0.6)	5.7	(0.4)	22.0	(2.9)	29.9	(1.7)
Corn cobs and stalks	8.6	(1.5)	15.6	(1.2)	4.8	(0.8)	7.7	(1.0)
Mattresses	3.5	(1.4)	2.3	(0.6)	1.6	(0.5)	1.5	(0.3)
Rubber mats	2.1	(0.9)	3.2	(0.7)	1.7	(0.8)	1.2	(0.4)
Rubber tires	0.0	(—)			0.0	(—)		
Sand	12.2	(1.6)	14.6	(1.1)	16.2	(1.9)	22.2	(1.5)
Sawdust/wood products	14.7	(1.9)	12.7	(1.2)	14.4	(2.1)	7.6	(0.7)
Shredded newspaper	1.0	(0.7)	0.1	(0.1)	0.4	(0.2)	0.0	(0.0)
Straw and/or hay	39.8	(2.8)	37.9	(1.7)	25.3	(2.4)	20.2	(1.4)
Waterbeds	0.3	(0.3)	0.4	(0.2)	0.3	(0.3)	0.4	(0.2)
Other	6.4	(1.5)	0.9	(0.3)	6.0	(1.6)	1.9	(0.7)
None	7.5	(1.4)	6.6	(0.7)	7.3	(1.9)	7.4	(1.2)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
[1]As a percentage of January 1 dairy cow inventory.
[2]Question variation – 2014 asked about bedding used during 2013 rather than in previous 90 days.

3. Flooring type

The percentage of operations that used grooved or textured concrete as their predominate flooring type for lactating cows increased from 34.3 percent in 2007 to 47.9 percent in 2014. The percentage of operations that used smooth concrete flooring decreased from 41.6 percent in 1996 to 11.5 percent in 2014. The percentage of operations that used rubber mats over concrete as their predominate flooring type increased from 2002 to 2007 (10.8 and 22.9 percent, respectively).

The most pronounced changes in the percentage of lactating cows by predominant flooring type occurred from 1996 to 2002. During this period, the percentage of cows predominately on smooth or textured concrete decreased and the percentage of cows predominately on dirt increased. There were no changes in the percentages of cows by predominant flooring type from 2007 to 2014.

E.3.a. Percentage of operations and percentage of cows on these operations by predominant flooring type that lactating cows stood or walked on when not being milked:

	Percent Operations				Percent Cows*			
	Dairy 1996	Dairy 2002	Dairy 2007	Dairy 2014	Dairy 1996	Dairy 2002	Dairy 2007	Dairy 2014
Flooring type	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)
Concrete–grooved	27.2 (1.4)	31.1 (1.7)	34.3 (2.4)	47.9 (1.7)	39.3 (1.7)	45.7 (1.9)	48.7 (3.5)	55.9 (1.8)
Concrete–textured	16.2 (1.4)	5.7 (1.0)			17.2 (1.7)	4.0 (0.7)		
Concrete–slat	0.8 (0.3)	1.0 (0.3)	1.3 (0.5)	2.2 (0.5)	1.6 (0.7)	1.7 (0.5)	1.1 (0.5)	1.5 (0.3)
Concrete–smooth	41.6 (1.8)	26.3 (2.0)	15.5 (2.3)	11.5 (1.2)	26.7 (1.4)	12.6 (1.0)	5.8 (0.8)	3.8 (0.5)
Rubber mats over concrete		10.8 (1.4)	22.9 (2.5)	21.0 (1.5)		6.9 (1.0)	13.9 (2.2)	10.1 (1.0)
Pasture	6.9 (1.0)	12.4 (1.3)	10.1 (1.7)	7.6 (1.0)	4.6 (0.6)	7.8 (0.8)	5.1 (0.9)	2.8 (0.4)
Dirt	5.8 (0.8)	7.1 (1.0)	5.4 (1.1)	8.1 (0.8)	9.6 (1.0)	18.0 (1.8)	20.0 (3.5)	24.2 (1.8)
Other	1.5 (0.4)	5.6 (1.0)	10.5 (1.8)	1.6 (0.5)	1.0 (0.3)	3.3 (0.7)	5.4 (1.1)	1.7 (0.9)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Population: Operations with 30 or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

A higher percentage of operations in 2014 than in 2007 used concrete or rubber mats over concrete as their predominant flooring type (82.6 and 74.0 percent, respectively).

E.3.b. Percentage of operations in which concrete or rubber mats over concrete was the predominant flooring type:

Percent Operations

Dairy 2007		Dairy 2014	
Pct.	**Std. error**	**Pct.**	**Std. error**
74.0	(2.4)	82.6	(1.3)

Population: Operations with 30 or more dairy cows.

The percentage of operations that used rubber belting or similar flooring in cow areas to reduce cows' time on concrete did not change from 2007 to 2014.

E.3.c. For operations in which concrete or rubber mats over concrete was the predominant flooring type used for cows (table E.3.b), percentage of operations that had rubber belting or similar flooring, by location of rubber belting:

Percent Operations

	Dairy 2007		Dairy 2014	
Area	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Adjacent to feed bunk	11.9	(2.3)	6.8	(0.8)
Freestall alleyways			6.5	(0.9)
Walkway to parlor	6.2	(1.4)	7.1	(0.8)
Holding pen	8.1	(1.9)	7.7	(0.9)
Other	7.5	(1.7)	10.4	(1.3)

Population: Operations with 30 or more dairy cows.

4. Surface moisture

Most changes in the percentage of operations by surface moisture of the ground or flooring that lactating cows stood on most the time in the summer and winter occurred from 1996 to 2002. The percentage of operations in which the ground or flooring surface was usually dry in summer and winter decreased from 1996 to 2002, while the percentage of operations in which the ground or flooring surface was almost always wet during summer and winter increased from 1996 to 2002.

E.4. Percentage of operations by category that best characterized the surface moisture of the ground or flooring that lactating cows stood on most of the time, and by season:

Percent Operations

	Season							
	Summer				Winter			
	Dairy 1996	Dairy 2002	Dairy 2007	Dairy 2014	Dairy 1996	Dairy 2002	Dairy 2007	Dairy 2014
Surface moisture	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error
Usually dry	71.0 (1.6)	63.3 (2.0)	60.3 (2.7)	65.4 (1.5)	58.9 (1.5)	49.7 (2.1)	49.5 (2.6)	54.2 (1.6)
Wet about half the time	20.9 (1.5)	22.2 (1.8)	22.8 (2.4)	19.3 (1.3)	22.9 (1.4)	26.0 (1.8)	21.8 (2.2)	24.5 (1.4)
Almost always wet, but no standing water	7.8 (0.8)	13.3 (1.2)	16.3 (1.7)	15.0 (1.0)	16.9 (1.0)	23.1 (1.5)	28.1 (2.1)	21.1 (1.2)
Usually standing water or slurry	0.3 (0.1)	1.2 (0.5)	0.6 (0.3)	0.2 (0.1)	1.3 (0.3)	1.2 (0.4)	0.6 (0.3)	0.3 (0.1)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Population: Operations with 30 or more dairy cows.

5. Nutrition

From 2007 to 2014, the percentages of operations that fed clover as forage or pasture, brewery byproducts, and green chop during the previous 90 days increased. The percentage of operations that fed whole soybeans/soybean meal or fat/tallow decreased during the same period.

E.5.a. Percentage of operations by type of feedstuff fed to lactating cows during the previous 90 days:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014[1]	
Feedstuff	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Alfalfa hay/haylage	72.3	(1.6)	93.8	(1.0)	92.3	(1.6)	92.0	(0.9)
Corn silage	77.4	(1.5)	81.6	(1.7)	87.6	(1.8)	89.4	(1.1)
Clover as forage or pasture	31.2	(1.7)	22.5	(1.9)	23.1	(2.4)	38.7	(1.7)
Whole cottonseed	28.7	(1.5)	37.8	(2.0)	33.0	(2.5)	27.0	(1.4)
Cottonseed meal or hulls	9.0	(0.9)	7.9	(1.0)	9.3	(1.5)		
Whole soybeans or soybean meal	80.0	(1.3)	83.6	(1.5)	84.4	(2.1)	76.9	(1.4)
Bakery byproducts	6.4	(0.8)	5.5	(0.8)	6.6	(1.0)	5.6	(0.8)
Brewery byproducts	28.6	(1.6)	30.6	(1.9)	37.1	(2.7)	46.0	(1.7)
Corn			95.8	(0.7)	94.2	(1.4)	90.3	(1.0)
Barley			12.8	(1.2)	14.1	(1.9)	15.0	(1.2)
Wheat (not silage)			6.7	(1.0)	6.7	(1.1)	9.0	(0.9)
Oats (not silage)			22.3	(2.0)	17.5	(2.4)	22.7	(1.5)
Green chop			3.9	(1.0)	4.9	(1.4)	13.5	(1.2)
Feather/poultry meal			3.0	(0.7)	3.2	(0.7)	1.1	(0.3)
Fish meal			4.9	(0.7)	4.4	(0.9)	2.9	(0.5)
Fat/tallow	25.3	(1.5)	20.0	(1.6)	32.7	(2.5)	20.1	(1.3)
Porcine meat and bone meal	21.8[2]	(1.4)			8.3	(1.3)	6.0	(0.7)
Blood meal					13.2	(1.7)	10.6	(0.9)

Population: Operations with 30 or more dairy cows.
[1]Question variation 2014: Fed to lactating or dry cows during 2013 rather than previous 90 days.
[2]Question variation 1996: “Meat and bone meal or blood meal.”

The only change observed in the percentage of operations by person primarily responsible for balancing rations fed to cows was that a higher percentage of operations used an independent nutritionist in 2014 than in 2007 (24.5 and 19.2 percent, respectively).

E.5.b. Percentage of operations by person primarily responsible for balancing rations fed to dairy cows:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Person primarily responsible	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Employee (not a veterinarian)	2.6	(0.5)	3.0	(0.5)
Independent nutritionist	19.2	(1.1)	24.5	(1.4)
Feed company nutritionist	44.9	(1.4)	42.0	(1.7)
Veterinarian	1.2	(0.3)	1.0	(0.3)
Operator/owner	31.7	(1.4)	29.6	(1.6)
Other	0.4	(0.2)	0.1	(0.1)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from 2014 were recalculated to only include operations with 30 or more cows to match previous study estimates.

A higher percentage of small, medium, and all operations fed a total mixed ration in 2002, 2007, and 2014 than in 1996. A higher percentage of medium and large than small operations fed a total mixed ration.

E.5.c. Percentage of operations that fed a total mixed ration, by herd size:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (fewer than 100)	28.2	(1.3)	36.6	(1.6)	37.8	(1.6)	38.2	(2.3)
Medium (100 to 499)	68.8	(2.0)	78.3	(1.7)	84.7	(1.7)	88.0	(1.8)
Large (500 or more)	84.1	(3.0)	90.2	(1.7)	94.1	(1.4)	89.1	(1.2)
All operations	35.6	(1.1)	47.0	(1.3)	51.1	(1.3)	55.5	(1.7)

Population: Operations with one or more dairy cows.

A higher percentage of operations that produced a rolling herd average (RHA) of 16,000 to 19,999 lb of milk fed a total mixed ration in 2002 and 2007 than in 1996. For herds that produced an RHA of 20,000 lb or more of milk, a higher percentage fed a total mixed ration in 2014 than in 1996 and 2002.

E.5.d. Percentage of operations that fed a total mixed ration, by RHA milk production:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
RHA milk production (pounds)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 16,000	28.9	(2.0)	25.4	(2.3)	23.5	(2.4)	24.8	(3.6)
16,000 to 19,999	33.2	(1.7)	45.0	(2.2)	42.7	(2.3)	43.6	(3.7)
20,000 or more	55.4	(2.5)	65.7	(2.1)	70.7	(1.9)	76.1	(2.1)

Population: Operations with one or more dairy cows.

Forage test results were used to balance feed rations on a higher percentage of medium operations in 2014 than in 1996 and 2002. Similarly, forage test results were used on a higher percentage of all operations in 2007 and 2014 than in 1996.

E.5.e. Percentage of operations that used forage test results to balance feed rations, by herd size:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (fewer than 100)	64.1	(1.4)	66.1	(1.6)	70.1	(1.7)	64.3	(2.3)
Medium (100 to 499)	84.8	(1.3)	87.1	(1.3)	89.9	(1.4)	93.5	(1.2)
Large (500 or more)	89.2	(2.7)	88.8	(1.8)	90.7	(1.8)	87.8	(1.2)
All operations	67.8	(1.2)	71.2	(1.2)	75.5	(1.2)	73.8	(1.6)

Population: Operations with one or more dairy cows.

The percentage of operations that routinely used milk urea nitrogen (MUN) increased each study year: 9.3 percent in 2002, 30.9 percent in 2007, and 48.2 percent in 2014. Subsequently, the percentage of operations that never used MUN testing decreased: 77.7 percent in 2002, 50.2 percent in 2007, and 35.8 percent in 2014.

E.5.f. Percentage of operations by use of milk urea nitrogen (MUN) testing to determine ration composition:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Frequency	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Use routinely	9.3	(1.0)	30.9	(2.4)	48.2	(1.7)
Use only if have a problem	13.0	(1.3)	18.9	(2.2)	15.9	(1.3)
Never used	77.7	(1.6)	50.2	(2.7)	35.8	(1.7)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.

A higher percentage of operations in 2014 than in 2007 used head locks/fence-line stanchion feed line (26.2 and 13.2 percent, respectively).

E.5.g. Percentage of operations by feed line used for the majority of lactating cows:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Feed line	Pct.	Std. error	Pct.	Std. error
Head locks/fence-line stanchion	13.2	(1.3)	26.2	(1.3)
Tie stall	34.1	(2.8)	31.1	(1.6)
Stanchion	10.7	(1.9)	10.4	(1.2)
Post and rail	18.0	(1.9)	15.1	(1.1)
Elevated feed bunk in pen	17.3	(2.0)	13.6	(1.2)
Other	6.7	(1.3)	3.7	(0.6)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

The percentage of operations that fed all lactating cows the same ration increased from 59.1 percent in 2002 to 66.9 percent in 2014. The percentage of operations that fed individuals or groups based on production/stage of lactation decreased from 38.2 percent in 2002 to 28.6 percent in 2014.

E.5.h. Percentage of operations by feeding practice used for the majority of lactating cows:

Percent Operations

	Dairy 2002		Dairy 2007		Dairy 2014	
Feeding practice	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Feed all lactating cows the same ration	59.1	(2.2)	62.3	(2.7)	66.9	(1.6)
Feed individuals or groups based on production/stage of lactation	38.2	(2.2)	35.6	(2.7)	28.6	(1.6)
Feed individuals or groups based on lactation number			1.6	(0.6)	4.4	(0.6)
Feed individuals or groups based on criteria other than production/ stage of lactation or lactation number	2.7	(0.4)	0.5	(0.3)	0.1	(0.1)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.

The percentage of operations that fed close-up cows anionic salts to prevent milk fever increased from 19.1 percent in 2002 to 28.1 percent in 2014. Similarly, the percentage of operations that fed springing heifers anionic salts to prevent milk fever increased from 14.3 percent 2002 to 19.9 percent in 2014.

E.5.i. Percentage of operations that fed anionic salts (e.g., BioChlor, SoyChlor, ammonium chloride, etc.) to prevent milk fever, by cattle class:

Percent Operations

	Dairy 2002		Dairy 2007		Dairy 2014[1]	
Cattle class	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Close-up cows[2]	19.1	(1.4)	22.9	(2.2)	28.1	(1.5)
Springing heifers[3]	14.3	(1.2)	15.7	(1.9)	19.9	(1.4)

Population: Operations with 30 or more dairy cows. Estimates from 2014 were recalculated to only include operations with 30 or more cows to match previous study estimates.
[1]In 2014, question asked about dairy cows and dairy heifers instead of close up cows and springing heifers.
[2]Cows 2 to 4 weeks prior to calving.
[3]Heifers 2 to 4 weeks prior to calving.

6. Water source

A water tank or trough was used as a water source for any cows by the highest percent of operations in 2014 (84.1 percent); however, this percentage is down from the 93.2 percent of operations in 2007 that used a water tank or trough as a source of drinking water. A single cup/bowl waterer used by only one cow was used by a lower percentage of operations in 2002 and 2007 (10.7 and 11.4 percent, respectively) than in 1996 (52.5 percent). A lake, pond, stream, river, etc. was used by 23.1 percent of operations in 2014, a substantial decrease from previous study years.

E.6.a. Percentage of operations by source of drinking water for any cows during the previous 12 months:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Water source	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Water tank or trough (covered or uncovered)	77.9	(1.5)	89.1	(1.4)	93.2	(1.5)	84.1	(1.4)
Single cup/bowl waterer used by one cow only	52.5	(1.6)	10.7	(1.4)	11.4	(2.0)	54.8	(1.5)
Single cup/bowl waterer used by multiple cows	50.0	(1.8)	61.7	(1.8)	64.1	(2.4)		
Lake, pond, stream, river, etc.	37.1	(1.7)	35.1	(2.0)	33.4	(2.7)	23.1	(1.5)
Other source	1.1	(0.4)	2.1	(0.7)	3.9	(1.3)	1.5	(0.5)

Population: Operations with 30 or more dairy cows.

In 2014, a higher percentage of operations drained and cleaned water tanks or troughs an average of 13 or more times per year than operations in previous study years. Conversely, a lower percentage of operations in 2014 than in previous study years drained and cleaned water tanks or troughs an average of four or fewer times.

E.6.b. For operations with a water tank or trough (table E.6.a), percentage of operations by average number of times per year the water tank or trough was drained and cleaned:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Average Number times/year	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0	8.4	(1.2)	6.3	(1.1)	4.6	(1.4)	3.2	(0.7)
1 to 4	51.7	(2.1)	46.5	(2.3)	37.1	(3.2)	28.5	(1.8)
5 to 12	26.2	(1.9)	22.3	(1.9)	24.1	(2.8)	23.8	(1.7)
13 or more	13.6	(1.4)	25.0	(1.9)	34.2	(2.8)	44.5	(1.9)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.

7. Vaccination and other preventive practices

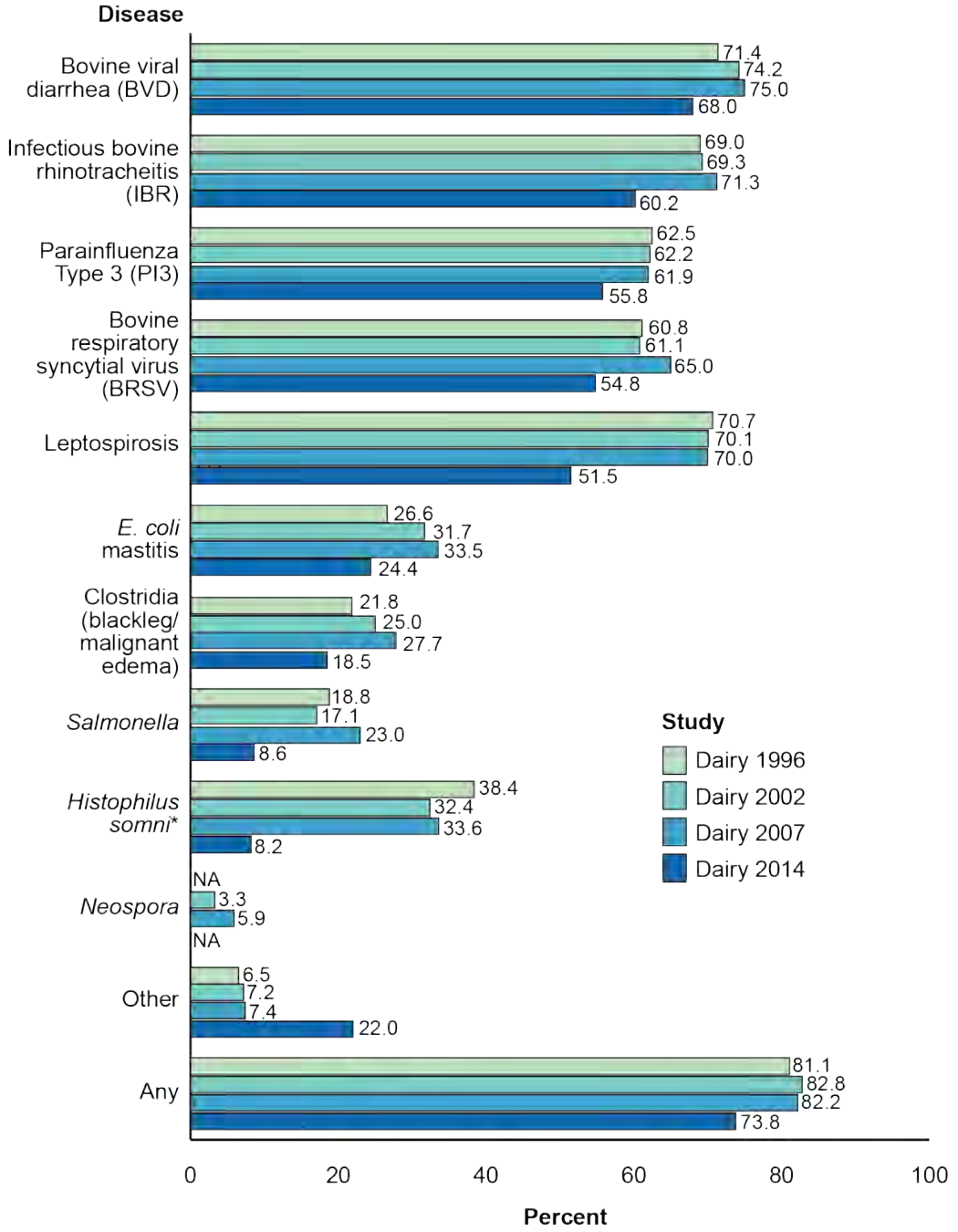
Overall, compared with previous study years, the percentages of operations that normally vaccinated cows against the diseases in the following table have decreased, with the exception of Parainfluenza Type 3.

E.7.a. Percentage of operations that normally vaccinated cows against the following diseases:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Disease	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Bovine viral diarrhea (BVD)	71.4	(1.3)	74.2	(1.2)	75.0	(1.3)	68.0	(1.8)
Infectious bovine rhinotracheitis (IBR)	69.0	(1.3)	69.3	(1.3)	71.3	(1.3)	60.2	(1.8)
Parainfluenza Type 3 (PI3)	62.5	(1.3)	62.2	(1.3)	61.9	(1.4)	55.8	(1.8)
Bovine respiratory syncytial virus (BRSV)	60.8	(1.3)	61.1	(1.3)	65.0	(1.4)	54.8	(1.8)
Leptospirosis	70.7	(1.3)	70.1	(1.3)	70.0	(1.3)	51.5	(1.8)
E. coli mastitis	26.6	(1.1)	31.7	(1.2)	33.5	(1.2)	24.4	(1.3)
Clostridia (blackleg/ malignant edema)	21.8	(1.0)	25.0	(1.1)	27.7	(1.2)	18.5	(1.1)
Salmonella	18.8	(1.0)	17.1	(1.0)	23.0	(1.1)	8.6	(0.8)
*Histophilus somni**	38.4	(1.3)	32.4	(1.2)	33.6	(1.3)	8.2	(0.9)
Neospora			3.3	(0.4)	5.9	(0.6)		
Other	6.5	(0.6)	7.2	(0.6)	7.4	(0.7)	22.0	(1.5)
Any	81.1	(1.1)	82.8	(1.1)	82.2	(1.1)	73.8	(1.7)

Population: Operations with one or more dairy cows.
*Previously known as *Haemophilus somnus*

Percentage of operations that normally vaccinated cows against the following diseases



Population: Operations with 1 or more dairy cows.
*Previously known as *Haemophilus somnus*

The percentage of operations that gave cows annual BVD booster injections was similar in all study years.

E.7.b. For operations that gave cows BVD vaccinations (table E.7.a), percentage of operations that gave annual BVD booster injections:

Percent Operations

Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
77.4	(1.3)	82.9	(1.2)	80.2	(1.3)	76.2	(1.8)

Population: Operations with one or more dairy cows.

The percentage of operations that used any preventive practices for cows increased slightly in 2002 but remained constant thereafter. Additionally, the use of dewormers and probiotics have increased since 1996, while the use of ionophores in feed increased from 2007 to 2014 (26.8 percent and 37.0 percent, respectively). The use of propylene glycol as an energy source increased from 20.1 percent of operations in 2002 to 43.8 percent in 2014. The percentages of operations that administered or fed vitamin A-D-E or selenium decreased in 2014 compared with previous study years. Anionic salts, used for the prevention of hypocalcemia, were used by a similar percentage of operations from 2002 to 2014.

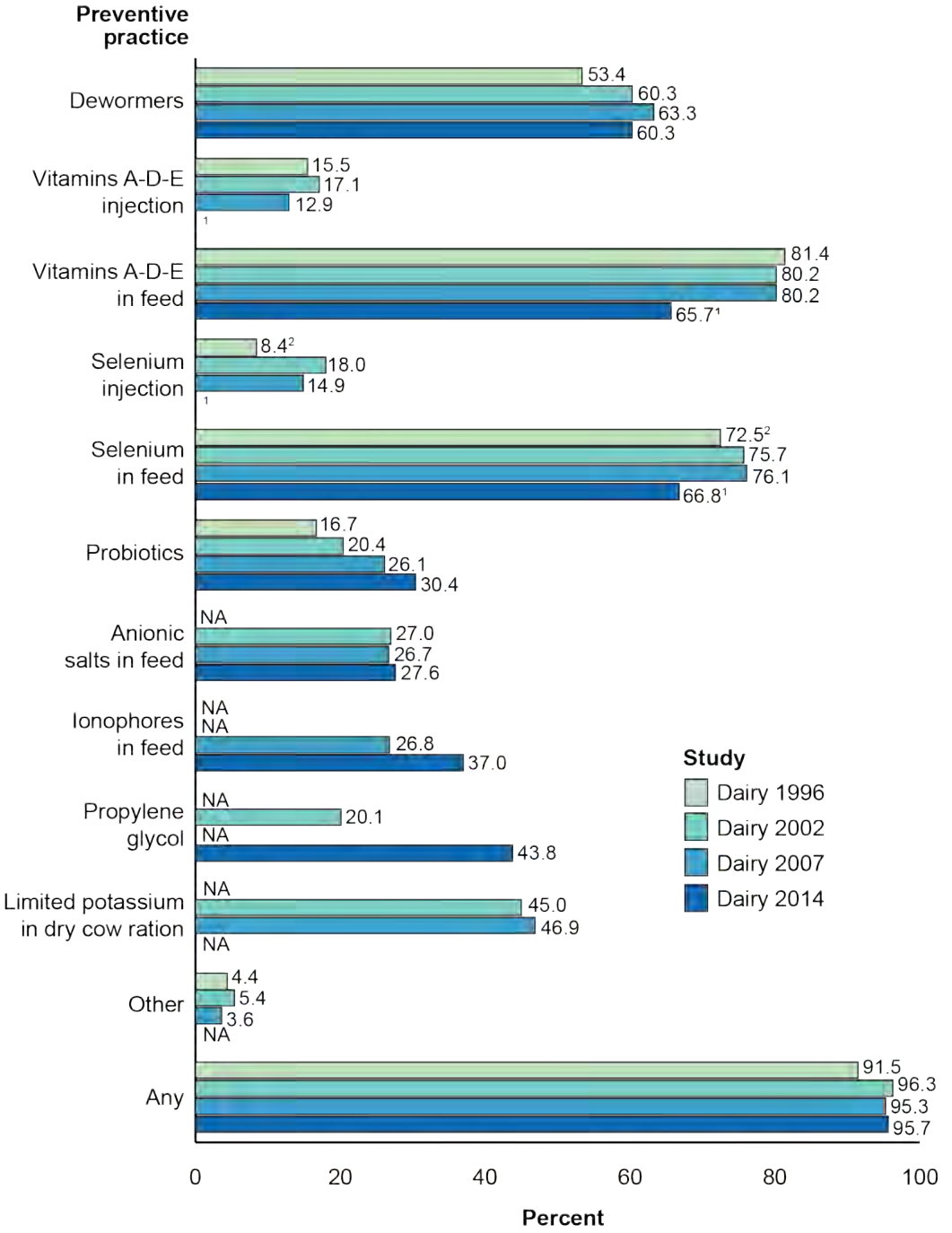
Note: Estimates in the following table regarding the use of anionic salts differed from table E.5.i. because a more specific question was asked for the table E.5.i, and the reference populations for the two tables differ: 1 or more cows for the table below versus 30 or more cows for table E.5.i.

E.7.c. Percentage of operations by preventive practices normally used for cows:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Preventive practice	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Dewormers	53.4	(1.3)	60.3	(1.3)	63.3	(1.4)	60.3	(1.7)
Vitamins A-D-E injection	15.5	(0.9)	17.1	(1.0)	12.9	(0.8)	65.7[1]	(1.7)
Vitamins A-D-E in feed	81.4	(1.1)	80.2	(1.1)	80.2	(1.2)		
Selenium injection	8.4[2]	(0.6)	18.0	(1.0)	14.9	(0.9)	66.8[1]	(1.7)
Selenium in feed	72.5[2]	(1.2)	75.7	(1.1)	76.1	(1.2)		
Probiotics	16.7	(0.9)	20.4	(1.0)	26.1	(1.2)	30.4	(1.6)
Anionic salts in feed			27.0	(1.2)	26.7	(1.2)	27.6	(1.5)
Ionophores in feed					26.8	(1.1)	37.0	(1.6)
Propylene glycol			20.1	(1.1)			43.8	(1.7)
Limited potassium in dry cow ration			45.0	(1.3)	46.9	(1.4)		
Other	4.4	(0.5)	5.4	(0.6)	3.6	(0.6)		
Any	91.5	(0.8)	96.3	(0.6)	95.3	(0.7)	95.7	(0.7)

Population: Operations with one or more dairy cows.
[1]Vitamins A-D-E injection/Vitamins A-D-E in feed were combined in 2014 as were Selenium injection/Selenium in feed.
[2]Lactating cows only.

Percentage of operations by preventive practices normally used for cows



Population: Operations with 1 or more dairy cows.
[1]Vitamins A-D-E injection/Vitamins A-D-E in feed were combined in 2014 as was Selenium injection/ Selenium in feed.
[2]Lactating cows only.

8. Adverse reactions to injections

There were no differences in 2007 and 2014 in the percentage of operations that had at least one cow experience an adverse drug reaction to any injection.

E.8.a. Percentage of operations in which at least one cow experienced an adverse drug reaction to any injection:

Percent Operations

Dairy 2007		Dairy 2014	
Pct.	Std. error	Pct.	Std. error
13.5	(0.9)	9.9	(1.0)

Population: Operations with 30 or more dairy cows.

There were no differences in 2007 and 2014 in the percentages of operations by clinical signs observed when a cow had an adverse drug reaction. More than three-fourths of operations that had a cow with an adverse drug reaction observed a lump or swelling at the injection site.

E.8.b. For operations in which at least one cow experienced an adverse reaction to any injection (table E.8.a), percentage of operations by the following clinical signs observed during reaction:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Clinical Sign	Pct.	Std. error	Pct.	Std. error
Lump or swelling in the location of injection	76.2	(3.0)	76.2	(4.1)
Decrease in milk production	33.3	(3.4)	23.6	(4.5)
Collapse	19.8	(2.8)	17.8	(3.5)
Hives	13.7	(2.3)	17.3	(3.9)
Respiratory distress	6.5	(1.7)	16.7	(3.8)
Abortion	13.7	(2.2)	14.6	(3.3)
Fever	11.4	(2.4)	12.3	(3.5)
Lethargy	10.2	(2.2)	9.4	(3.0)
Product didn’t work as expected (lack of efficacy)	5.8	(1.8)	7.1	(2.4)
Infertility	4.9	(1.5)	1.9	(1.0)
Other	6.5	(1.6)	3.0	(1.3)

Population: Operations with 30 or more dairy cows.

There were no differences from 2007 to 2014 in the percentages of operations that reported an adverse drug reaction to the entities in the following table. About one-half of operations in 2007 and 2014 reported an adverse reaction to a veterinarian.

E.8.c. For operations in which at least one cow had an adverse reaction to any injection (table E.8.a), percentage of operations that reported adverse reactions to the following entities:

Percent Operations

	Dairy 2007		Dairy 2014	
Entities	**Pct.**	**Std. error**	**Pct.**	**Std. error**
A veterinarian	48.9	(3.6)	52.3	(5.3)
The drug manufacturer	4.2	(1.2)	4.9	(1.5)
FDA's Center for Veterinary Medicine	0.0	(—)	0.5	(0.3)
USDA's Center for Veterinary Biologics	0.0	(—)	0.3	(0.2)
Other	0.3	(0.3)	0.6	(0.5)
Any	49.4	(3.6)	52.8	(5.3)

Population: Operations with 30 or more dairy cows.

In 2007 and 2014, about one-third of operations had a veterinarian examine at least one cow with an adverse reaction.

E.8.d. For operations in which at least one cow had an adverse reaction to any injection (table E.8.a), percentage of operations that had the cow(s) examined by a veterinarian:

Percent Operations

Dairy 2007		Dairy 2014	
Pct.	**Std. error**	**Pct.**	**Std. error**
31.3	(3.4)	35.3	(5.0)

Population: Operations with 30 or more dairy cows.

9. Recombinant bovine somatotropin (rbST)

In general, the percentage of operations that administered rbST to cows increased from 1996 to 2002. Compared with 2002, a similar percentage of small, medium and all operations administered rbST to cows in 2007. A lower percentage of operations administered rbST in 2014 than in 2007. During each study year, the percentage of operations that used of rbST increased as herd size increased.

E.9.a. Percentage of operations that used rbST in cows during the current lactation (at the time of interview), by herd size:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (fewer than 100)	6.5	(0.6)	8.8	(0.8)	9.1	(0.9)	5.2	(1.0)
Medium (100 to 499)	21.0	(1.7)	32.2	(1.9)	28.8	(2.0)	14.0	(1.8)
Large (500 or more)	38.7	(3.9)	54.4	(2.6)	42.7	(2.5)	28.6	(1.9)
All operations	9.4	(0.6)	15.2	(0.8)	15.2	(0.8)	9.7	(0.8)

Population: Operations with one or more dairy cows.

The percentage of cows that were administered rbST increased from 1996 to 2002. A lower percentage of cows on medium operations received rbST in 2014 than in 2007 (10.4 and 17.7 percent, respectively).

E.9.b. Percentage of cows milked on January 1 and administered rbST during the current lactation (at the time of interview), by herd size:

Percent Cows

	Dairy 1996*		Dairy 2002		Dairy 2007		Dairy 2014*	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (fewer than 100)	3.7	(0.4)	6.2	(0.7)	6.2	(0.7)	3.2	(0.8)
Medium (100 to 499)	13.2	(1.3)	24.5	(1.5)	17.7	(1.4)	10.4	(1.7)
Large (500 or more)	17.9	(2.3)	34.1	(1.8)	22.6	(1.5)	18.7	(1.6)
All operations	10.1	(0.7)	22.3	(0.8)	17.2	(0.8)	14.7	(1.1)

Population: Operations with one or more dairy cows.
*Question variation: In 1996 and 2014, questionnaire asked about all cows in January 1 inventory, not just those milked.

F. Cow Health

1. Morbidity

NOTE: All health problems are producer reported and may or may not have relied on a diagnosis by a veterinarian or laboratory testing.

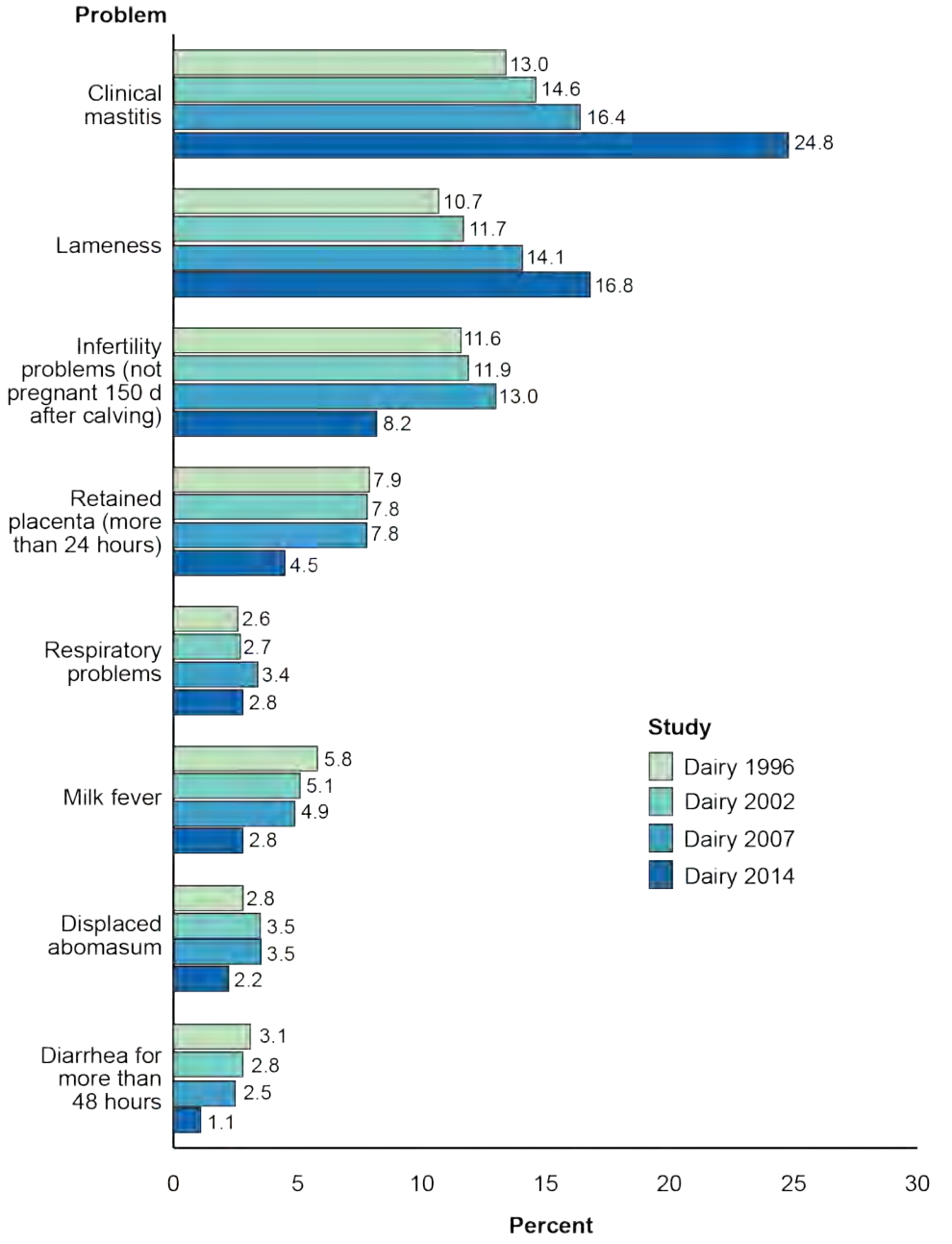
With the exception of cows with clinical mastitis or lameness, a lower percentage of cows experienced health problems in 2014 than in the previous study years. The percentage of cows with clinical mastitis increased from 13.0 percent in 1996 to 24.8 percent in 2014, which could be partially explained by an increase in operations performing forestripping of cows prior to milking since 2002 (table J.5.a). The percentage of cows with lameness gradually increased from 10.7 percent in 1996 to 16.8 percent in 2014. Lower percentages of cows had infertility problems, retained placenta, milk fever, displaced abomasum, and diarrhea for more than 48 hours in 2014 than in 2002 and 2007.

F.1.a. Percentage of cows by health problem(s):

	Percent Cows*							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Problem	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Clinical mastitis	13.0	(0.3)	14.6	(0.3)	16.4	(0.5)	24.8	(2.4)
Lameness	10.7	(0.3)	11.7	(0.3)	14.1	(0.4)	16.8	(1.6)
Infertility problems (not pregnant 150 days after calving)	11.6	(0.3)	11.9	(0.3)	13.0	(0.3)	8.2	(0.5)
Retained placenta (more than 24 hours)	7.9	(0.2)	7.8	(0.2)	7.8	(0.2)	4.5	(0.4)
Respiratory problems	2.6	(0.1)	2.7	(0.1)	3.4	(0.2)	2.8	(0.5)
Milk fever	5.8	(0.1)	5.1	(0.1)	4.9	(0.1)	2.8	(0.2)
Displaced abomasum	2.8	(0.1)	3.5	(0.1)	3.5	(0.1)	2.2	(0.2)
Diarrhea for more than 48 hours	3.1	(0.2)	2.8	(0.2)	2.5	(0.2)	1.1	(0.3)

Population: Operations with 30 or more dairy cows.
Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.
*As a percentage of January 1 dairy cow inventory.

Percentage of cows* by health problem(s)



Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.
*As a percentage of January 1 dairy cow inventory.

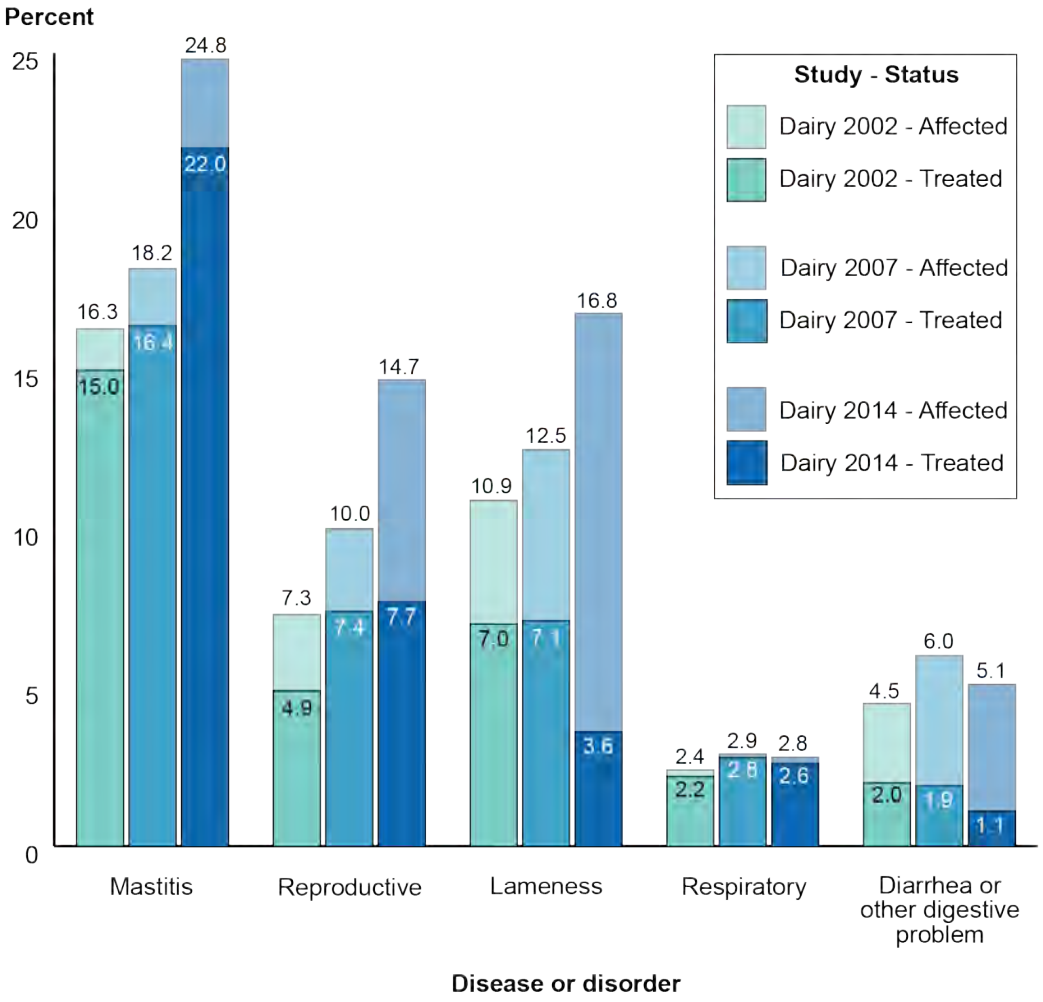
The percentages of cows affected with mastitis, reproductive disease, or lameness increased from 2002 to 2014. The percentages of cows treated for mastitis or reproductive disease increased from 2002 to 2014. Interestingly the percentage of cows treated for lameness decreased from 7.0 percent in 2002 to 3.6 percent in 2014.

F.1.b. Percentage of cows affected with the following diseases or disorders during the previous 12 months and percentage treated with antimicrobials:

	Percent Cows*											
	Affected						Treated					
	Dairy 2002		Dairy 2007		Dairy 2014		Dairy 2002		Dairy 2007		Dairy 2014	
Disease or disorder	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Mastitis	16.3	(0.7)	18.2	(0.9)	24.8	(2.4)	15.0	(0.7)	16.4	(0.8)	22.0	(2.4)
Reproductive	7.3	(0.4)	10.0	(0.7)	14.7	(1.7)	4.9	(0.3)	7.4	(0.7)	7.7	(1.0)
Lameness	10.9	(0.7)	12.5	(0.9)	16.8	(1.6)	7.0	(0.6)	7.1	(0.7)	3.6	(0.4)
Respiratory	2.4	(0.2)	2.9	(0.2)	2.8	(0.5)	2.2	(0.1)	2.8	(0.2)	2.6	(0.5)
Diarrhea or other digestive problem	4.5	(0.3)	6.0	(0.6)	5.1	(0.6)	2.0	(0.2)	1.9	(0.2)	1.1	(0.3)
Other	0.6	(0.1)	0.7	(0.2)	0.7	(0.4)	0.2	(0.1)	0.5	(0.1)	0.5	(0.4)

Population: Operations with 30 or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

Percentage of cows* affected with the following diseases or disorders during the previous 12 months and percentage treated with antimicrobials



Population: Operations with 30 or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

2. Permanently removed cows

Almost all operations in 2007 and 2014 permanently removed cows from the operation, excluding cows that died.

F.2.a. Percentage of operations that permanently removed any cows from the operation (excluding cows that died):

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Population: Operations with…	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
One or more dairy cows	97.0	(0.6)	100.0	(0.0)	97.0	(0.6)	94.6	(1.0)
30 or more dairy cows	98.7	(0.3)	100.0	(—)	99.1	(0.2)	98.8	(0.4)

A higher percentage of cows on all operations were permanently removed in 2014 than in any previous study year. This increase was due to a higher percentage of cows being removed from large operations in 2014, as the percentage of cows removed from small and medium operations were similar in 2007 and 2014.

F.2.b. Percentage of cows permanently removed from the operation (excluding cows that died), as a percentage of January 1 inventory, by herd size:

	Percent Cows							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (fewer than 100)	23.9	(0.7)	24.9	(0.6)	24.1	(0.6)	25.9	(0.8)
Medium (100 to 499)	21.6	(0.4)	23.9	(0.5)	23.7	(0.5)	26.3	(0.9)
Large (500 or more)	27.4	(0.8)	27.5	(0.6)	23.4	(0.7)	29.7	(0.7)
All operations	24.0	(0.4)	25.5	(0.3)	23.6	(0.4)	28.4	(0.5)

Population: Operations with one or more dairy cows.

The percentage estimates for permanently removed cows on operations with 30 or more cows are similar to the percentage estimates for cows on operations with one or more cows (table F.2.b)

F.2.c. Percentage of cows permanently removed from the operation (excluding cows that died), as a percentage of January 1 inventory, by herd size:

	Percent Cows							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (fewer than 100)	23.5	(0.7)	24.5	(0.6)	23.7	(0.5)	25.4	(0.7)
Medium (100 to 499)	21.6	(0.4)	23.9	(0.5)	23.7	(0.5)	26.3	(0.9)
Large (500 or more)	27.4	(0.8)	27.5	(0.6)	23.4	(0.7)	29.7	(0.7)
All operations	23.9	(0.4)	25.4	(0.3)	23.5	(0.4)	28.4	(0.5)

Population: Operations with 30 or more dairy cows. Estimates from all studies were recalculated to only include operations with 30 or more dairy cows to serve as a proper reference value for future tables in this section.

Note: In the Dairy 2014 questionnaire, the list of reasons for removing cows was greatly expanded compared with the lists in previous studies' questionnaires. For comparison purposes, reasons for removing cows listed in the Dairy 2014 study questionnaire but not in the questionnaires of the previous studies were combined into the "other diseases" category. Therefore, caution should be taken when comparing 2014 estimates on removing cows to estimates in the other study years.

Reproductive problems were one of the most common reasons cows were permanently removed, accounting for about one-quarter of cows removed in each study year. The percentages of cows removed due to udder or mastitis problems or lameness or injury decreased from 2007 to 2014. The percentage of cows removed due to "other diseases" was likely higher in 2014, due to the expanded number of categories that were queried and ultimately collapsed into the "other diseases" category.

F.2.d. For cows permanently removed from the operation (excluding cows that died) [table F.2.c], percentage of cows removed, by producer reported reason:

	Percent Cows Removed							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Producer reported reason for removal	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Reproductive problems	25.7	(0.8)	25.2	(0.5)	26.5	(0.7)	26.4	(2.5)
Poor production not related to other listed reasons	21.4	(0.8)	18.4	(0.7)	16.2	(0.7)	21.1	(2.6)
Udder or mastitis problems	25.8	(0.6)	25.4	(0.5)	23.1	(0.6)	16.5	(1.4)
Lameness or injury	14.8	(0.6)	15.6	(0.4)	16.2	(0.4)	10.1	(1.0)
Sold as replacements to another dairy	4.3	(1.1)	5.4	(0.6)	5.4	(0.7)	9.5	(3.5)
Other diseases	3.7	(0.3)	5.7	(0.2)	3.8	(0.2)	8.5	(1.0)
Aggressiveness or belligerence	0.9	(0.1)	0.9	(0.1)	0.7	(0.1)	2.0	(1.5)
Other reasons	3.4	(0.3)	3.6	(0.4)	8.2	(1.1)	5.9	(1.5)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

About one-half of permanently removed cows were removed at 200 days or more in milk from 2002 to 2014.

F.2.e. For cows permanently removed from the operation (excluding cows that died) [table F.2.c], percentage of permanently removed cows by stage of lactation:

	Percent Cows Removed					
	Dairy 2002		Dairy 2007		Dairy 2014	
Lactation stage	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Fewer than 50 days in milk (early lactation)	15.6	(0.5)	16.2	(1.1)	20.1	(3.0)
50 to 199 days in milk (mid lactation)	24.1	(0.7)	22.6	(1.3)	24.0	(1.0)
200 days or more in milk (late lactation)	60.3	(0.9)	58.0	(1.8)	49.3	(3.8)
Dry cows			3.2	(0.4)	6.7	(3.1)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.

More than half of permanently removed cows were in the 2nd to 4th lactation at the time of removal during both study years.

F.2.f. For cows permanently removed from the operation (excluding cows that died) [table F.2.c], percentage of permanently removed cows by lactation category:

	Percent Cows Removed			
	Dairy 2007		Dairy 2014	
Lactation category	Pct.	Std. error	Pct.	Std. error
First	16.9	(1.1)	22.2	(3.0)
2 to 4	58.5	(1.4)	51.9	(3.1)
5 or more	24.6	(1.4)	25.9	(1.7)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

The percentages of permanently removed cows sent to market, auction or stockyards decreased in 2014 compared with 2007 (58.3 and 76.5 percent, respectively). Although the percentage of cows sent directly to a slaughter plant was much higher in 2014 than in 2007 (33.5 and 17.5 percent, respectively), the large standard error in 2014 estimate render the difference insignificant (confidence intervals overlap).

F.2.g. For cows permanently removed from the operation (excluding cows that died) [table F.2.c], percentage of permanently removed cows by destination:

	Percent Cows Removed							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Destination	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Sent to market, auction, or stockyard	74.0	(1.4)	74.2	(1.2)	76.5	(1.2)	58.3	(7.2)
Sent directly to packer or slaughter plant	21.2	(1.2)	19.8	(1.1)	17.5	(1.0)	33.5	(7.5)
Sent directly to another dairy	4.3	(1.1)	5.4	(0.6)	5.2	(0.6)	7.3	(2.9)
Sent elsewhere	0.5	(0.1)	0.6	(0.1)	0.7	(0.2)	1.0	(0.5)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

3. Mortality

A higher percentage of all operations in 2014 than in 1996 had at least one cow death (91.1 and 78.4 percent, respectively).

F.3.a. Percentage of operations that had any cow deaths, by herd size:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30 to 99)	73.9	(1.3)	81.5	(1.4)	83.9	(1.5)	84.2	(5.0)
Medium (100 to 499)	93.8	(1.1)	96.3	(0.8)	99.1	(0.4)	97.9	(1.5)
Large (500 or more)	100.0	(—)	100.0	(—)	100.0	(—)	100.0	(—)
All operations	78.4	(1.1)	85.8	(1.1)	88.6	(1.0)	91.1	(2.7)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

The percentage of cows that died in 2014 (5.6 percent) was similar to the percentage that died in 2002 and 2007 but was higher than reported in 1996 (3.8 percent). In 2014, there were no differences across herd sizes in the percentage of cows that died.

F.3.b. Percentage of cows that died, as a percentage of January 1 inventory, by herd size:

	Percent Cows							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30 to 99)	3.5	(0.1)	4.3	(0.1)	4.9	(0.2)	5.0	(0.4)
Medium (100 to 499)	3.9	(0.1)	5.0	(0.1)	5.8	(0.2)	5.0	(0.4)
Large (500 or more)	4.0	(0.2)	4.9	(0.1)	6.1	(0.2)	5.8	(0.5)
All operations	3.8	(0.1)	4.8	(0.1)	5.7	(0.1)	5.6	(0.4)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

Note: In the Dairy 2014 questionnaire, the list of causes for cow deaths was greatly expanded compared to previous study questionnaires. For comparison, causes of cow deaths listed in the Dairy 2014 study questionnaire but not in the questionnaires of the previous studies were combined into the “other diseases” category. Therefore, caution should be taken when comparing 2014 estimates on causes of cow deaths to estimates in the other study years.

The percentages of cows put down due to lameness or injury, died due to calving problems, or died due to respiratory problems were lower in 2014 than in 2007.

F.3.c. Percentage of cow deaths by cause:

	Percent Cow Deaths							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Cause	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Nonambulatory (downers)							25.2	(2.6)
Put down due to lameness or injury	12.9	(0.7)	13.9	(0.6)	20.0	(0.8)	14.5	(1.4)
Mastitis	16.4	(0.8)	17.3	(0.6)	16.6	(0.7)	13.2	(1.0)
Bloat, diarrhea, or other digestive problems	9.2	(1.0)	8.6	(0.5)	10.5	(0.5)	9.9	(1.3)
Calving problems	18.4	(0.7)	17.5	(0.7)	15.3	(0.7)	5.5	(0.8)
Respiratory problems	9.8	(0.7)	10.4	(0.5)	11.4	(0.7)	4.6	(0.5)
Hypocalcemia (milk fever)							2.6	(0.4)
Metritis							1.9	(0.7)
Lack of coordination or severe depression	1.4	(0.2)	1.4	(0.2)	1.0	(0.1)		
Poison	1.0	(0.2)	0.4	(0.1)	0.4	(0.1)		
Other known reasons	16.9	(0.9)	10.9	(0.6)	10.0	(0.8)	10.7	(3.2)
Unknown reasons	14.0	(0.7)	19.6	(0.9)	15.0	(1.1)	11.9	(2.2)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

Necropsies on cows were performed by a higher percentage of large and all operations in 2014 than in 2007.

F.3.d. For operations with at least one cow death (table F.3.a), percentage of operations that performed any necropsies to determine cause of death:

Percent Operations

	Dairy 2007		Dairy 2014	
Herd size (number dairy cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30 to 99)	8.3	(1.1)	6.6	(3.1)
Medium (100 to 499)	20.2	(1.8)	25.7	(5.5)
Large (500 or more)	33.3	(2.7)	55.4	(5.9)
All operations	13.3	(0.9)	22.2	(2.8)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

On operations with at least one cow death, less than 5 percent of cow deaths were necropsied to determine cause of death in 2007 and 2014.

F.3.e. For operations with at least one cow death (table F.3.a), percentage of dead cows that were necropsied to determine cause of death:

Percent Cow Deaths Necropsied

Dairy 2007		Dairy 2014	
Pct.	**Std. error**	**Pct.**	**Std. error**
4.3	(0.4)	4.7	(0.7)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

4. Carcass disposal methods

The percentage of operations that rendered dead cows in 2007 and 2014 (58.8 and 49.6 percent, respectively) was lower than in 2002 (65.3 percent). The percentage of operations that composted dead cows increased from 6.9 percent of operations in 2002 to 24.1 percent in 2014.

F.4. For operations with at least one cow death (table F.3.a), percentage of operations by primary method used to dispose of dead cows:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Method of disposal	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Rendered	65.3	(1.2)	58.8	(1.3)	49.6	(4.0)
Composted	6.9	(0.6)	16.6	(0.9)	24.1	(3.7)
Buried	21.3	(1.1)	19.1	(1.1)	20.9	(3.7)
Burned/incinerated	1.8	(0.4)	1.4	(0.3)	1.0	(0.5)
Landfill	1.7	(0.3)	1.9	(0.3)	1.0	(0.5)
Other	3.1	(0.4)	2.3	(0.4)	3.4	(1.3)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

G. Biosecurity

1. Biosecurity for new arrivals

The percentage of operations that brought any cattle onto the operation decreased from 2002 to 2007 and again from 2007 to 2014. With the exception of dairy bulls, the percentages of operations that brought on the cattle classes in the following table decreased from 1996 to 2014. The percentages of operations that brought on weaned heifers not yet bred or dairy bulls decreased from 2007 to 2014. The percentage of operations that brought on any dairy cattle decreased from 41.9 percent in 2002 to 27.2 percent in 2014.

G.1. Percentage of operations that brought the following classes of cattle onto the operation:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Cattle class	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Heifers weaned but not yet bred	7.5	(0.6)	6.1	(0.6)	6.5	(0.7)	3.1	(0.6)
Bred heifers not yet calved	21.0	(1.0)	17.0	(0.9)	13.0	(0.9)	11.4	(1.1)
Fresh dairy heifers							6.0	(0.8)
Lactating cows	21.4	(1.0)	17.1	(1.0)	13.7	(1.0)	11.9	(1.2)
Dry cows	6.4	(0.6)	5.9	(0.6)	4.1	(0.6)	2.2	(0.5)
Dairy bulls	9.3[2]	(0.7)	14.3	(0.9)	13.3	(0.9)	7.2	(0.9)
Any dairy cattle[3]	42.2	(1.2)	41.9	(1.4)	36.0	(1.4)	27.2	(1.5)
Preweaned beef or dairy calves	4.4	(0.6)	3.7	(0.6)	2.3	(0.4)	1.7	(0.4)
Beef bulls	[2]		2.0	(0.3)	1.9	(0.4)	1.6	(0.5)
Beef heifers and cows[1]	2.0	(0.4)	1.4	(0.3)	1.3	(0.3)		
Steers	2.1	(0.4)	1.2	(0.3)	1.6	(0.4)		
Any	45.2	(1.2)	45.6	(1.4)	39.3	(1.4)	28.6	(1.6)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.
[1]Question variation: 1996 estimate is for “other heifers and cows (including beef)”
[2]Question variation: In 1996, questionnaire asked about beef and dairy bulls together.
[3]Any dairy cattle excludes preweaned beef and dairy calves since beef and dairy weren’t differentiated on the questionnaires.

2. Quarantine

For operations that brought on preweaned calves (table G.1), the percentage that quarantined these calves after arrival decreased from 64.1 percent in 2007 to 7.5 percent in 2014. A lower percentage of operations in 2014 than in 2007 quarantined newly arrived lactating cows (4.0 and 13.1 percent, respectively).

G.2.a. For operations that brought the following classes of cattle onto the operation (table G.1), percentage of operations that quarantined these cattle upon arrival[1]:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Cattle class	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Preweaned beef or dairy calves	34.4	(5.9)	35.3	(7.9)	64.1	(8.7)	7.5	(5.6)
Heifers weaned but not yet bred	21.8	(3.6)	27.0	(4.4)	20.9	(4.4)	14.7	(6.3)
Bred heifers not yet calved	14.6	(1.7)	20.6	(2.4)	14.8	(2.3)	11.7	(2.9)
Fresh dairy heifers							4.7	(1.9)
Lactating cows	5.5	(1.1)	10.5	(1.7)	13.1	(2.6)	4.0	(1.1)
Dry cows	16.4	(4.1)	8.3	(2.6)	19.3	(5.5)	5.5	(2.5)
Dairy bulls	13.1	(2.7)	16.9	(2.6)	16.5	(2.7)	8.7	(3.0)
Beef bulls			26.9	(7.2)	20.3	(6.5)	15.6	(10.1)
Beef heifers and cows[2]	18.1	(6.7)	30.1	(10.4)	33.2	(10.6)		
Steers	24.4	(7.5)	42.2	(11.8)	36.7	(11.2)		
Any	16.0	(1.3)	20.9	(1.6)	20.6	(1.7)	9.6	(1.6)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.
[1]Producers were asked for the number of head brought on and number of head quarantined.
[2]Question variation: 1996 estimate is for other heifers and cows (including beef)

There were no differences across cattle classes in the average number of days that new arrivals were quarantined since 1996.

G.2.b. For operations that quarantined new arrivals (table G.2.a), average number of days new arrivals were quarantined, by cattle class:

	Average Number of Days							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Cattle class	Avg.	Std. error	Avg.	Std. error	Avg.	Std. error	Avg.	Std. error
Preweaned beef or dairy calves	44.0	(5.3)	61.5	(13.0)	41.4	(5.3)	[1]	
Heifers weaned but not yet bred	24.6	(4.8)	28.5	(6.7)	22.8	(3.4)	25.9	(3.2)
Bred heifers not yet calved	18.1	(2.7)	23.6	(4.1)	23.1	(3.0)	14.2	(3.4)
Fresh dairy heifers							26.6	(6.2)
Lactating cows	13.3	(2.7)	20.1	(4.1)	16.5	(2.5)	14.1	(2.0)
Dry cows	11.6	(2.1)	21.4	(4.3)	16.5	(4.3)	16.5	(4.6)
Dairy bulls	21.0	(3.1)	19.2	(2.6)	26.1	(3.8)	20.4	(5.3)
Beef bulls			36.0	(14.7)	31.9	(12.6)	[1]	
Beef heifers and cows[2]	24.3	(9.1)	31.1	(6.6)	33.3	(12.1)		
Steers	41.5	(22.0)	41.3	(14.0)	40.7	(18.7)		
Any[3]	26.4	(2.6)	30.2	(3.2)	27.9	(2.4)	20.9	(2.9)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.
[1]Too few to report.
[2]Question variation: 1996 estimate is for other heifers and cows (including beef)
[3]Estimates are weighted to the total number of cattle on the operation

3. Vaccination requirements

For operations that brought any dairy cattle onto the operation (table G.1.), the percentage that normally required any vaccination for new arrivals decreased from 66.6 percent in 1996 to 33.7 percent in 2014. A lower percentage of operations required vaccination for each of the diseases listed in the following table in 2014 than in any of the previous study years.

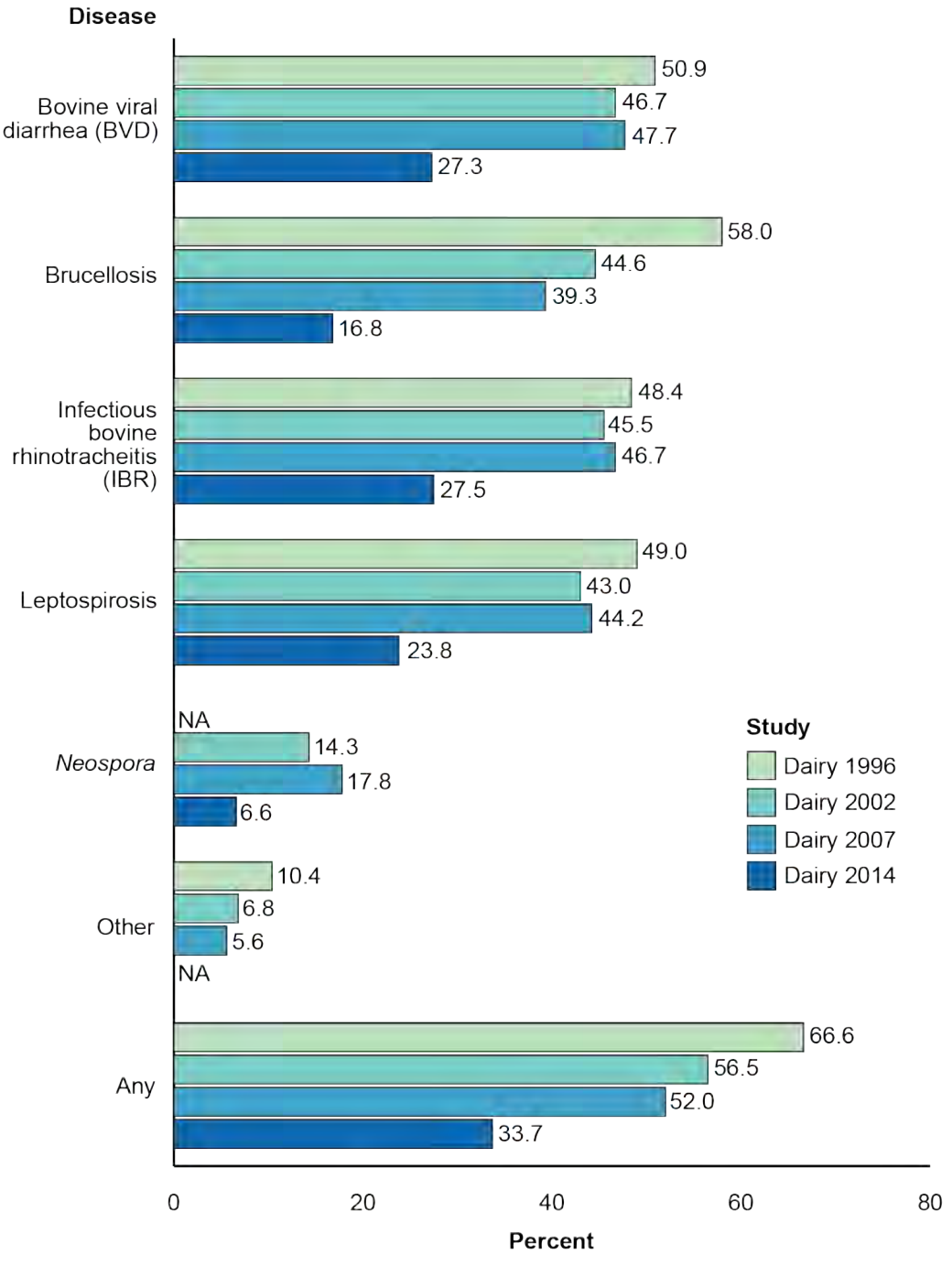
G.3. For operations that brought any dairy cattle onto the operation (table G.1), percentage of operations that normally required vaccination against the following diseases before bringing animals onto the operation:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Disease	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bovine viral diarrhea (BVD)	50.9	(1.9)	46.7	(2.0)	47.7	(2.3)	27.3	(2.8)
Brucellosis	58.0	(1.9)	44.6	(2.0)	39.3	(2.2)	16.8	(2.2)
Infectious bovine rhinotracheitis (IBR)	48.4	(1.9)	45.5	(2.0)	46.7	(2.3)	27.5	(2.8)
Leptospirosis	49.0	(1.9)	43.0	(2.0)	44.2	(2.3)	23.8	(2.5)
Neospora			14.3	(1.3)	17.8	(1.7)	6.6	(1.3)
Other	10.4	(1.1)	6.8	(0.8)	5.6	(0.9)		
Any	66.6	(1.8)	56.5	(2.1)	52.0	(2.3)	33.7	(3.0)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

For operations that brought any dairy cattle onto the operation, percentage of operations that normally required vaccination against the following diseases before bringing animals onto the operation



Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.

4. Testing requirements

For operations that brought any dairy cattle onto the operation, the percentages that performed any testing of individual animals brought on were highest in 1996 (36.6 percent) compared with subsequent study years. There were no changes from 2007 to 2014 in the percentages of operations that required disease-specific testing for each of the diseases listed in the following table.

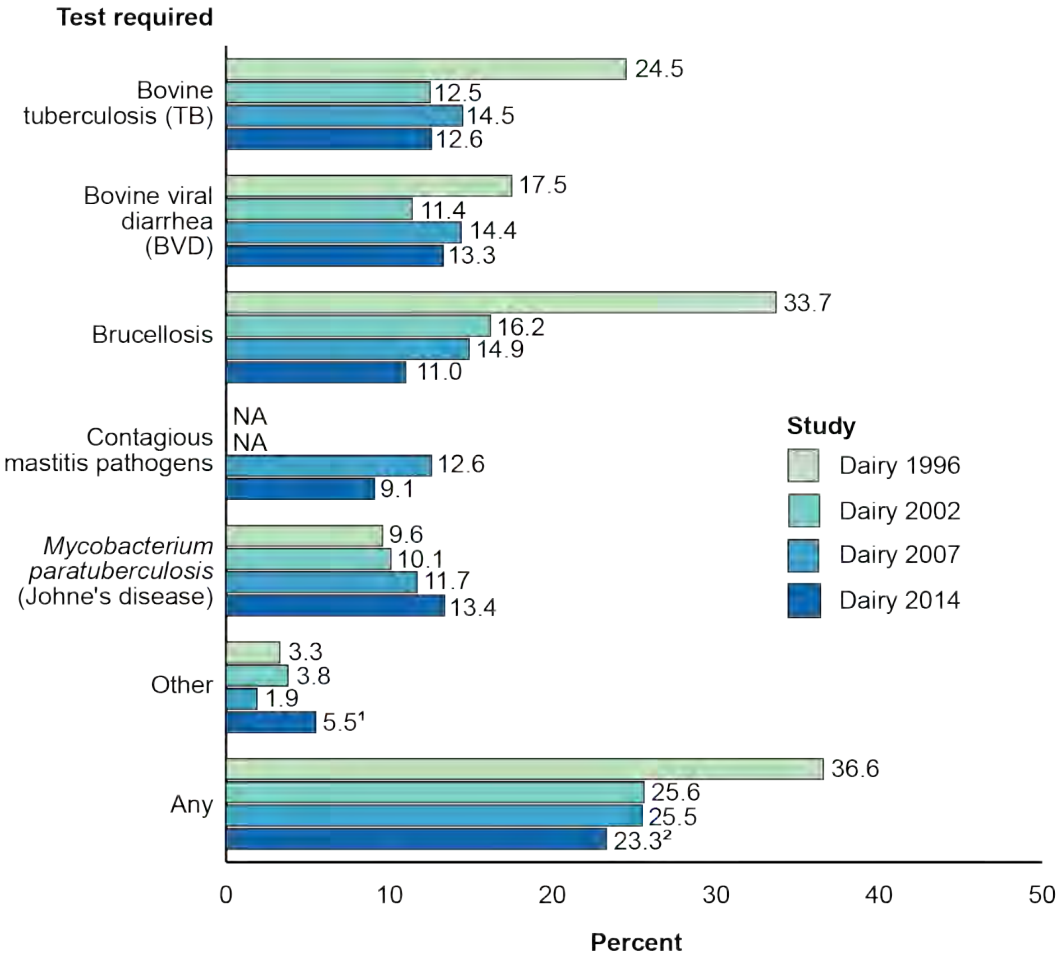
G.4.a. For operations that brought any dairy cattle onto the operation (table G.1), percentage of operations that tested individual animals brought onto the operation, by disease testing normally required:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Test required	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bovine tuberculosis (TB)	24.5	(1.6)	12.5	(1.2)	14.5	(1.6)	12.6	(2.0)
Bovine viral diarrhea (BVD)	17.5	(1.4)	11.4	(1.2)	14.4	(1.6)	13.3	(2.0)
Brucellosis	33.7	(1.7)	16.2	(1.4)	14.9	(1.6)	11.0	(1.9)
Contagious mastitis pathogens					12.6	(1.6)	9.1	(1.8)
Mycobacterium avium subspecies *paratuberculosis* (Johne's disease)	9.6	(1.2)	10.1	(1.2)	11.7	(1.9)	13.4	(2.2)
Other	3.3	(0.6)	3.8	(0.7)	1.9	(0.6)	5.5[1]	(1.3)
Any	36.6	(1.8)	25.6	(1.7)	25.5	(2.0)	23.3[2]	(2.6)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.
[1]Included specific options for bovine leukemia virus (BLV) and bluetongue in 2014.
[2]Estimate was recalculated to only include operations with 30 or more dairy cows to match the rest of the 2014 estimates

For operations that brought any dairy cattle onto the operation, percentage of operations that tested individual animals brought onto the operation, by disease testing normally required



Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more dairy cows to match 2014 estimates.
[1]Included specific options for bovine leukemia virus (BLV) and bluetongue in 2014.
[2]Estimate was rerun to only include operations with 30 or more dairy cows to match the rest of the 2014 estimates.

A lower percentage of operations in 2014 than in 2007 required a bulk-tank milk culture (7.6 and 13.5 percent, respectively).

G.4.b. For operations that brought any dairy cattle onto the operation (table G.1), percentage of operations by information that the operation normally required on the animals' herd of origin:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Herd-of-origin information	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Bovine viral diarrhea (BVD) status	19.7	(1.8)	14.8	(2.3)
Bulk-tank milk somatic cell count	21.6	(1.9)	14.1	(2.2)
Johne's disease status	18.1	(1.7)	12.9	(2.1)
Bulk-tank milk culture to screen forcontagious mastitis pathogens	13.5	(1.5)	7.6	(1.4)
Other	2.8	(0.8)	2.8	(1.1)
Any information	30.5	(2.1)	27.3	(2.9)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

5. Off-site heifer rearing

There were no changes from 2007 to 2014 in the percentage of operations that raised any heifers off-site. Almost one-half of large operations raised some calves off-site. In 2014, about one-fourth of all heifer calves were raised off-site (data not shown).

G.5.a. Percentage of operations that raised any heifers off-site or sold them and then bought them back later:

Percent Operations

	Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	4.9	(0.8)	5.5	(1.2)
Medium (100-499)	15.5	(1.7)	12.5	(1.8)
Large (500 or more)	46.0	(2.9)	46.5	(2.3)
All operations	10.1	(0.7)	12.1	(0.9)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

There were no differences in 2007 and 2014 in the percentages of operations by heifer class that left the operation.

G.5.b. For operations that raised any heifers off-site or sold them and then bought them back later (table G.5.a), percentage of operations by class of the majority of heifers that left:

Percent Operations

	Dairy 2007		Dairy 2014	
Heifer class	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Preweaned	48.8	(3.8)	40.2	(3.6)
Weaned but not pregnant	45.6	(3.9)	55.7	(3.8)
Pregnant	5.6	(1.7)	4.0	(1.7)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

There were no age differences from 2007 and 2014 by heifer class that left the operation.

G.5.c. For operations that raised any heifers off-site or sold them and then bought them back later (table G.5.a), operation average age of heifers when leaving the operation, by heifer class:

	Operation Average Age (days)			
	Dairy 2007		**Dairy 2014**	
Heifer class	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Preweaned	4.8	(0.7)	6.4	(1.4)
Weaned but not pregnant	192.5	(15.8)	200.3	(16.0)
Pregnant	413.8	(25.3)	400.6	(65.6)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

The percentages of operations by distance heifers were transported to an off-site rearing facility were similar in 2007 and 2014 across distances traveled.

G.5.d. For operations that raised any heifers off-site or sold them and then bought them back later (table G.5.a), percentage of operations by distance (miles) heifers were transported:

	Percent Operations			
	Dairy 2007		**Dairy 2014**	
Distance (mi)	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 5	27.2	(3.7)	22.5	(3.8)
5–19	40.3	(3.9)	37.2	(4.0)
20–49	21.5	(3.0)	24.9	(3.4)
50–99	5.5	(1.5)	9.6	(2.0)
100 or more	5.4	(1.4)	5.8	(1.1)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

A single rearing facility where cattle had contact with cattle from other operations was used by about one-half of the operations in 2007 and 2014. There were no differences from 2007 to 2014 in the percentages of operations by rearing arrangement.

G.5.e. For operations that raised any heifers off-site or sold them and then bought them back later (table G.5.a), percentage of operations by type of arrangement with the off-site rearing facility:

Percent Operations

	Dairy 2007		Dairy 2014	
Arrangement	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Single rearing facility; contact with cattle from other operations	51.5	(4.0)	53.8	(4.1)
Single rearing facility; no contact with cattle from other operations	27.0	(3.2)	28.7	(3.9)
Multiple rearing facilities; contact with cattle from other operations	12.8	(3.1)	10.6	(2.2)
Multiple rearing facilities; no contact with cattle from other operations	8.7	(2.1)	6.8	(1.8)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

About two-thirds of operations in 2007 and 2014 brought or bought pregnant heifers back from the off-site rearing facility.

G.5.f. For operations that raised any heifers off-site or sold them and bought them back later (table G.5.a), percentage of operations by class of the majority of heifers returned to the operation:

Percent Operations

	Dairy 2007		Dairy 2014	
Heifer class	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Weaned but not pregnant	31.0	(3.4)	29.3	(3.4)
Pregnant	67.8	(3.4)	69.6	(3.4)
Recently fresh	1.2	(0.7)	1.1	(0.4)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

There were no differences by heifer class in the operation average ages of heifers by when returning to the operation.

G.5.g. For operations that raised any heifers off-site or sold them and bought them back later (table G.5.a), operation average age (months) of heifers when returned to the operation, by heifer class:

	Operation Average Age (mo)			
	Dairy 2007		**Dairy 2014**	
Heifer class	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Weaned but not pregnant	7.0	(0.6)	7.5	(0.7)
Pregnant	21.6	(0.3)	21.5	(0.3)
Recently fresh	27.4	(1.4)	23.4	(0.6)

Population: Operations with 30 or more dairy cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.

H. Disease Familiarity and Biosecurity Practices

1. Disease familiarity

Since 2002, a higher percentage of producers have become fairly knowledgeable or knew some basics about hemorrhagic bowel syndrome (HBS) and *mycoplasma* mastitis. Conversely, since 2002, a lower percentage of producers were fairly knowledgeable or knew some basics about anthrax and foot-and-mouth disease (FMD). Over the three study years, more than 80 percent of producers had not heard of heartwater or vesicular stomatitis (VS).

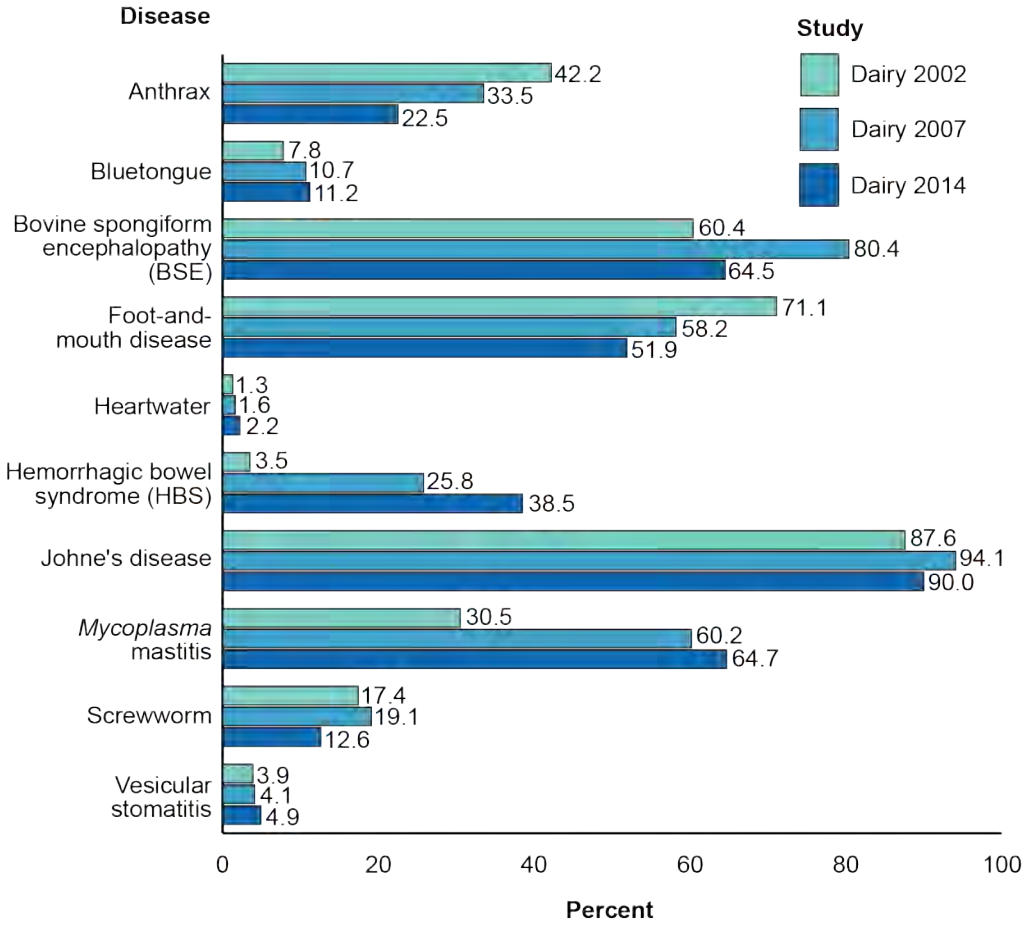
H.1.a. Percentage of producers by level of familiarity with the following cattle diseases:

Percent Producers

	Level of Familiarity								
	Fairly knowledgeable/ knew some basics			Recognized name, not much else			Had not heard of it before		
	Dairy 2002	Dairy 2007	Dairy 2014	Dairy 2002	Dairy 2007	Dairy 2014	Dairy 2002	Dairy 2007	Dairy 2014
Disease	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)
Anthrax	42.2 (2.1)	33.5 (2.7)	22.5 (3.1)	54.0 (2.2)	56.3 (2.8)	65.9 (3.7)	3.8 (0.8)	10.2 (1.8)	11.7 (2.7)
Bluetongue	7.8 (1.0)	10.7 (1.4)	11.2 (2.2)	40.7 (2.0)	41.0 (2.8)	55.8 (4.0)	51.5 (2.1)	48.3 (2.8)	33.0 (3.7)
Bovine spongiform encephalopathy (BSE)	60.4 (2.1)	80.4 (2.3)	64.5 (3.9)	38.0 (2.1)	18.8 (2.2)	33.3 (3.8)	1.6 (0.5)	0.8 (0.6)	2.2 (1.2)
Foot-and-mouth disease (FMD)	71.1 (1.9)	58.2 (2.8)	51.9 (4.0)	28.1 (1.9)	40.7 (2.9)	46.8 (4.0)	0.8 (0.3)	1.1 (0.7)	1.3 (0.8)
Heartwater	1.3 (0.4)	1.6 (0.5)	2.2 (1.2)	3.7 (0.7)	4.5 (1.0)	12.3 (2.6)	95.1 (0.8)	93.9 (1.1)	85.5 (2.8)
Hemorrhagic bowel syndrome (HBS)	3.5 (0.5)	25.8 (2.1)	38.5 (3.7)	8.7 (1.3)	22.6 (2.3)	22.5 (3.4)	87.8 (1.3)	51.6 (2.7)	38.9 (4.1)
Mycobacterium avium subspecies *paratuberculosis* (Johne's disease)	87.6 (1.4)	94.1 (1.3)	90.0 (2.4)	11.4 (1.4)	4.4 (1.2)	9.6 (2.4)	1.0 (0.3)	1.5 (0.6)	0.4 (0.4)
Mycoplasma mastitis	30.5 (1.9)	60.2 (2.9)	64.7 (3.9)	46.6 (2.2)	30.4 (2.8)	27.9 (3.7)	22.9 (2.0)	9.4 (1.8)	7.5 (2.0)
Screwworm	17.4 (1.5)	19.1 (2.0)	12.6 (2.9)	45.1 (2.2)	37.4 (2.6)	40.9 (4.0)	37.5 (2.2)	43.5 (2.7)	46.4 (4.0)
Vesicular stomatitis (VS)	3.9 (0.6)	4.1 (0.8)	4.9 (1.6)	12.9 (1.3)	14.1 (1.7)	12.3 (2.3)	83.2 (1.4)	81.8 (1.9)	82.8 (2.7)

Population: Operations with 30 or more dairy cows.

Percentage of producers that were fairly knowledgeable or knew some basics about the following cattle diseases



Population: Operations with 30 or more dairy cows.

From 2007 to 2014, there were no differences across herd sizes in the operation average percentage change in total daily milk production that would have to occur before a veterinarian would be contacted to assist with a possible disease problem. In both study years, the operation average percentage decrease in milk production before a veterinarian was contacted was higher on small and medium operations than on large operations.

H.1.b. Operation average percentage decrease in total daily milk production before a veterinarian would be contacted to assist with a potential disease problem in the herd, by herd size and by region:

Operation Average Percent Decrease

	Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	22.3	(1.2)	20.3	(2.1)
Medium (100-499)	18.0	(1.1)	15.0	(1.2)
Large (500 or more)	12.9	(1.2)	11.2	(0.8)
All operations	20.6	(0.9)	17.1	(1.2)

Population: Operations with 30 or more dairy cows.

2. Foreign animal disease information and resources

More than 90 percent of producers in each of the three study years reported that they would very likely contact their private veterinarian if an outbreak of a foreign animal disease occurred. A higher percentage of producers in 2014 than in 2002 would very likely use the Internet as an information source (39.3 and 19.0 percent respectively). Alternatively, a lower percentage of producers in 2014 than in 2002 would very likely use television/newspapers as an information source during a foreign animal disease outbreak (17.8 and 30.7 percent, respectively). The use of other information sources did not change over the three study years.

H.2.a. Percentage of producers by likelihood of using the following information sources if an outbreak of foreign animal disease occurred in the United States (e.g., foot-and-mouth disease):

Percent Producers

Likelihood

	Very Likely			Somewhat Likely			Not Likely		
	Dairy 2002	Dairy 2007	Dairy 2014	Dairy 2002	Dairy 2007	Dairy 2014	Dairy 2002	Dairy 2007	Dairy 2014
Information Source	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error	Pct. Std. error
Private veterinarian	92.8 (1.1)	93.6 (1.3)	94.8 (1.8)	6.6 (1.1)	5.4 (1.3)	4.1 (1.5)	0.6 (0.3)	1.0 (0.5)	1.1 (0.9)
Internet	19.0 (1.6)	23.1 (2.2)	39.3 (3.8)	27.4 (1.9)	28.8 (2.6)	20.4 (3.1)	53.6 (2.1)	48.1 (2.8)	40.3 (4.0)
Magazines	41.8 (2.1)	39.0 (2.8)	33.0 (3.8)	44.7 (2.1)	49.4 (2.8)	46.4 (4.1)	13.5 (1.5)	11.6 (1.5)	20.6 (3.0)
Dairy organization or cooperative	30.3 (1.9)	30.7 (2.6)	32.6 (3.6)	41.8 (2.1)	42.3 (2.8)	38.6 (4.0)	27.9 (1.9)	27.0 (2.6)	28.8 (3.8)
Other dairy producers	40.5 (2.1)	41.4 (2.8)	31.0 (3.8)	34.5 (2.0)	37.8 (2.7)	42.1 (4.0)	25.0 (1.9)	20.8 (2.3)	26.9 (3.5)
State Veterinarian's office	34.7 (2.1)	26.7 (2.4)	30.5 (3.5)	31.3 (2.0)	37.4 (2.8)	23.0 (3.3)	34.0 (2.1)	35.9 (2.9)	46.5 (4.1)
U.S. Department of Agriculture	25.1 (1.8)	22.6 (2.4)	28.1 (3.5)	38.1 (2.2)	42.5 (2.8)	34.4 (3.9)	36.8 (2.1)	34.9 (2.7)	37.4 (4.0)
Extension agent	34.2 (2.0)	32.5 (2.7)	26.6 (3.6)	36.9 (2.1)	38.9 (2.9)	35.1 (3.9)	28.9 (2.0)	28.6 (2.5)	38.3 (3.8)
Television/ newspapers	30.7 (2.1)	25.8 (2.5)	17.8 (3.0)	35.2 (2.0)	38.8 (2.8)	40.1 (4.0)	34.1 (2.0)	35.4 (2.6)	42.1 (3.9)
Other	3.7 (0.9)	4.7 (1.2)		0.8 (0.3)	2.4 (1.0)		95.5 (1.0)	92.9 (1.6)	

Population: Operations with 30 or more dairy cows.

There were no substantial differences from 2002 to 2014 in the percentages of producers that would use the resources listed in the following table if an animal on their operation was suspected of having a foreign animal disease. Almost all producers in 2014 (98.6 percent) would contact their private veterinarian if they suspected a foreign animal disease on their operation.

H.2.b. Percentage of producers that would contact the following resources if an animal on the operation was suspected of having foot-and-mouth disease or another foreign animal disease:

	Percent Producers					
	Dairy 2002		Dairy 2007		Dairy 2014	
Resource	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Private veterinarian	97.9	(0.7)	98.6	(0.5)	98.6	(0.8)
State Veterinarian's office	43.9	(2.2)	35.7	(2.6)	40.8	(3.9)
U.S. Department of Agriculture	25.5	(1.8)	21.8	(2.3)	31.7	(3.7)
Feed company or milk cooperative representative	28.0	(1.9)	25.7	(2.3)	30.2	(3.6)
Extension agent/ university	25.4	(1.8)	20.8	(2.3)	16.4	(2.8)
Other	3.3	(0.7)	4.1	(1.3)		

Population: Operations with 30 or more dairy cows.

3. Employees and visitors

The percentage of operations that had employees increased from 47.2 percent in 2002 to 70.9 percent in 2014. Compared with 2007, a lower percentage of medium operations in 2014 had any employees (80.9 and 95.0 percent, respectively).

H.3.a. Percentage of operations that had employees, by herd size:

	Percent Operations					
	Dairy 2002		Dairy 2007*		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	32.2	(2.5)	65.6	(4.1)	55.5	(6.3)
Medium (100-499)	84.2	(2.4)	95.0	(2.0)	80.9	(3.1)
Large (500 or more)	99.0	(0.6)	98.0	(1.9)	100.0	(—)
All operations	47.2	(2.0)	75.7	(2.8)	70.9	(3.7)

Population: Operations with 30 or more dairy cows.
*Question variation: In 2007, estimates specifically excluded owners and family members.

For operations with employees, a higher percentage in 2014 than in 2002 had written standard operating procedures for employees (22.1 and 8.1 percent, respectively). A lower percentage of operations had restrictions on employee livestock ownership outside their operation in 2014 (9.8 percent) than in 2002 (27.7 percent).

H.3.b. For operations with employees (table H.3.a), percentage of operations by biosecurity practice used:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Biosecurity practice	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Written standard operating procedures (other than milking procedures)	8.1	(1.4)	12.2	(2.0)	22.1	(3.6)
Guidelines regarding foreign travel by employees	21.8	(2.3)	12.0	(2.0)	11.9	(3.4)
Restrictions on employee livestock ownership outside this operation	27.7	(2.2)	18.1	(2.5)	9.8	(2.9)

Population: Operations with 30 or more dairy cows.

The percentage of all operations that allowed visitors in animal areas increased from 2002 to 2007 and from 2007 to 2014.

H.3.c. Percentage of operations that allowed visitors in animal areas, by herd size:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	84.6	(2.0)	98.6	(0.8)	100.0	(—)
Medium (100-499)	91.7	(1.5)	95.9	(1.8)	100.0	(—)
Large (500 or more)	89.2	(2.8)	97.9	(1.6)	99.4	(0.6)
All operations	86.5	(1.5)	97.9	(0.7)	99.9	(0.1)

Population: Operations with 30 or more dairy cows.

For operations that allowed visitors into animal areas, a lower percentage had footbaths for visitors entering animal areas in 2014 (2.4 percent) than in 2002 and 2007 (6.3 and 6.9 percent, respectively).

H.3.d. For operations that allowed visitors into animal areas (table H.3.c), percentage of operations by biosecurity practice used:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Biosecurity practice	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Disposable or clean boots for visitors entering animal areas	18.9	(1.6)	28.3	(2.6)	27.2	(3.3)
Footbaths for visitors entering animal areas	6.3	(1.0)	6.9	(1.3)	2.4	(0.8)

Population: Operations with 30 or more dairy cows.

4. Specific biosecurity practices

Of the biosecurity practices listed in the following table, a closed herd was the only practice that showed a change across all study years. A lower percentage of operations in 2014 (47.2 percent) than in 2002 (59.5 percent) had a closed herd. A higher percentage of operations limited cattle contact with other livestock, elk, and deer in 2014 compared with 2002 (54.2 and 41.4 percent, respectively). The percentage of operations that had restrictions on vehicles entering animal areas was lower in 2014 than in 2007 (35.8 and 51.3 percent, respectively).

H.4. Percentage of operations that used the following biosecurity practices to prevent disease during the previous 12 months:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Biosecurity practice	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Rodent control	94.7	(0.9)	94.4	(1.1)	92.2	(2.0)
Insect control	92.5	(1.1)	87.4	(2.0)	86.2	(2.8)
Control access to cattle feed by other livestock and wildlife	53.7	(2.1)	49.9	(2.9)	55.7	(4.0)
Limit cattle contact with other livestock, elk, and deer	41.4	(2.1)	48.5	(2.8)	54.2	(4.0)
Closed herd*	59.5	(2.1)	56.2	(2.9)	47.2	(4.0)
Bird control	29.1	(1.9)	33.8	(2.7)	38.4	(3.9)
Restrictions on vehicles entering animal areas	44.2	(2.1)	51.3	(2.9)	35.8	(3.7)
Guidelines regarding which visitors are allowed in animal areas	38.6	(2.0)	29.8	(2.6)	31.5	(3.6)

Population: Operations with 30 or more dairy cows.
*All replacements are from the operation; no contact with cattle from other operations.

5. Equipment handling for manure and feeding

There were no changes across study years in the percentage of operations that never used the same equipment to handle manure and feed cattle.

H.5.a. Percentage of operations by frequency that the same equipment was ever used to handle manure and feed cattle:

	Percent Operations					
	Dairy 2002[1]		Dairy 2007		Dairy 2014	
Frequency	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Routinely	58.8	(2.1)	32.2	(2.7)	35.5	(4.1)
Sometimes			35.6[2]	(2.7)	27.6	(3.3)
Never	41.2	(2.1)	32.2	(2.7)	36.9	(3.7)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
[1]Question variation: In 2002, questionnaire asked “Does this operation ever use the same equipment to handle manure and feed cattle.”
[2]Question variation: In 2007, rarely was used instead of sometimes.

For operations that ever used the same equipment to handle manure and feed cattle, the majority in each study year washed equipment with water or steam only. In the 2014 survey, the additional answer choice of using a separate bucket for feeding and cleaning but not cleaning of tires and equipment (33.2 percent of operations) likely resulted in the percentage of operations reporting 'other' procedures to decrease from previous study years.

H.5.b. For operations that ever used the same equipment to handle manure and feed cattle (table H.5.a), percentage of operations by procedure that best describes what was usually done with the equipment after handling manure:

Percent Operations

	Dairy 2002		Dairy 2007		Dairy 2014	
Procedure	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Wash equipment with water or steam only	54.2	(2.9)	61.0	(3.4)	55.3	(5.2)
Separate bucket used for each, but no cleaning of tires/equipment					33.2	(4.8)
Wash equipment and chemically disinfect	5.7	(1.5)	4.6	(1.5)	4.4	(2.7)
Chemically disinfect only	0.0	(—)	0.1	(0.1)	0.2	(0.2)
Other	24.9	(2.5)	23.2	(3.1)	1.0	(0.1)
No procedures	15.2	(2.2)	11.1	(2.3)	5.8	(3.1)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.

6. Equipment sharing with other livestock operations

There were no substantial changes across study years or by herd size in the percentage of operations that had shared heavy equipment with other livestock operations during the previous 12 months.

H.6.a. Percentage of operations that had shared any heavy equipment (tractors, feeding equipment, manure spreaders, trailers, etc.) with other livestock operations during the previous 12 months:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	40.0	(2.7)	35.9	(3.7)	28.2	(5.9)
Medium (100-499)	33.4	(2.8)	41.0	(4.1)	24.3	(5.1)
Large (500 or more)	28.0	(3.7)	21.3	(4.3)	35.3	(5.7)
All operations	38.0	(2.1)	36.2	(2.8)	28.3	(3.5)

Population: Operations with 30 or more dairy cows.

For operations that shared heavy equipment, there were no changes from 2007 to 2014 in the percentages of operations by procedures used to clean borrowed equipment before using it. About 25 percent of operations washed borrowed equipment with water or steam before using it, and about 60 percent did not clean borrowed equipment.

H.6.b. For operations that shared heavy equipment with other livestock operations (table H.6.a), percentage of operations by procedure used for cleaning equipment before using it on their operation:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Procedure	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Wash equipment with water or steam only	26.6	(3.9)	32.5	(7.1)
Chemically disinfect only	0.0	(—)	1.2	(1.2)
Wash equipment and chemically disinfect	0.5	(0.3)	0.0	(—)
Other	9.9	(3.2)	7.4	(4.0)
No procedures	63.0	(4.6)	58.9	(7.4)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

7. Johne's disease

Participation in any Johne's disease control or certification program increased from 0.9 percent in 1996 to 34.9 percent in 2014; however, the percentage of operations that participated in a Johne's control or certification program remained constant from 2007 to 2014.

H.7.a. Percentage of operations that participated in any Johne's disease control or certification program:

Percent Operations

Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0.9	(0.3)	11.2	(1.4)	31.7	(2.5)	34.9	(3.6)

Population: Operations with 30 or more dairy cows.

The percentage of operations that tested for Johne's disease increased from 1996 to 2007. During this period, a higher percentage of medium operations than small operations tested for Johne's disease. From 2007 to 2014, the percentage of operations that tested for Johne's disease decreased from 35.3 percent of to 16.4 percent. One possible reason for this decline could be the elimination of federal funding for producer testing, which occurred after the 2007 study.

From 1996 to 2002, a higher percentage of operations tested for Johne's disease than participated in a control or certification program in (table H.7.a). One potential reason for the change could be that operations were performing diagnostic testing (i.e., testing sick cows) and did not consider testing for Johne's disease as part of a control program.

H.7.b. Percentage of operations that performed any testing for Johne's disease, by herd size:

	Percent Operations							
	Dairy 1996*		Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	10.5	(1.3)	20.4	(2.5)	30.7	(3.4)	15.2	(4.9)
Medium (100-499)	22.0	(2.4)	39.5	(3.3)	47.6	(4.1)	18.6	(4.8)
Large (500 or more)	19.9	(4.3)	38.3	(4.0)	37.5	(5.7)	16.5	(3.0)
All operations	13.1	(1.1)	25.7	(1.9)	35.3	(2.6)	16.4	(3.0)

Population: Operations with 30 or more dairy cows.
*Question variation: In 1996, estimate was for operations that tested in the last 24 months, while the 2002 and 2007 estimates were for testing performed during the previous 12 months, and the 2014 estimate was for testing performed during 2013.

8. Calving areas

A multiple-animal area/pen was used by a lower percentage of operations in 2014 than in 2007 (58.7 and 70.0 percent, respectively). 'Other' calving areas was used by a higher percentage of operations in 2014 than in 2007 (22.7 and 4.6 percent, respectively). In 2014, the 'other' areas were primarily pasture, fields, tie stalls, and stanchions.

H.8.a. Percentage of operations by area(s) usually used for calving:

Percent Operations

	Dairy 2007		Dairy 2014	
Calving area	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Multiple-animal area/pen (group calving)	70.0	(2.6)	58.7	(1.8)
Individual-animal area/pen cleaned between each calving	25.5	(2.5)	28.6	(1.7)
Individual-animal area/pen cleaned after two or more calvings	26.2	(2.5)	20.0	(1.5)
Other	4.6	(1.2)	22.7	(1.6)

Population: Operations with 30 or more dairy cows.

There was no difference from 2007 to 2014 in the percentage of operations that had a usual calving area.

H.8.b. Percentage of operations that had a usual calving area:

Percent Operations

Dairy 2007		Dairy 2014	
Pct.	**Std. error**	**Pct.**	**Std. error**
70.1	(2.7)	69.4	(1.7)

Population: Operations with 30 or more dairy cows.

On operations that had a usual calving area, lame cows were allowed in the calving area on a lower percentage of operations in 2014 than in 2007 (36.0 and 51.6 percent, respectively). There were no differences from 2007 to 2014 in the percentage of operations that allowed sick cows in the calving area.

H.8.c. For operations that had a usual calving area (table H.8.b), percentage that allowed lame or sick cows in the calving area:

Percent Operations

	Dairy 2007		Dairy 2014	
Cow condition	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Lame	51.6	(3.1)	36.0	(2.0)
Sick	34.2	(3.2)	24.9	(1.8)

Population: Operations with 30 or more dairy cows.

Johne's disease is one of many diseases that can be transmitted in calving areas. For operations that had a usual calving area, the percentage of operations that allowed cows that tested positive for Johne's disease into the calving area did not change from 2007 to 2014, when considering the estimates' standard errors.

H.8.d. For operations that had a usual calving area (table H.8.b) and tested for Johne's disease (table H.7.b), percentage that allowed cows that tested positive for Johne's disease into the calving area:

Percent Operations

Dairy 2007		Dairy 2014	
Pct.	**Std. error**	**Pct.**	**Std. error**
15.5	(3.2)	7.3	(1.2)

Population: Operations with 30 or more dairy cows.

I. Reproduction

1. Number of bulls

Across study years, about one-half of operations had no bulls. The percentage of operations with one bull decreased since 1996, while the percentage of operations with 5 or more bulls increased since 1996.

I.1. Percentage of operations by the number of bulls used for breeding dairy cows or heifers:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Number bulls	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0	45.4	(1.3)	45.1	(1.4)	48.3	(1.4)	48.5	(1.8)
1	34.8	(1.3)	31.1	(1.3)	28.5	(1.3)	24.3	(1.6)
2 to 4	16.9	(0.8)	19.1	(1.0)	18.6	(1.0)	20.8	(1.4)
5 or more	2.9	(0.2)	4.7	(0.3)	4.6	(0.3)	6.3	(0.5)
Total	100.0		100.0		100.0		100.0	

Population: Operations with one or more dairy cows.

2. Breeding practices

A controlled internal drug release (CIDR) insert was approved for dairy cows and heifers in 2003. The product contains progesterone and is inserted vaginally to synchronize estrus in cattle. The CIDR insert is removed after 7 days, and estrus in nonpregnant cows is usually observed 3 to 4 days later.

There were no differences by herd size in the percentage of operations that used a controlled internal drug release (CIDR) insert from 2007 to 2014.

I.2.a. Percentage of operations that used controlled internal drug release (CIDR) insert as part of their breeding program, by herd size:

Percent Operations

	Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	28.6	(3.5)	27.8	(6.0)
Medium (100-499)	41.1	(4.5)	40.4	(6.3)
Large (500 or more)	39.7	(5.5)	44.6	(5.2)
All operations	32.4	(2.7)	34.6	(3.8)

Population: Operations with 30 or more dairy cows.

For operations that used a CIDR insert, there were no differences from 2007 to 2014 in the percentages of operations by use of the CIDR.

I.2.b. For operations that used a CIDR insert (table I.2.a), percentage of operations by how it was used:

Percent Operations

	Dairy 2007		Dairy 2014	
Use	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Specifically for animals identified as in anestrus	65.7	(4.4)	70.1	(5.9)
Specifically for animals identified as having cystic ovaries	43.5	(4.7)	49.3	(6.7)
As part of a herd-synchronization program	34.3	(4.4)	32.3	(6.2)
Postbreeding	15.0	(3.8)	7.8	(3.4)
Other	10.9	(3.1)	8.0	(3.4)

Population: Operations with 30 or more dairy cows.

There were no differences from 2007 to 2014 in the percentage of operations by first-service breeding practices used for the majority of heifers. More than one-half of operations used artificial insemination (AI) to natural estrus in both study years.

I.2.c. Percentage of operations by **first-service** breeding practice used for the majority of **heifers**:

	Percent Operations			
	Dairy 2007		Dairy 2014	
First-service breeding practice	Pct.	Std. error	Pct.	Std. error
Natural service (bull bred)	33.2	(3.0)	28.3	(3.8)
AI to natural estrus (no injections given to induce estrus)	57.1	(3.0)	59.4	(4.0)
AI to induced estrus (prostaglandin injections only)	4.4	(1.0)	9.3	(2.4)
AI to induced estrus after Ovsynch program (prostaglandin and GnRH injections)	1.8	(0.8)	0.2	(0.2)
Timed AI after Ovsynch program	0.4	(0.2)	1.9	(0.9)
AI to estrus after Presynch/Ovsynch program	0.1	(0.1)	0.1	(0.1)
Timed AI after Presynch/Ovsynch program	0.3	(0.2)	0.0	(—)
Other	2.7	(0.8)	0.8	(0.5)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

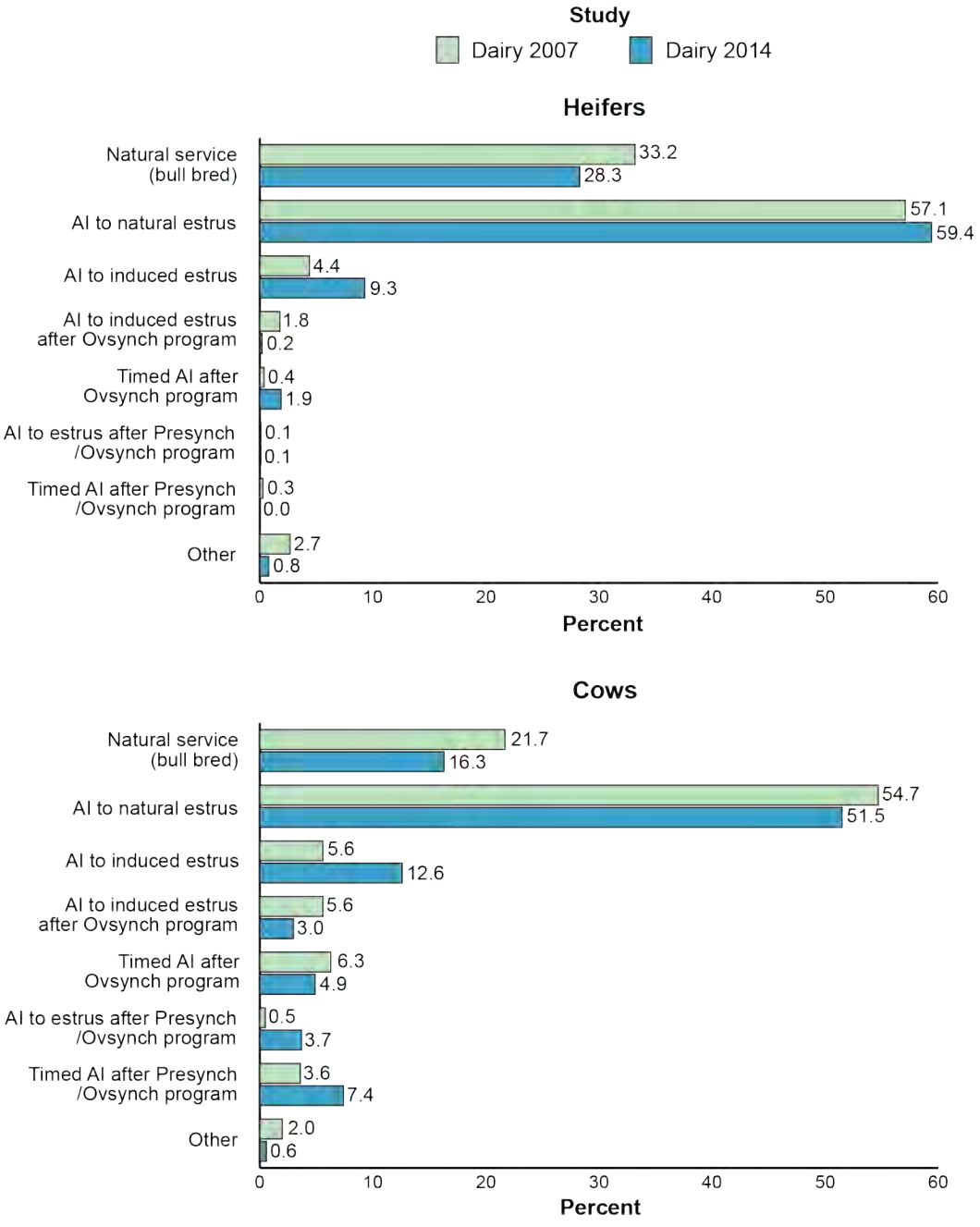
More than one-half of operations in 2007 and 2014 used AI to natural estrus as the first-service breeding for the majority of cows.

I.2.d. Percentage of operations by **first-service** breeding practice used for the majority of **cows**:

	Percent Operations			
	Dairy 2007		Dairy 2014	
First-service breeding practice	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Natural service (bull bred)	21.7	(2.7)	16.3	(3.3)
AI to natural estrus (no injections given to induce estrus)	54.7	(3.0)	51.5	(4.0)
AI to induced estrus (prostaglandin injections only)	5.6	(1.3)	12.6	(2.4)
AI to induced estrus after Ovsynch program (prostaglandin and GnRH injections)	5.6	(1.3)	3.0	(1.1)
Timed AI after Ovsynch program	6.3	(1.4)	4.9	(1.5)
AI to estrus after Presynch/Ovsynch program	0.5	(0.2)	3.7	(1.4)
Timed AI after Presynch/Ovsynch program	3.6	(0.8)	7.4	(1.6)
Other	2.0	(0.6)	0.6	(0.5)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

Percentage of operations by first-service breeding practice used for the majority of heifers and for the majority of cows



Population: Operations with 30 or more dairy cows.

There were no differences between 2007 and 2014 in the percentage of operations by second or greater breeding practice used for the majority of heifers.

I.2.e. Percentage of operations by **second or greater service** breeding practice used for the majority of **heifers**:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Second or greater service breeding practice	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Natural service (bull bred)	35.1	(2.9)	38.4	(4.0)
AI to natural estrus (no injections given to induce estrus)	46.5	(3.0)	33.0	(3.8)
AI to induced estrus (prostaglandin injections only)	11.0	(2.0)	17.1	(3.1)
AI to induced estrus after Ovsynch program (prostaglandin and GnRH injections)	4.1	(1.2)	2.7	(1.5)
Timed AI after Ovsynch program	1.0	(0.4)	4.5	(1.9)
AI to induced estrus after Resynch program	0.0	(—)	0.0	(—)
Timed AI to Resynch program	0.2	(0.1)	0.9	(0.8)
Other	2.1	(0.7)	3.4	(1.4)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

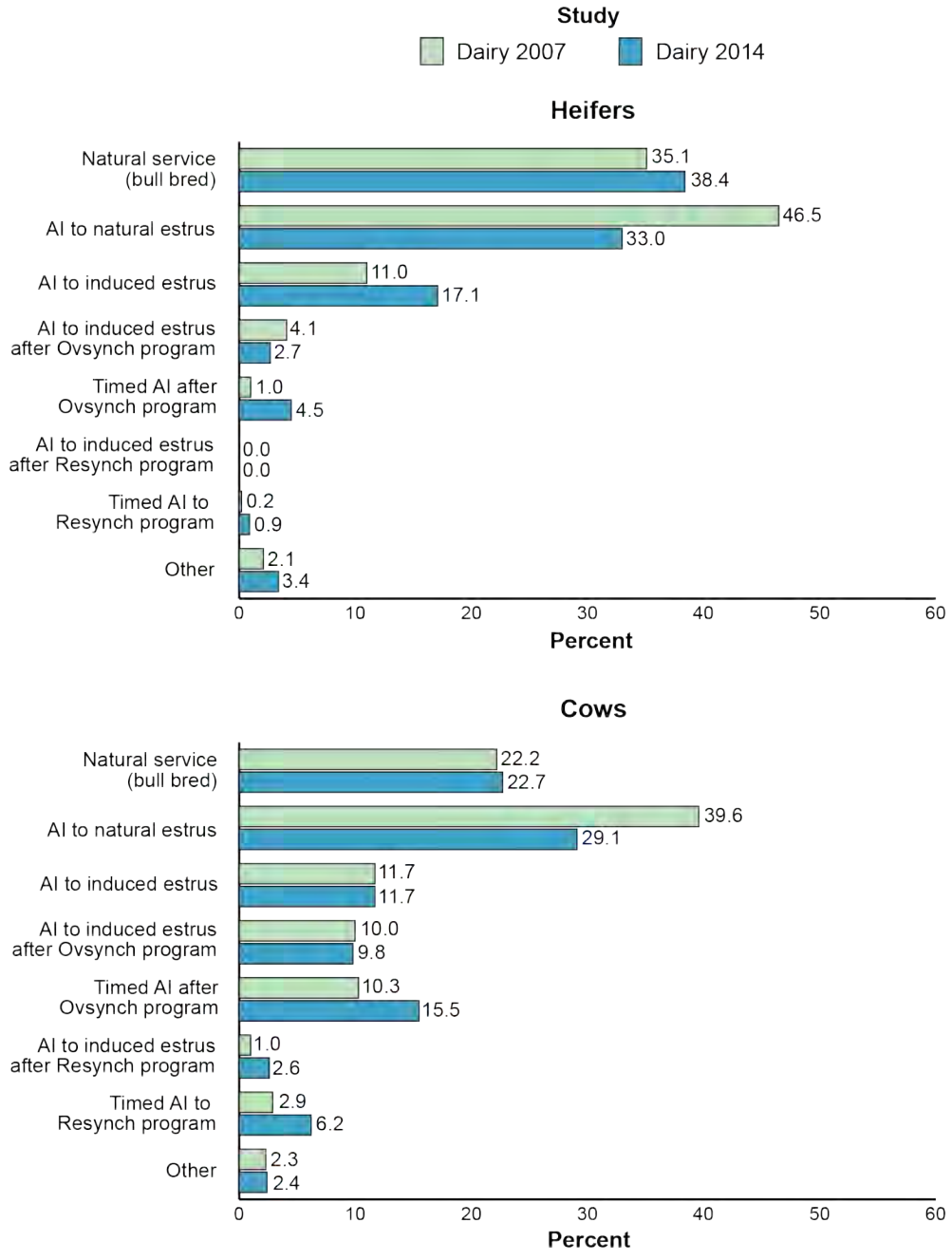
There were no differences from 2007 to 2014 in the percentage of operations by second or greater breeding practice used for the majority of cows.

I.2.f. Percentage of operations by **second or greater service** breeding practice used for the majority of **cows**:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Second or greater service breeding practice	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Natural service (bull bred)	22.2	(2.6)	22.7	(3.6)
AI to natural estrus (no injections given to induce estrus)	39.6	(3.0)	29.1	(3.7)
AI to induced estrus (prostaglandin injections only)	11.7	(2.0)	11.7	(2.8)
AI to induced estrus after Ovsynch program (prostaglandin and GnRH injections)	10.0	(1.8)	9.8	(2.4)
Timed AI after Ovsynch program	10.3	(1.8)	15.5	(2.7)
AI to induced estrus after Resynch program	1.0	(0.4)	2.6	(1.0)
Timed AI to Resynch program	2.9	(0.9)	6.2	(1.6)
Other	2.3	(0.8)	2.4	(1.3)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

Percentage of operations by second or greater service breeding practice used for the majority of heifers and for the majority of cows



Population: Operations with 30 or more dairy cows.

Timed AI was used by similar percentages of operations within each cattle class in 2007 and 2014. A lower percentage of operations used timed AI in heifers than in cows in both study years.

I.2.g. Percentage of operations that used timed AI programs to manage reproduction:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Cattle class	Pct.	Std. error	Pct.	Std. error
Heifers	25.4	(2.5)	34.9	(3.8)
Cows	57.6	(2.9)	55.5	(4.0)
Either	58.2	(2.9)	55.9	(4.0)

Population: Operations with 30 or more dairy cows.

For operations that used a timed AI program, the average number of years that timed AI programs were used increased from 7.6 years in 2007 to 11.1 years in 2014.

I.2.h. For operations that used a timed AI program (table I.2.g), average number of years timed AI programs had been used:

Average Number of Years			
Dairy 2007		Dairy 2014	
Avg.	Std. error	Avg.	Std. error
7.6	(0.5)	11.1	(0.6)

Population: Operations with 30 or more dairy cows.

The percentage of operations that used sexed semen in heifers increased from 15.7 percent in 2007 to 41.1 percent in 2014. Similarly, a higher percentage of operations used sexed semen in cows in 2014 than in 2007 (18.6 and 6.3 percent, respectively).

I.2.i. Percentage of operations that used the following reproductive technologies for heifers and for cows:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Technology	Pct.	Std. error	Pct.	Std. error
Heifers				
Fresh embryos	7.1	(1.7)	6.5	(2.0)
Frozen embryos	5.2	(1.2)	5.9	(1.8)
Any embryos	8.9	(1.8)	8.9	(2.2)
Sexed semen	15.7	(1.8)	41.1	(4.0)
Cows				
Fresh embryos	6.1	(1.6)	3.5	(1.3)
Frozen embryos	4.3	(1.2)	5.4	(1.7)
Any embryos	8.6	(1.9)	6.9	(1.9)
Sexed semen	6.3	(1.4)	18.6	(2.9)

Population: Operations with 30 or more dairy cows.

Higher percentages of heifers and cows in 2007 than in 2014 were implanted with fresh, frozen, or any embryos.

I.2.j. Percentage of heifers and cows bred using the following reproductive technologies:

	Percent Heifers/Cows*			
	Dairy 2007		Dairy 2014	
Technology	Pct.	Std. error	Pct.	Std. error
Heifers				
Fresh embryos	9.7	(2.3)	1.7	(0.6)
Frozen embryos	9.9	(2.4)	0.8	(0.3)
Any embryos	12.1	(2.5)	2.6	(0.8)
Sexed semen	30.0	(3.7)	32.5	(7.8)
Cows				
Fresh embryos	5.9	(1.7)	0.2	(0.1)
Frozen embryos	7.0	(2.1)	0.2	(0.1)
Any embryos	9.5	(2.2)	0.4	(0.2)
Sexed semen	8.0	(2.2)	3.4	(1.7)

Population: Operations with 30 or more dairy cows.
*As a percentage of weaned, pregnant heifer and cow inventories on January 1.

There were no differences from 2007 to 2014 in the percentages of operations by breeding method(s) used. Almost 90 percent of operations used any AI during those years, while about 50 percent used any natural service.

I.2.k. Percentage of operations by breeding method(s) used:

Percent Operations

	Dairy 2007		Dairy 2014	
Breeding method	**Pct.**	**Std. error**	**Pct.**	**Std. error**
AI only	45.2	(3.0)	46.0	(4.0)
Natural service only (bull bred)	11.6	(2.0)	10.6	(2.7)
AI and natural service	43.4	(3.0)	43.4	(4.0)
Any AI	88.6	(2.0)	89.3	(2.7)
Any natural service	54.9	(3.0)	54.0	(4.0)

Population: Operations with 30 or more dairy cows.

There were no differences from 2007 to 2014 in the percentages of operations with pregnancies by breeding method. Almost 90 percent of operations had pregnancies conceived by AI after detected estrus, while about one-half of operations had pregnancies by timed AI without detected estrus or natural service.

I.2.l. Percentage of operations with any pregnancies conceived, by breeding method(s) used:

Percent Operations

	Dairy 2007		Dairy 2014	
Breeding method	**Pct.**	**Std. error**	**Pct.**	**Std. error**
AI after detected estrus (natural or induced)	87.3	(2.1)	87.1	(2.9)
Timed AI without detected estrus	50.2	(3.0)	49.1	(4.0)
Natural service (bull bred)	54.9	(3.0)	54.0	(4.0)
Embryo transfer using superovulated embryo	9.0	(1.9)	7.6	(2.0)
Embryo transfer using in-vitro-produced embryo	0.9	(0.5)	3.5	(1.6)

Population: Operations with 30 or more dairy cows.

There were no differences from 2007 to 2014 in the operation average percentages of pregnancies by breeding method. About 50 percent of pregnancies were conceived by AI after detected estrus, while about a 25 percent of pregnancies were conceived by natural service.

I.2.m. Operation average percentage of pregnancies conceived, by breeding method(s) used:

	Operation Average Percent Pregnancies			
	Dairy 2007		Dairy 2014	
Breeding method	Pct.	Std. error	Pct.	Std. error
AI after detected estrus (natural or induced)	56.6	(2.1)	55.5	(2.9)
Timed AI without detected estrus	16.0	(1.3)	18.2	(2.0)
Natural service (bull bred)	26.8	(2.4)	25.4	(3.1)
Embryo transfer using superovulated embryo	0.6	(0.2)	0.7	(0.4)
Embryo transfer using in-vitro-produced embryo	0.1	(0.1)	0.2	(0.1)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

3. AI personnel and services

For operations that performed any AI, the owner/operator and AI service technicians performed almost 90 percent of AI services in both 2007 and 2014.

I.3.a. For operations that performed any AI (table I.2.k), percentage of operations by personnel who performed the majority of AI services:

Percent Operations

	Dairy 2007		Dairy 2014	
Personnel	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Owner/operator	51.0	(3.2)	45.0	(4.2)
AI service technician	40.7	(3.2)	42.5	(4.2)
Herdsman	5.6	(1.0)	9.0	(1.6)
General employee	0.3	(0.2)	2.7	(0.8)
Other	2.4	(1.0)	0.7	(0.6)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that performed any AI, almost all personnel performing AI services in 2007 and 2014 were formally trained.

I.3.b. For operations that performed any AI (table I.2.k), percentage of operations in which the person responsible for performing the majority of AI services had been formally trained to do so:

Percent Operations

Dairy 2007		Dairy 2014	
Pct.	**Std. error**	**Pct.**	**Std. error**
95.9	(1.2)	96.8	(1.3)

Population: Operations with 30 or more dairy cows.

For operations that used both AI and natural service, a higher percentage of operations in 2014 than in 2007 performed AI one or two times before using a bull for natural service in (31.3 and 10.8 percent, respectively). Additionally, a lower percentage of operations performed AI seven or more times in 2014 than in 2007 (2.5 and 18.3 percent, respectively).

I.3.c. For operations that used both AI and natural service, percentage of operations by number of times AI was performed on individual cows before a bull was used for natural service:

Percent Operations

	Dairy 2007		Dairy 2014	
Number times	**Pct.**	**Std. error**	**Pct.**	**Std. error**
1–2	10.8	(2.2)	31.3	(6.4)
3–4	33.2	(3.0)	44.5	(6.4)
5–6	37.7	(3.2)	21.7	(5.3)
7 or more	18.3	(2.1)	2.5	(1.5)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

4. Pregnancy detection

Pregnancy exams were performed weekly on a higher percentage of operations in 2014 than in 2007 (14.4 and 4.3 percent, respectively). No pregnancy exams were performed by a lower percentage of operations in 2014 than in 2007 (1.2 and 7.0 percent, respectively). In general, “other” responses were exams conducted less frequently than every other month.

I.4.a. Percentage of operations by frequency that pregnancy exams were performed:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Frequency	Pct.	Std. error	Pct.	Std. error
Weekly	4.3	(0.6)	14.4	(1.9)
Every 2 weeks	19.6	(2.1)	19.4	(2.8)
Monthly	43.1	(3.0)	34.9	(3.9)
Every other month	11.5	(2.0)	18.6	(3.3)
Other	14.5	(2.2)	11.4	(3.0)
No exams performed	7.0	(1.5)	1.2	(1.0)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

A higher percentage of operations routinely used ultrasound to determine pregnancy status in 2014 than in 2007 (44.1 and 25.4 percent, respectively). Milk progesterone was also used by a higher percentage of operations in 2014 than in 2007 (7.2 and 0.0 percent, respectively). Any method of pregnancy diagnosis was used by a higher percentage of operations in 2014 (98.8 percent) than in 2007 (92.9 percent).

I.4.b. Percentage of operations by method(s) routinely used to determine pregnancy status:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Method	Pct.	Std. error	Pct.	Std. error
Rectal palpation	79.7	(2.5)	70.6	(3.5)
Ultrasound	25.4	(2.6)	44.1	(3.9)
Either rectal palpation or ultrasound	91.3	(1.7)	91.7	(1.9)
Abdominal palpation (ballottement/bumping)			22.6	(3.5)
Milk progesterone	0.0	(—)	7.2	(2.0)
Blood test	3.8	(1.1)	4.9	(1.4)
Other	0.6	(0.3)	0.4	(0.3)
Any method	92.9	(1.5)	98.8	(1.0)
None	7.1	(1.5)	1.2	(1.0)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that routinely performed pregnancy exams via rectal palpation or ultrasound, a private veterinarian performed the majority of pregnancy exams in both 2007 and 2014. There were no differences from 2007 to 2014 in the percentages of operations by person routinely performing the majority of pregnancy exams.

I.4.c. For operations that routinely performed pregnancy exams via rectal palpation or ultrasound (table I.4.b), percentage of operations by person who performed the majority of exams:

Percent Operations

	Dairy 2007		Dairy 2014	
Person	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Private veterinarian	91.1	(1.5)	89.8	(2.1)
Veterinary technician	2.2	(0.7)	4.4	(1.6)
Owner/operator	3.7	(0.9)	2.2	(1.0)
Employee—nonveterinarian	0.9	(0.4)	2.1	(0.7)
Employee—veterinarian	0.0	(0.0)	0.5	(0.3)
Other	2.1	(1.0)	1.1	(0.6)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that used ultrasound to determine pregnancy status, the highest percentage in 2007 and 2014 reported that the ultrasound equipment was owned by a veterinarian.

I.4.d. For operations that used ultrasound to determine pregnancy status (table I.4.b), percentage of operations by owner of ultrasound equipment used for the majority of pregnancy diagnoses:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Owner	Pct.	Std. error	Pct.	Std. error
Veterinarian	99.6	(0.2)	97.1	(1.4)
Dairy operation	0.2	(0.1)	2.6	(1.4)
Other	0.2	(0.1)	0.4	(0.3)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that used ultrasound to determine pregnancy status, the percentage of operations by information other than pregnancy status collected/evaluated during ultrasound exams was similar in 2007 and 2014.

I.4.e. For operations that used ultrasound to determine pregnancy status (table I.4.b), percentage of operations by information other than pregnancy status collected/evaluated during ultrasound exams:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Additional information collected/evaluated during ultrasound	Pct.	Std. error	Pct.	Std. error
Twin pregnancies	81.2	(4.8)	93.2	(2.2)
Ovarian structures (e.g., cysts, CL, follicles)	87.0	(4.2)	89.5	(3.8)
Noncycling (no heat) cows	80.3	(4.6)	86.5	(4.0)
Assessment of fetal viability	69.9	(5.6)	79.3	(4.8)
Fetal sexing	49.0	(5.9)	45.0	(5.8)
Other	8.5	(3.5)	4.3	(2.5)
Any	93.7	(2.5)	99.1	(0.7)

Population: Operations with 30 or more dairy cows.

J. Milk Quality and Milking Procedures

1. Bulk-tank somatic cell count

The percentage of operations with bulk-tank somatic cell counts (BTSCCs) less than 200,000 cell/mL remained relatively constant from 1996 to 2007, before increasing from 2007 to 2014. Alternatively, a lower percentage of operations had BTSCCs of 400,000 cells/mL or more in 2014 than in 1996 and 2002. These changes are consistent with other data that show BTSCCs decreasing from over 300,000 cells/mL in 1996 to less than 200,000 in 2014.

J.1. Percentage of operations by average BTSCC for milk shipped during the previous 12 months:

	Percent Operations							
	Dairy 1996[1]		Dairy 2002[2]		Dairy 2007		Dairy 2014	
BTSCC (cells/mL)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 100,000	4.4	(0.7)	2.3	(0.6)	2.8	(1.0)	3.7	(1.3)
100,000 to 199,000	25.4	(1.6)	23.6	(1.9)	27.8	(2.6)	48.6	(4.0)
200,000 to 299,000	34.4	(1.7)	34.5	(2.1)	40.3	(2.8)	28.7	(3.5)
300,000 to 399,000	20.2	(1.5)	21.7	(1.7)	18.7	(2.0)	16.4	(3.2)
400,000 to 499,000	10.1	(1.2)	11.0	(1.4)	8.7	(1.9)	2.7	(1.3)
500,000 or more	5.5	(0.9)	6.8	(1.1)	1.7	(1.0)	0.0	(—)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
[1]Question variation: In 1996, questionnaire asked about previous 6 months.
[2]Question variation: In 2002, questionnaire asked about previous 90 days.

2. Milking facility and equipment

The percentage of operations that used a parlor milking facility and the percentage of cows milked in a parlor have increased since 1996. The use of tie stall/stanchion facilities have decreased at both the operation level and cow level during the same period.

J.2.a. Percentage of operations and percentage of cows on these operations by primary milking facility used:

Percent

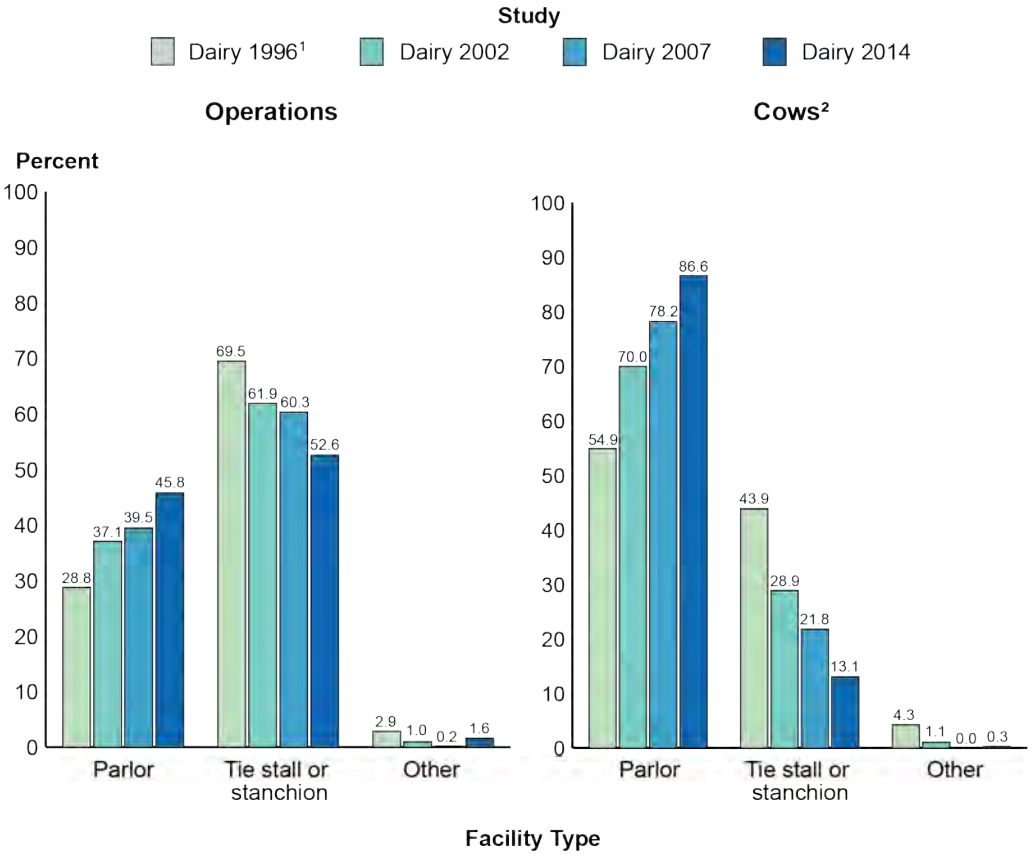
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Facility type	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Operations								
Parlor	28.8	(0.9)	37.1	(1.0)	39.5	(1.0)	45.8	(1.5)
Tie stall or stanchion	69.5	(0.9)	61.9	(1.0)	60.3	(1.0)	52.6	(1.5)
Other	2.9	(0.5)	1.0	(0.2)	0.2	(0.1)	1.6	(0.5)
Total	[1]		100.0		100.0		100.0	
Cows[2]								
Parlor	54.9	(1.0)	70.0	(0.8)	78.2	(0.6)	86.6	(0.6)
Tie stall or stanchion	43.9	(1.0)	28.9	(0.8)	21.8	(0.6)	13.1	(0.6)
Other	4.3	(0.7)	1.1	(0.2)	0.0	(0.0)	0.3	(0.1)
Total	[1]		100.0		100.0		100.0	

Population: Operations with one or more dairy cows.

[1]Question variation: Dairy 1996 did not ask about primary milking facilities; therefore, the column totals for 1996 are greater than 100 percent.

[2]As a percentage of January 1 dairy cow inventory.

Percentage of operations and percentage of cows on these operations by primary milking facility used



Population: Operations with 1 or more dairy cows.
[1]Question variation: Dairy 1996 did not ask about primary milking facilities; therefore, the column totals for 1996 are greater than 100 percent.
[2]As a percentage of January 1 dairy cow inventory.

For operations with 30 or more cows, the percentage of operations and percentage of cows by use of milking facilities were similar to those operations with 1 or more cows (table J.2.a).

J.2.b. Percentage of operations and percentage of cows on these operations by primary milking facility used:

	Percent							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Facility type	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Operations								
Parlor	31.6	(0.9)	41.1	(1.1)	42.2	(1.1)	50.6	(1.5)
Tie stall or stanchion	67.0	(0.9)	57.8	(1.1)	57.7	(1.1)	49.0	(1.5)
Other	2.9	(0.4)	1.1	(0.3)	0.0	(0.0)	0.4	(0.2)
Total	[1]		100.0		100.0		100.0	
Cows[2]								
Parlor	56.7	(1.0)	71.1	(0.8)	79.0	(0.6)	87.4	(0.6)
Tie stall or stanchion	42.2	(1.0)	27.7	(0.8)	21.0	(0.6)	12.4	(0.6)
Other	4.3	(0.7)	1.2	(0.3)	0.0	(0.0)	0.2	(0.1)
Total	[1]		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from all studies were recalculated to only include operations with 30 or more dairy cows to serve as a proper reference value for future tables in this section.

[1]Question variation: Dairy 1996 did not ask about primary milking facilities; therefore, the column totals for 1996 are greater than 100 percent.

[2]As a percentage of January 1 dairy cow inventory.

For operations that used a milking parlor, the highest percentage in 2007 and 2014 primarily used herringbone parlors, although the percentage decreased from 56.0 percent in 2007 to 45.7 percent in 2014. The percentage of cows milked in a herringbone parlor also decreased from 2007 to 2014 (48.7 and 30.7 percent, respectively). A higher percentage of operations used a parallel parlor in 2014 than in 2007 (29.9 percent and 19.4 percent, respectively), and a higher percentage of cows were milked in a parallel parlor in 2014 than in 2007 (44.7 percent and 30.6 percent, respectively).

J.2.c. For the operations that used a milking parlor (table J.2.b), percentage of operations and percentage of cows on these operations by primary milking parlor used:

	Percent Operations				Percent Cows*			
	Dairy 2007		Dairy 2014		Dairy 2007		Dairy 2014	
Primary milking parlor	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Herringbone (fishbone)	56.0	(1.7)	45.7	(2.1)	48.7	(1.9)	30.7	(1.9)
Parallel (side by side)	19.4	(1.3)	29.9	(1.8)	30.6	(1.7)	44.7	(2.3)
Parabone (herringbone-parallel hybrid)	4.0	(0.6)	8.0	(1.1)	3.9	(0.6)	5.6	(0.9)
Flat barn	8.7	(1.1)	6.6	(1.1)	6.1	(0.8)	4.0	(0.6)
Side opening (tandem)	5.9	(0.9)	3.8	(0.9)	3.6	(0.7)	1.1	(0.3)
Swing	2.4	(0.6)	2.8	(0.7)	0.8	(0.2)	1.2	(0.3)
Rotary (carousel)	1.2	(0.3)	2.0	(0.4)	5.3	(1.3)	10.7	(2.0)
Other	2.4	(0.6)	1.3	(0.4)	1.0	(0.3)	2.1	(1.1)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more cows. Estimates from studies prior to 2014 were recalculated to only include operations with 30 or more cows to match 2014 estimates.
*As a percentage of January 1 dairy cow inventory.

There were no differences across study years in the percentage of operations that used a backflush system in milking units across study years, with 6.0 percent of operations using one in 2014.

J.2.d. Percentage of operations that used a backflush system in milking units, by herd size:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	4.9	(1.1)	5.9	(1.8)	5.0	(3.0)
Medium (100-499)	9.8	(1.7)	8.6	(2.1)	4.2	(1.9)
Large (500 or more)	20.7	(3.1)	9.3	(2.6)	12.1	(2.6)
All operations	6.7	(0.9)	6.8	(1.3)	6.0	(1.7)

Population: Operations with 30 or more dairy cows.

Automatic takeoffs were used by a higher percentage of large than small operations across all study years. A higher percentage of all operations in 2007 and 2014 used automatic takeoffs compared with operations in 2002.

J.2.e. Percentage of operations that used automatic takeoffs, by herd size:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	21.3	(2.1)	30.2	(3.3)	19.9	(5.0)
Medium (100-499)	71.0	(2.8)	76.9	(3.8)	74.1	(6.0)
Large (500 or more)	93.3	(1.5)	89.5	(3.4)	93.5	(2.6)
All operations	36.0	(1.8)	45.4	(2.6)	49.1	(3.8)

Population: Operations with 30 or more dairy cows.

3. Personnel and training

There were no substantial differences from 2007 to 2014 in the percentages of operations by person who milked the majority of cows. The owner/operator milked the majority of cows on the highest percentage of operations in 2007 and 2014.

J.3.a. Percentage of operations by personnel who milked the majority of cows on the operation:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Personnel	Pct.	Std. error	Pct.	Std. error
Owner/operator	59.8	(2.5)	47.2	(4.0)
Hired worker(s) (nonfamily member)	24.6	(1.7)	30.8	(2.9)
Family member(s) of owner	15.6	(2.2)	22.0	(3.7)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

The percentage of operations that provided milkers with any training did not change from 2007 to 2014. A higher percentage of operations trained all milkers one to two times per year in 2014 (17.8 percent) than in 2007 (7.2 percent).

J.3.b. Percentage of operations by how frequently milkers were trained:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Frequency	Pct.	Std. error	Pct.	Std. error
Trained as new employees only	35.6	(2.7)	28.1	(3.3)
1 to 2 times per year for all milkers	7.2	(1.0)	17.8	(3.0)
3 to 4 times per year for all milkers	3.5	(1.0)	3.4	(1.1)
More than 4 times per year for all milkers	3.0	(0.9)	7.1	(2.1)
Other	4.7	(1.2)	3.4	(1.2)
Any training	54.0	(2.8)	59.8	(4.0)
No milker training	46.0	(2.8)	40.2	(4.0)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that trained milking personnel, the percentages of operations by method used to train milkers did not change from 2007 to 2014. On-the-job was used by nearly all operations in both study years (97.1 percent).

J.3.c. For operations that trained milking personnel (table J.3.b), percentage of operations by method(s) used to train milkers:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Method	Pct.	Std. error	Pct.	Std. error
On-the-job training	97.1	(0.9)	97.1	(1.1)
Discussion/lecture	31.9	(3.2)	40.7	(4.4)
Video/Web-based training	6.9	(1.1)	12.0	(2.3)

Population: Operations with 30 or more dairy cows.

Milkers wore gloves to milk all cows on a higher percentage of operations in 2007 and 2014 than in 2002. The percentage of cows on operations in which milkers wore gloves increased from 48.7 percent in 2002 to 87.9 percent in 2014.

J.3.d. Percentage of operations and percentage of cows on these operations in which milkers wore gloves to milk all cows:

Percent Operations						Percent Cows[1]					
Dairy 2002		Dairy 2007[2]		Dairy 2014[2]		Dairy 2002		Dairy 2007[2]		Dairy 2014[2]	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
32.9	(1.9)	55.2	(2.8)	59.1	(4.1)	48.7	(1.9)	76.8	(2.5)	87.9	(2.2)

Population: Operations with 30 or more dairy cows.
[1]As a percentage of January 1 dairy cow inventory.
[2]Question variation: In 2007 and 2014, questionnaire specified latex or nitrile gloves.

4. Milking frequency

In 2014, 87.8 percent of operations milked the majority of cows two times per day compared with 92.5 percent of operations in 2007. The percentage of operations that milked the majority of cows three times per day increased from 7.0 percent in 2007 to 12.0 percent in 2014.

J.4.a Percentage of operations by number of times per day the majority of cows* were milked:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Times per day	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
1	0.5	(0.4)	0.5	(0.4)	0.1	(0.1)
2	93.6	(0.8)	92.5	(0.9)	87.8	(0.8)
3	5.8	(0.7)	7.0	(0.8)	12.0	(0.8)
More than 3	0.1	(0.1)	0.0	(—)	0.1	(0.1)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from 2014 were recalculated to only include operations with 30 or more cows to match previous study estimates.
*Question variation: In 2007, questionnaire specified 'other than fresh cows.'

The percentage of cows milked twice per day remained constant from 2002 to 2007 but decreased from 2007 to 2014. The percentage of cows milked three times per day increased from 2002 to 2014.

J.4.b Percentage of cows by number of times per day the majority of cows[1] were milked:

	Percent Cows[2]					
	Dairy 2002		Dairy 2007		Dairy 2014	
Times per day	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
1	0.1	(0.1)	0.1	(0.1)	0.1	(0.0)
2	78.6	(1.7)	73.6	(3.4)	60.4	(1.8)
3	21.2	(1.7)	26.3	(3.4)	39.2	(1.8)
More than 3	0.1	(0.1)	0.0	(—)	0.3	(0.3)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from 2014 were recalculated to only include operations with 30 or more cows to match previous study estimates.
[1]Question variation: In 2007, questionnaire specified 'other than fresh cows.'
[2]As a percentage of January 1 dairy cow inventory.

5. Milking procedures

A higher percentage of operations in 2007 and 2014 forestripped all cows than operations in 2002. A lower percentage of operations in 2014 than in 2002 and 2007 forestripped some cows. A similar percentage of operations across study years did not forestrip cows.

J.5.a. Percentage of operations by use of forestripping:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Forestripping	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
All cows	44.5	(2.1)	58.9	(2.9)	72.4	(3.6)
Some cows	42.4	(2.1)	33.7	(2.8)	15.9	(2.9)
Any	86.9	(1.5)	92.6	(1.6)	88.4	(2.8)
None	13.1	(1.5)	7.4	(1.6)	11.6	(2.8)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that forestripped any cows, a lower percentage of operations in 2014 (25.0 percent) than in 2007 (43.3 percent) forestripped cows after disinfecting and drying teats.

J.5.b. For operations that forestripped any cows (table J.5.a), percentage of operations by order of forestripping:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Forestripping order	Pct.	Std. error	Pct.	Std. error
Before teat disinfection applied	27.4	(2.6)	34.5	(4.2)
After applying teat disinfection but before drying teats	29.3	(2.6)	40.6	(4.0)
After disinfection and after drying	43.3	(2.9)	25.0	(3.6)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

There were no substantial changes from 2007 to 2014 in the percentages of operations by method used to dry teats before milking.

J.5.c. Percentage of operations by the method(s) used to dry teats before milking:

	Percent Operations			
	Dairy 2007*		Dairy 2014	
Drying Method	Pct.	Std. error	Pct.	Std. error
Air dry	12.4	(2.1)	8.5	(2.4)
Single-use cloth towel	21.5	(2.1)	31.7	(3.3)
Single-use paper towel	54.8	(2.8)	44.5	(4.0)
Multiple-use cloth towel	7.1	(1.3)	12.1	(2.9)
Multiple-use paper towel	0.6	(0.4)	0.4	(0.3)
Other	0.4	(0.3)		
Not applicable – teats not wet prior to milking	3.2	(1.1)	2.8	(1.2)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.
*Question variation: In 2007, questionnaire asked about summer and winter season separately. Summer estimates are provided.

Across study years, about 95 percent of operations disinfected teats postmilking. The percentage of operations that foamed teats with commercial postdip increased from 0.5 percent in 2007 to 5.6 percent in 2014, representing the only change from 2007 to 2014 in the percentages of operations by primary method used to disinfect teats.

J.5.d. Percentage of operations by primary method used to disinfect teats postmilking:

	Percent Operations			
	Dairy 2007*		Dairy 2014	
Method	Pct.	Std. error	Pct.	Std. error
Dip teats with commercial postdip	79.7	(2.4)	80.1	(3.2)
Spray teats with commercial postdip	12.6	(1.8)	11.0	(2.6)
Foam teats with commercial postdip	0.5	(0.3)	5.6	(1.5)
Dip teats with homemade (not commercial) postdip	0.5	(0.4)	0.1	(0.1)
Teats covered in commercial powder	0.1	(0.1)	0.0	(—)
Other	1.4	(0.9)	0.0	(—)
Any	94.8	(1.6)	96.8	(1.4)
None	5.2	(1.6)	3.2	(1.4)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.
*Question variation: In 2007, questionnaire asked about summer and winter season separately. Summer estimates are provided.

There were no changes from 2007 to 2014 in the percentages of operations by how or when a barrier dip was used.

J.5.e. Percentage of operations by use of barrier teat dip:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Use of barrier teat dip	Pct.	Std. error	Pct.	Std. error
All cows on the operation all the time	24.5	(2.2)	30.1	(3.8)
All cows during winter or adverse weather	2.3	(0.6)	6.1	(1.7)
Only on selected cows (e.g., mastitis)			3.4	(1.6)
Other	6.5	(1.6)	2.4	(1.1)
Any barrier	33.3	(2.5)	41.9	(4.0)
No barrier teat dip used on the operation	66.7	(2.5)	58.1	(4.0)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

6. Milk cultures

There were no changes from 2007 to 2014 in the percentages of operations by source of milk cultures.

J.6.a. Percentage of operations by source of milk cultures:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Source	Pct.	Std. error	Pct.	Std. error
Individual cows	42.6	(2.7)	45.4	(4.1)
Bulk-tank milk	33.6	(2.5)	34.2	(3.6)
String samples*	1.9	(0.3)	4.2	(0.9)
Any	52.9	(2.8)	57.0	(4.0)

Population: Operations with 30 or more dairy cows.
*Aggregate samples representing a group/pen of cows, such as fresh cows.

For operations that performed milk cultures on individual cows, there were no changes in the percentages of operations by the type of cows typically selected for individual milk cultures.

J.6.b. For operations that performed milk cultures on individual cows (table J.6.a), percentage of operations by type of cows typically selected for milk cultures:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Cow type	Pct.	Std. error	Pct.	Std. error
Fresh cows	13.9	(2.5)	12.3	(2.9)
All clinical mastitis cases	30.5	(3.7)	40.6	(6.0)
Chronic clinical mastitis cases	59.1	(4.2)	55.8	(6.2)
Clinical mastitis cases that did not respond to treatment	54.0	(4.3)	47.9	(6.1)
High somatic cell count cows	41.1	(3.9)	45.2	(6.3)
Other	9.5	(3.0)	7.6	(2.8)

Population: Operations with 30 or more dairy cows.

For operations that performed milk cultures on individual cows, there were no changes from 2007 to 2014 in the percentages of operations by facility used to perform milk cultures.

J.6.c. For operations that performed milk cultures on individual cows (table J.6.a), percentage of operations by facility used to perform cultures:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Facility	Pct.	Std. error	Pct.	Std. error
Commercial lab	41.5	(3.6)	47.2	(5.4)
Private veterinary lab (veterinary clinic)	49.2	(3.7)	39.0	(5.2)
State or university diagnostic laboratory	31.8	(3.3)	26.9	(4.7)
On farm, by farm personnel	9.0	(1.8)	7.9	(2.2)

Population: Operations with 30 or more dairy cows.

For operations that performed any milk cultures on individual cows, a higher percentage of operations in 2014 than in 2007 found environmental streptococci via milk culture (79.9 and 60.1 percent, respectively).

J.6.d. For operations that performed any milk cultures on individual cows (table J.6.a), percentage of operations by organisms identified:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Organism	Pct.	Std. error	Pct.	Std. error
Environmental S*treptococci* (*Strep.* spp.) non*agalactiae*	60.1	(3.8)	79.9	(4.5)
Staphylococcus aureus	52.3	(3.9)	66.6	(5.1)
*E. coli/Klebsiella/*other gram negative	53.3	(3.8)	52.4	(5.5)
Coagulase neg. staph (*Staph.* spp.) non-*aureus*	33.5	(3.5)	40.8	(5.3)
Streptococcus. agalactiae	34.4	(3.6)	37.5	(5.3)
Mycoplasma	5.7	(1.9)	8.7	(2.0)

Population: Operations with 30 or more dairy cows.

7. Mastitis vaccination

A lower percentage of operations in 2014 (27.9 percent) than in 2007 and 2002 (37.6 and 36.0 percent, respectively) vaccinated cows for coliform mastitis during the previous 12 months.

J.7. Percentage of operations that vaccinated cows for coliform mastitis during the previous 12 months:

Percent Operations

Dairy 2002[1]		Dairy 2007[2]		Dairy 2014	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
36.0	(2.0)	37.6	(2.6)	27.9	(1.4)

Population: Operations with 30 or more dairy cows. Estimates from 2014 were recalculated to only include operations with 30 or more cows to match previous study estimates.
[1]Question variation: In 2002, questionnaire asked about 'majority of cows.
[2]Question variation: In 2007, questionnaire asked about 'all or some cows.

8. Dry-off procedures/antimicrobial treatment

Approximately 90 percent of operations dry-treated some cows with intramammary antimicrobials in 2007 and 2014, and these operations represented about 95 percent of all cows in 2007 and 2014.

J.8.a. Percentage of operations and percentage of cows on these operations by percentage of cows treated with dry-cow intramammary antimicrobials at dry-off during the previous 12 months:

	Percent Operations						Percent Cows[1]					
	Dairy 2002		Dairy 2007		Dairy 2014[2]		Dairy 2002		Dairy 2007		Dairy 2014[2]	
Percent dry cows treated	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0.0	5.9	(1.0)	9.9	(1.7)	9.2	(2.0)	4.3	(0.8)	5.9	(1.5)	4.7	(1.4)
1.0 to 33.0	7.1	(1.2)	5.6	(1.4)	6.0	(1.9)	3.7	(0.6)	2.7	(0.9)	2.2	(0.8)
33.1 to 66.0	2.9	(0.7)	3.0	(0.8)	1.0	(0.8)	1.9	(0.6)	2.4	(0.8)	0.2	(0.2)
66.1 to 99.9	8.9	(1.2)	9.2	(1.8)	7.2	(2.0)	6.6	(0.9)	7.3	(1.3)	17.7	(6.2)
100.0	75.2	(1.9)	72.3	(2.7)	76.5	(3.2)	83.4	(1.4)	81.7	(2.3)	75.1	(6.2)
Total	100.0		100.0		100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
[1]As a percentage of January 1 dairy cow inventory.
[2]2014 estimates were recalculated to be consistent with questionnaire design of previous study years.

For cows treated with dry cow intramammary antimicrobials, the percentage that received beta-lactam third-generation cephalosporins increased from 7.0 percent of dry cows treated in 2007 to 22.7 percent of dry cows treated in 2014.

J.8.b. For cows treated with dry cow intramammary antimicrobials during the previous 12 months (table J.8.a), percentage of cows treated, by antimicrobial class used:

		Percent Dry Cows[1] Treated					
		Dairy 2002		Dairy 2007		Dairy 2014	
Product (ingredient)	Antimicrobial class	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Cefa-Dri®/ Tomorrow (cephapirin benzathine)	Beta-lactam–1st generation cephalosporin	42.1	(1.8)	31.0	(2.3)	30.7	(5.4)
Quartermaster® Dry Cow Treatment (penicillin G procaine/ dihydrostreptomycin)	Other	31.7	(2.0)	36.9	(3.2)	24.4	(7.4)
SPECTRAMAST® DC (ceftiofur hydrochloride)[2]	Beta-lactam–3rd generation cephalosporin			7.0	(2.0)	22.7	(4.0)
Albadry® Plus Suspension (penicillin G procaine/ novobiocin)	Other	5.8	(1.0)	13.2	(2.4)	11.8	(4.0)
Boviclox; Dry-Clox®; Dry-Clox Intramammary Infusion; Orbenin-DC® (cloxacillin benzathine)	Beta-lactam penicillin	12.8	(1.4)	7.9	(1.8)	8.8	(2.4)
Hanford's/US Vet Go Dry (penicillin G procaine)	Beta-lactam penicillin	1.3	(0.4)	1.7	(0.5)	0.7	(0.4)
Gallimycin®-Dry (erythromycin)	Macrolide	0.8	(0.3)	0.3	(0.1)	0.0	(—)
Biodry® (novobiocin)	Aminoglycoside	5.7	(1.1)	2.5	(1.9)	0.0	(—)
Other		0.2	(0.1)	0.0	(—)	0.9	(0.5)

Population: Operations with 30 or more dairy cows.
[1]As a percentage of cows dry treated during the previous 12 months. Some cows were treated with more than one antimicrobial.
[2]Approved for use in dry cows in 2005.

Internal teat sealants at dry-off were used by about one-third of operations in 2007 and 2014, while external teat sealants were used by about 15 percent of operations in both study years.

J.8.c. Percentage of operations by use of teat sealants at dry-off:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Teat sealant	Pct.	Std. error	Pct.	Std. error
Internal	36.3	(2.7)	36.9	(3.7)
External	17.2	(2.2)	14.0	(2.4)

Population: Operations with 30 or more dairy cows.

9. Residue testing

A higher percentage of small and all operations in 2014 than in 2007 tested milk on-farm for antimicrobial residues.

J.9.a. Percentage of operations that tested milk on-farm for antimicrobial residues, and by herd size:

Percent Operations

	Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	44.2	(3.8)	69.6	(5.9)
Medium (100-499)	64.5	(4.0)	81.3	(4.8)
Large (500 or more)	53.2	(5.4)	56.3	(5.3)
All operations	49.8	(2.9)	70.8	(3.6)

Population: Operations with 30 or more dairy cows.

For operations that tested milk on-farm for antimicrobial residues, there were no differences from 2007 to 2014 in the percentages of operations by test used to evaluate the presence of antimicrobial residues in milk. The Delvotest® was used by more than one-half of operations across study years.

J.9.b. For operations that tested milk on-farm for antimicrobial residues (table J.9.a), percentage of operations by test most commonly used:

Percent Operations

	Dairy 2007		Dairy 2014	
Test	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Delvotest®	62.9	(3.6)	54.3	(5.2)
Snap® kit (beta lactam or tetracycline)	22.8	(2.9)	31.1	(4.8)
Charm Farm	10.8	(2.7)	10.4	(2.4)
Penzyme® Milk Test	1.7	(0.6)	2.6	(1.8)
CITE Probe®	0.0	(—)	0.0	(—)
Other	1.8	(0.8)	1.6	(0.9)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that tested milk on-farm for antimicrobial residues, about 90 percent in both study years tested individual cows that were recently treated with. Milk samples from the bulk tank before processor pickup were tested for antimicrobial residues on a higher percentage of operations in 2014 than in 2007 (51.8 and 29.1 percent, respectively).

J.9.c. For operations that tested milk on-farm for antimicrobial residues (table J.9.a), percentage of operations by source of milk sample tested:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Sample source	Pct.	Std. error	Pct.	Std. error
Individual cows recently treated with antimicrobials	90.9	(1.6)	89.7	(3.0)
Fresh cows	57.8	(3.7)	57.3	(5.2)
Bulk tank—before processor pickup	29.1	(3.3)	51.8	(5.2)
Other	8.3	(1.9)	1.1	(0.7)

Population: Operations with 30 or more dairy cows.

K. Antimicrobial Use

1. Preweaned heifers

The majority of preweaned heifers affected with the diseases listed in the following table were treated with antimicrobials. There were no substantial differences across study years or by disease or disorder in the percentages of affected preweaned heifers treated with antimicrobials.

K.1.a. For preweaned heifers affected with the following diseases or disorders during the previous 12 months (table D.2.a), percentage treated with an antimicrobial:

Percent Affected Preweaned Heifers Treated

	Dairy 2002		Dairy 2007		Dairy 2014*	
Disease or disorder	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Diarrhea or other digestive problem	85.7	(2.0)	74.5	(4.8)	75.9	(4.5)
Respiratory	95.6	(1.1)	93.4	(2.3)	94.8	(2.9)
Navel infection	82.8	(4.9)	92.3	(2.4)	91.0	(4.7)
Other	96.9	(2.0)	97.2	(1.9)	65.8	(16.4)

Population: Operations with 30 or more dairy cows.
*Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.

The percentage of operations by primary antimicrobial used to treat preweaned heifers for diarrhea/other digestive problems remained similar from 2002 to 2014. There were, however, a few changes in the percentage of preweaned heifers by primary antimicrobial received. For example, a lower percentage of treated preweaned heifers received macrolides for diarrhea in 2014 than in 2002 (1.0 and 7.1 percent, respectively). Similarly, a lower percentage of treated preweaned heifers received sulfonamides to treat diarrhea in 2014 than in 2002 (8.6 and 23.8 percent, respectively).

K.1.b. Percentage of operations by primary antimicrobial used to treat preweaned heifers for diarrhea/other digestive problems during the previous 12 months (including operations that reported no diarrhea/other digestive problems), and percentage of treated preweaned heifers by primary antimicrobial received:

Diarrhea/other Digestive Disease

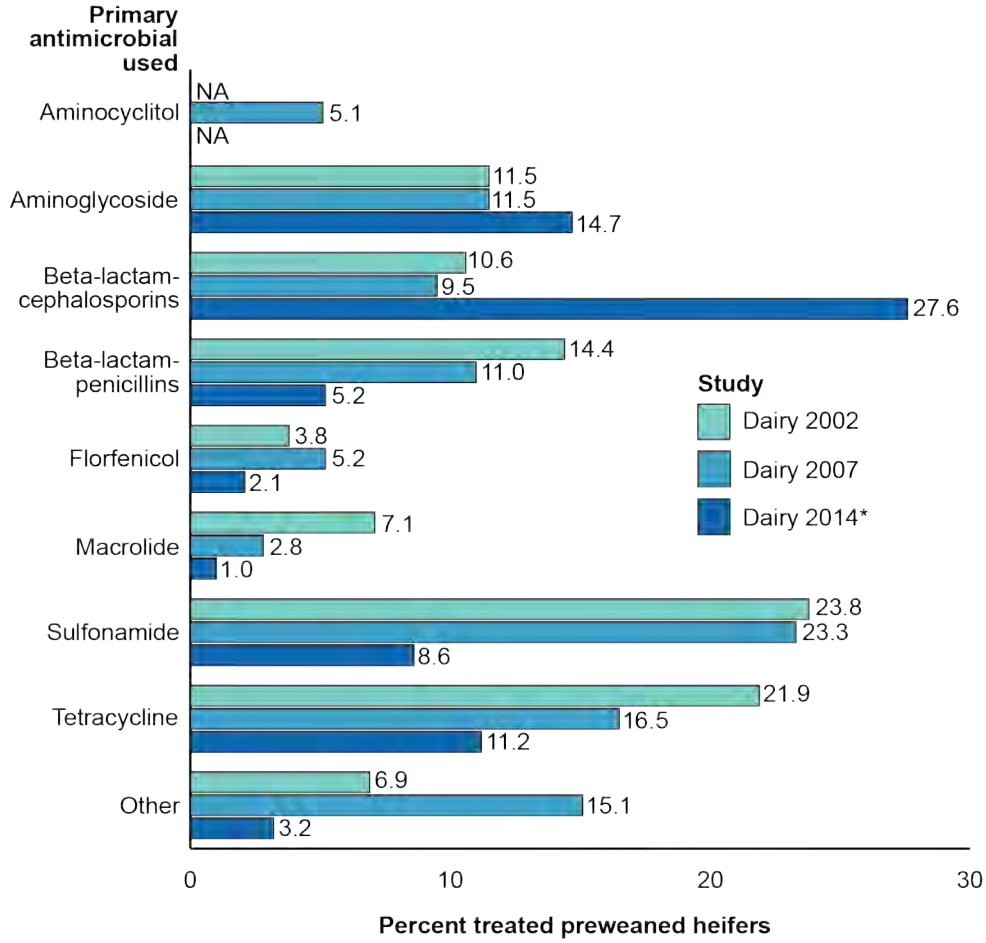
	Percent Operations							Percent Treated Preweaned Heifers					
	Dairy 2002		Dairy 2007		Dairy 2014[1]			Dairy 2002		Dairy 2007		Dairy 2014[1]	
Primary antimicrobial used	**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**		**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**
Aminocyclitol			1.7	(0.7)						5.1	(2.0)		
Aminoglycoside	6.0	(1.0)	4.0	(1.1)	7.3	(2.3)		11.5	(2.5)	11.5	(3.9)	14.7	(7.2)
Beta-lactam–cephalosporins	4.7	(0.8)	5.6	(1.1)	8.9	(2.1)		10.6	(2.0)	9.5	(2.3)	27.6	(9.0)
Beta-lactam–penicillins	12.4	(1.6)	9.4	(1.8)	7.5	(2.2)		14.4	(2.3)	11.0	(2.8)	5.2	(2.1)
Florfenicol	2.3	(0.6)	4.0	(1.1)	1.5	(0.7)		3.8	(1.1)	5.2	(1.8)	2.1	(1.1)
Fluoroquinolone					5.7	(1.4)						7.6	(2.4)
Macrolide	3.4	(0.9)	1.5	(0.5)	0.9	(0.8)		7.1	(1.8)	2.8	(1.6)	1.0	(1.0)
Sulfonamide	13.8	(1.6)	9.2	(1.5)	6.6	(2.3)		23.8	(2.7)	23.3	(6.2)	8.6	(3.1)
Tetracycline	12.8	(1.4)	16.2	(2.3)	10.7	(2.9)		21.9	(3.2)	16.5	(2.9)	11.2	(4.4)
Trimethoprim/sulfa					8.5	(2.0)						18.7	(7.8)
Other/unknown	3.8	(0.8)	10.5	(1.8)	6.4	(1.9)		6.9	(1.5)	15.1	(3.0)	3.2	(1.7)
Any antimicrobial	59.2	(2.2)	62.1	(2.8)	64.1	(3.9)	Total	100.0		100.0		100.0	
Disease but no treatment	7.0	(1.2)	17.4	(2.2)	35.9[2]	(3.9)	Pct. all heifers treated (table D.2.a.)	13.1	(0.8)	17.9	(1.7)	16.0	(2.0)
No disease or disorder	33.8	(2.1)	20.5	(2.4)									
Total	100.0		100.0		100.0								

Population: Operations with 30 or more dairy cows.

[1]Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.

[2]Question variation: In 2014, due to questionnaire design, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

Percentage of treated preweaned heifers by primary antimicrobial used during the previous 12 months to treat heifers for diarrhea or other digestive disease



Population: Operations with 30 or more dairy cows
*Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.

The primary antimicrobial used on operations to treat preweaned heifers for respiratory disease remained similar across study years. The only notable change observed was the percentage of operations that used macrolides as their primary antimicrobial for treating respiratory disease: 9.6 percent of operations in 2002 used macrolides compared with 18.2 percent in 2014.

The most substantial change from 2002 to 2014 in the percentage of treated preweaned heifers by primary antimicrobial received was the decrease in the use of tetracyclines; in 2002, 17.9 percent of treated preweaned heifers received tetracyclines for respiratory disease compared with 2.7 percent of heifers in 2014.

K.1.c. Percentage of operations by primary antimicrobial used to treat preweaned heifers for respiratory disease during the previous 12 months (including operations reporting no respiratory disease), and percentage of treated preweaned heifers by primary antimicrobial received:

Respiratory Disease

	Percent Operations						Percent Treated Preweaned Heifers					
	Dairy 2002		Dairy 2007		Dairy 2014[1]		Dairy 2002		Dairy 2007		Dairy 2014[1]	
Primary antimicrobial used	Pct.	(SE)	Pct.	(SE)	Pct.	(SE)	Pct.	(SE)	Pct.	(SE)	Pct.	(SE)
Aminoglycoside	1.1	(0.4)	0.6	(0.4)	0.0	(—)	1.8	(0.7)	2.4	(1.7)	0.0	(—)
Beta-lactam–cephalosporins	6.9	(1.0)	8.2	(1.5)	5.9	(1.7)	14.6	(2.0)	24.6	(8.5)	10.3	(5.1)
Beta-lactam–penicillins	13.9	(1.7)	11.6	(2.0)	8.1	(2.6)	14.5	(2.0)	7.9	(2.1)	9.1	(3.5)
Florfenicol	11.8	(1.4)	18.3	(2.2)	15.1	(2.9)	29.3	(3.3)	25.4	(5.5)	35.6	(9.0)
Fluoroquinolone					6.6	(1.7)					7.2	(2.4)
Macrolide	9.6	(1.3)	15.2	(2.1)	18.2	(2.8)	16.1	(2.2)	19.8	(3.7)	31.7	(6.4)
Sulfonamide	2.8	(0.8)	1.9	(0.7)	1.0	(0.8)	3.9	(1.4)	3.3	(1.8)	0.9	(0.6)
Tetracycline	9.7	(1.2)	8.9	(1.7)	6.1	(1.9)	17.9	(2.7)	13.2	(3.3)	2.7	(1.1)
Trimethoprim/sulfa					0.5	(0.4)					0.1	(0.1)
Other/unknown	1.9	(0.5)	2.0	(0.7)	0.4	(0.3)	1.9	(0.6)	3.3	(1.5)	2.4	(2.2)

Population: Operations with 30 or more dairy cows.
[1]Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.
[2]Question variation: In 2014, due to questionnaire design, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

K.1.c. (continued) Percentage of operations by primary antimicrobial used to treat preweaned heifers for respiratory disease during the previous 12 months (including operations reporting no respiratory disease), and percentage of treated preweaned heifers by primary antimicrobial received:

Respiratory Disease

	Percent Operations							Percent Treated Preweaned Heifers					
	Dairy 2002		Dairy 2007		Dairy 2014[1]			Dairy 2002		Dairy 2007		Dairy 2014[1]	
Primary antimicrobial used	**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**		**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**
Any antimicrobial	57.7	(2.3)	66.7	(2.8)	62.0	(4.1)	Total	100.0		100.0		100.0	
Disease but no treatment	0.5	(0.3)	1.4	(0.6)	38.0[2]	(4.1)	Pct. all heifers treated (table D.2.a.)	8.6	(0.5)	11.4	(1.3)	11.4	(1.3)
No disease or disorder	41.8	(2.3)	31.9	(2.8)									
Total	100.0		100.0		100.0								

Population: Operations with 30 or more dairy cows.
[1]Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.
[2]Question variation: In 2014, due to questionnaire design, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

The percentage of operations and the percentage of treated preweaned heifers by primary antimicrobial used for navel infections were similar across study years.

K.1.d. Percentage of operations by primary antimicrobial used to treat preweaned heifers for navel infection during the previous 12 months (including operations reporting no navel infections), and percentage of treated preweaned heifers by primary antimicrobial received:

Navel Infection

	Percent Operations							Percent Treated Preweaned Heifers					
	Dairy 2002		Dairy 2007		Dairy 2014[1]			Dairy 2002		Dairy 2007		Dairy 2014[1]	
Primary antimicrobial used	**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**		**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**
Aminoglycoside	0.3	(0.2)	0.0	(0.0)	0.0	(—)		0.5	(0.5)	0.3	(0.2)	0.0	(—)
Beta-lactam–cephalosporins	1.1	(0.4)	2.2	(0.6)	1.6	(0.8)		4.8	(2.1)	5.0	(1.7)	17.4	(8.1)
Beta-lactam–penicillins	11.4	(1.3)	21.2	(2.5)	18.7	(2.8)		80.5	(4.2)	69.6	(7.9)	58.1	(8.5)
Florfenicol	0.6	(0.4)	1.1	(0.5)	2.9	(1.6)		3.9	(2.6)	3.7	(2.0)	12.2	(6.3)
Fluoroquinolone					0.5	(0.3)						3.2	(2.3)
Macrolide	0.3	(0.3)	0.8	(0.4)	1.8	(1.1)		1.2	(1.1)	11.6	(8.9)	2.2	(1.5)
Sulfonamide	0.1	(0.1)	0.9	(0.9)	0.0	(—)		0.4	(0.3)	1.8	(1.8)	0.0	(—)
Tetracycline	1.4	(0.4)	1.4	(0.4)	2.0	(1.0)		8.7	(2.8)	6.7	(3.2)	4.0	(1.9)
Trimethoprim/sulfa					0.0	(—)						0.0	(—)
Other/unknown	0.0	(0.0)	1.1	(0.6)	1.2	(0.7)		0.0	(—)	1.3	(0.6)	2.7	(2.4)
Any antimicrobial	15.2	(1.5)	28.7	(2.6)	28.7	(3.4)	Total	100.0		100.0		100.0	
Disease but no treatment	1.8	(0.6)	2.5	(0.7)	71.3[2]	(3.4)	Pct. all heifers treated (table D.2.a.)	0.8	(0.1)	1.5	(0.2)	1.5	(0.2)
No disease or disorder	83.0	(1.6)	68.8	(2.7)									
Total	100.0		100.0		100.0								

Population: Operations with 30 or more dairy cows.

[1]Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.

[2]Question variation: In 2014, due to questionnaire design, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

2. Weaned heifers

There were no differences from 2007 to 2014 in the percentages of operations by antimicrobial use in weaned-heifer rations to prevent disease or promote growth.

K.2.a. Percentage of operations by use of antimicrobials in weaned-heifer rations to prevent disease or promote growth during the previous 12 months:

	Percent Operations			
	Dairy 2007		Dairy 2014[1]	
Antimicrobial use	Pct.	Std. error	Pct.	Std. error
Antimicrobials in heifer ration	18.2	(2.0)	25.4	(3.4)
Ionophores[2] only in heifer ration	32.7	(2.6)	30.5	(3.7)
Any antimicrobials	50.9	(2.8)	55.9	(4.1)
Did not know if antimicrobials were in heifer ration	2.3	(0.9)		
No antimicrobials (or ionophores) in heifer ration	44.2	(2.8)	43.8	(4.1)
No weaned heifers on operation	2.6	(0.8)	0.3	(0.2)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.
[1]Question variation: In 2014, questionnaire asked if medications were used in feed or water for any weaned or pregnant dairy heifers.
[2]Ionophores have not consistently been considered antimicrobials, but according to FDA guidelines ionophores are a type of antimicrobial.

For operations that used antimicrobials in weaned-heifer rations, percentage that used neomycin sulfate in weaned-heifer rations decreased from 4.1 percent in 2007 to 0.1 percent in 2014. There were no other changes from 2007 to 2014 in the percentages of operations by antimicrobial used in weaned-heifer rations.

K.2.b. For operations that used antimicrobials in weaned-heifer rations during the previous 12 months (table K.2.a), percentage of operations by antimicrobial used:

	Percent Operations			
	Dairy 2007		Dairy 2014[1]	
Antimicrobial used	Pct.	Std. error	Pct.	Std. error
Ionophores[2]	84.9	(2.8)	90.2	(2.9)
Chlortetracycline compounds	14.4	(2.3)	22.3	(4.2)
Oxytetracycline compounds	10.9	(2.2)	6.2	(1.7)
Neomycin-oxytetracycline	5.4	(1.9)	2.1	(1.2)
Sulfamethazine	5.7	(1.5)	1.2	(0.6)
Neomycin sulfate	4.1	(1.8)	0.1	(0.1)
Bacitracin methylene disalicylate	0.0	(—)		
Bambermycin	0.5	(0.5)		
Tylosin phosphate	0.0	(—)		
Virginiamycin	0.2	(0.2)		
Other antimicrobials	2.0	(1.4)	0.3	(0.3)

Population: Operations with 30 or more dairy cows.
[1]Question variation: In 2014, questionnaire asked if medications were used in feed or water for any weaned or pregnant dairy heifers.
[2]Ionophores have not consistently been considered antimicrobials, but according to FDA guidelines ionophores are a type of antimicrobial.

Across study years, the highest percentages of weaned heifers affected with and treated for diseases in the following table remained consistent.

K.2.c. For weaned heifers affected with the following diseases or disorders during the previous 12 months (table D.2.b), percentage treated with an antimicrobial:

Percent Weaned Heifers Affected and Treated

	Dairy 2002		Dairy 2007		Dairy 2014*	
Disease or disorder	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Respiratory	97.5	(0.9)	93.3	(1.8)	91.8	(3.2)
Diarrhea or other digestive problem	50.7	(12.6)	85.4	(7.8)	52.7	(18.2)
Other	86.3	(4.3)	81.3	(8.9)	92.4	(3.6)

Population: Operations with 30 or more dairy cows.
*Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.

A higher percentage of operations in 2014 than in 2002 used macrolides as the primary antimicrobial to treat weaned heifers for respiratory disease (14.1 and 6.5 percent, respectively). A higher percentage of weaned heifers were given tetracycline to treat respiratory disease in 2002 (34.3 percent) than in 2014 (14.7 percent).

K.2.d. Percentage of operations by primary antimicrobial used to treat weaned heifers for respiratory disease during the previous 12 months (including operations reporting no respiratory disease), and percentage of treated weaned heifers by primary antimicrobial received:

Respiratory Disease

	Percent Operations							**Percent Treated Weaned Heifers**					
	Dairy 2002		**Dairy 2007**		**Dairy 2014[1]**			**Dairy 2002**		**Dairy 2007**		**Dairy 2014[1]**	
Primary antimicrobial used	**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**		**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**
Aminoglycoside	0.0	(0.0)	0.0	(—)	0.0	(—)		0.4	(0.4)	0.0	(—)	0.0	(—)
Beta-lactam–cephalosporins	4.6	(0.8)	4.5	(1.3)	4.9	(1.5)		5.6	(1.2)	9.8	(2.8)	13.4	(7.2)
Beta-lactam–penicillins	7.2	(1.1)	7.8	(1.6)	3.5	(1.3)		9.3	(1.5)	3.4	(0.8)	4.4	(2.5)
Florfenicol	8.0	(1.1)	12.4	(1.7)	14.1	(2.6)		26.4	(3.8)	30.3	(4.9)	31.5	(8.2)
Fluoroquinolone					2.8	(1.1)						3.7	(1.7)
Macrolide	6.5	(1.0)	8.0	(1.2)	14.1	(2.6)		17.4	(3.4)	15.6	(3.2)	29.1	(5.9)
Sulfonamide	2.2	(0.7)	1.5	(0.5)	0.0	(—)		5.2	(1.8)	4.1	(1.7)	0.0	(—)
Tetracycline	11.6	(1.3)	11.0	(1.7)	8.4	(2.0)		34.3	(3.9)	25.0	(4.7)	14.7	(4.7)
Trimethoprim/sulfa					0.2	(0.2)						0.4	(0.3)
Other/unknown	1.3	(0.5)	3.6	(1.1)	2.8	(1.4)		1.4	(0.7)	9.0	(3.5)	2.8	(1.6)
Any antimicrobial	41.4	(2.1)	49.2	(2.9)	50.9	(4.1)	Total	100.0		100.0		100.0	
Disease but no treatment	0.5	(0.3)	5.1	(1.4)	49.1[2]	(4.1)	Pct. all heifers treated (table D.2.b.)	4.6	(0.3)	5.5	(0.5)	4.7	(0.5)
No disease or disorder	58.1	(2.1)	45.7	(2.9)									
Total	100.0		100.0		100.0								

Population: Operations with 30 or more dairy cows.
[1]Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.
[2]Question variation: In 2014, due to questionnaire design, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

Across study years, about 90 percent of operations reported no disease or disorders in weaned heifers, and less than 10 percent treated weaned heifers for diarrhea/other digestive problems

K.2.e. Percentage of operations by primary antimicrobial used to treat weaned heifers for diarrhea/digestive disease during the previous 12 months (including operations reporting no diarrhea/digestive disease or disorder):

Diarrhea/digestive Disease

Percent Operations

	Dairy 2002		Dairy 2007		Dairy 2014[1]	
Primary antimicrobial used	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Aminoglycoside	0.3	(0.1)	0.2	(0.1)	0.1	(0.1)
Beta-lactam–cephalosporins	0.5	(0.1)	0.7	(0.2)	0.5	(0.4)
Beta-lactam–penicillins	1.0	(0.4)	1.6	(0.8)	1.5	(0.9)
Florfenicol	0.0	(—)	0.4	(0.2)	0.1	(0.1)
Fluoroquinolone					0.5	(0.4)
Macrolide	0.0	(—)	0.2	(0.2)	0.0	(—)
Sulfonamide	0.8	(0.2)	0.4	(0.1)	0.5	(0.3)
Tetracycline	0.8	(0.3)	1.4	(0.5)	1.5	(1.1)
Trimethoprim/sulfa					0.3	(0.3)
Other/unknown	0.1	(0.1)	2.5	(0.7)	3.0	(1.1)
Any antimicrobial	3.5	(0.6)	7.4	(1.3)	8.1	(1.9)
Disease but no treatment	3.1	(0.8)	4.2	(1.1)	91.9[2]	(1.9)
No disease or disorder	93.4	(1.0)	88.4	(1.6)		
Total	100.0		100.0		100.0	
Pct. all heifers treated (table D.2.b.)	0.4	(0.2)	1.6	(0.7)	0.5	(0.3)

Population: Operations with 30 or more dairy cows.
[1]Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.
[2]Question variation: In 2014, due to questionnaire design, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

3. Cows

The percentage of cows affected and treated for reproductive disease decreased from 2007 to 2014 (74.7 percent and 52.8 percent, respectively). The percentage of cows affected and treated for diarrhea or other digestive problem decreased from 2002 to 2014, as did the percentage of cows affected and treated for lameness.

K.3.a. Of cows affected with the following diseases or disorders during the previous 12 months (table F.1.b), percentage treated with an antimicrobial:

Percent Affected Cows Treated

	Dairy 2002		Dairy 2007		Dairy 2014*	
Disease or disorder	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Mastitis	91.9	(1.2)	89.9	(1.3)	85.6	(4.2)
Reproductive	66.9	(3.1)	74.7	(3.1)	52.8	(5.1)
Lameness	64.9	(3.3)	56.5	(4.1)	24.8	(3.3)
Respiratory	92.6	(4.0)	96.4	(1.2)	95.0	(2.1)
Diarrhea or other digestive problem	44.7	(3.7)	32.3	(4.0)	21.5	(5.0)
Other	41.4	(11.0)	66.2	(12.7)	75.5	(16.0)

Population: Operations with 30 or more dairy cows.
*Question variation: 2014 estimates are for the 91.3 percent of operations that administered any antimicrobials to heifers or cows.

A lower percentage of operations in 2014 than in 2002 used beta-lactam penicillins to treat mastitis, and a lower percentage of cows were treated with beta-lactam penicillins in 2014 than in 2002. The use of lincosamide as the primary antimicrobial for treating mastitis decreased from 15.8 percent of operations in 2007 to 6.0 percent in 2014, while the percentage of cows treated with lincosamide remained at about 20 percent during the same period. Mastitis was treated on about 85 percent of operations during all three study years. The percentage of cows treated for mastitis increased from 15.0 percent in 2002 to 22.0 percent in 2014.

K.3.b. Percentage of operations by primary antimicrobial used to treat cows for mastitis during the previous 12 months (including operations reporting no mastitis), and percentage of treated cows by primary antimicrobial received:

Mastitis

	Percent Operations							Percent Treated Cows					
	Dairy 2002		Dairy 2007		Dairy 2014			Dairy 2002		Dairy 2007		Dairy 2014	
Primary antimicrobial used	**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**		**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**
Aminocyclitol			1.1	(0.6)						2.9	(2.0)		
Aminoglycoside	0.9	(0.4)	0.5	(0.4)	0.0	(—)		1.0	(0.5)	0.2	(0.2)	0.0	(—)
Beta-lactam–first-generation cephalosporins	33.3	(2.2)	44.5	(2.9)	29.8	(4.1)		36.8	(3.1)	53.2	(4.1)	15.1	(4.6)
Beta-lactam–third-generation cephalosporins					33.4	(3.7)						50.5	(9.6)
Beta-lactam–penicillins	29.1	(2.1)	16.9	(2.0)	10.9	(2.6)		33.8	(2.9)	19.1	(3.0)	8.7	(3.0)
Florfenicol	0.1	(0.1)	0.0	(—)	0.0	(—)		0.0	(0.0)	0.0	(—)	0.0	(—)
Lincosamide	11.9	(1.5)	15.8	(2.1)	6.0	(1.8)		21.3	(3.2)	19.4	(3.1)	24.6	(11.5)
Macrolide	2.6	(0.8)	0.3	(0.2)	0.0	(—)		2.8	(1.0)	0.2	(0.2)	0.0	(—)
Sulfonamide	1.0	(0.4)	1.8	(0.9)	1.2	(0.9)		0.7	(0.3)	1.2	(0.5)	0.2	(0.2)
Tetracycline	4.4	(0.9)	2.5	(0.7)	1.5	(0.8)		3.1	(0.8)	2.0	(0.7)	0.2	(0.2)
Other	1.0	(0.5)	2.0	(1.0)	3.9	(1.5)		0.5	(0.2)	1.8	(0.9)	0.7	(0.4)
Any antimicrobial	84.3	(1.7)	85.4	(2.2)	86.7	(2.7)	Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
*Due to questionnaire design in 2014, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

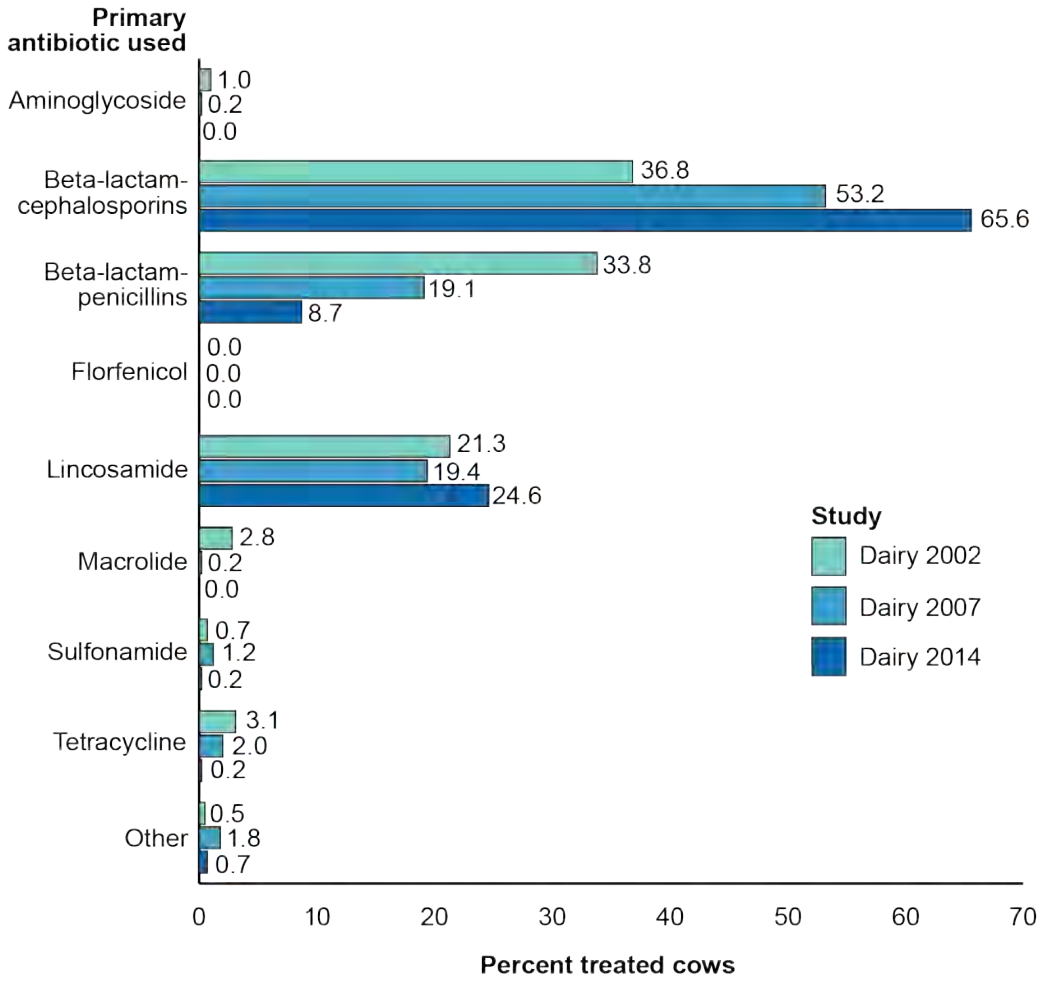
K.3.b. (continued) Percentage of operations by primary antimicrobial used to treat cows for mastitis during the previous 12 months (including operations reporting no mastitis), and percentage of treated cows by primary antimicrobial received:

Mastitis

	Percent Operations							Percent Treated Cows					
	Dairy 2002		Dairy 2007		Dairy 2014			Dairy 2002		Dairy 2007		Dairy 2014	
Primary antimicrobial used	**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**		**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**
Disease but no treatment	1.0	(0.5)	7.7	(1.5)	13.3*	(2.7)	Pct. all cows treated (table F.1.b.)	15.0	(0.7)	16.4	(0.8)	22.0	(2.4)
No disease or disorder	14.7	(1.7)	6.9	(1.7)									
Total	100.0		100.0		100.0								

Population: Operations with 30 or more dairy cows.
*Due to questionnaire design in 2014, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

Of cows treated with antimicrobials for mastitis during the previous 12 months, percentage of cows by primary antimicrobial received



Population: Operations with 30 or more dairy cows.

A higher percentage of operations in 2014 (24.3 percent) than in 2002 (7.3 percent) used beta-lactam cephalosporins as the primary antimicrobial for treating reproductive disease. Overall, a higher percentage of operations in 2007 and 2014 than in 2002 used any antimicrobial to treat reproductive disease.

A lower percentage of cows were treated with tetracycline in 2007 than in 2014 (44.4 and 10.7 percent of treated cows, respectively). The percentage of cows treated for reproductive disease increased from 4.9 percent in 2002 to 7.7 percent in 2014.

K.3.c. Percentage of operations by primary antimicrobial used to treat cows for reproductive disease during the previous 12 months (including operations reporting no reproductive disease), and percentage of treated cows by primary antimicrobial received:

Reproductive Disease

	Percent Operations							Percent Treated Cows					
	Dairy 2002		Dairy 2007		Dairy 2014			Dairy 2002		Dairy 2007		Dairy 2014	
Primary antimicrobial used	**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**		**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**
Aminocyclitol			0.6	(0.6)						0.2	(0.2)		
Aminoglycoside	0.1	(0.1)	0.0	(—)	0.0	(—)		0.1	(0.1)	0.0	(—)	0.0	(—)
Beta-lactam–cephalosporins	7.3	(1.0)	17.2	(2.0)	24.3	(3.2)		23.2	(3.0)	27.9	(4.7)	45.6	(8.5)
Beta-lactam–penicillins	15.9	(1.7)	13.5	(2.0)	16.6	(3.2)		31.1	(3.4)	19.7	(3.8)	41.7	(9.7)
Florfenicol	0.0	(—)	0.2	(0.2)	0.0	(—)		0.0	(—)	0.2	(0.2)	0.0	(—)
Macrolide	0.3	(0.3)	0.0	(—)	0.0	(—)		0.1	(0.1)	0.0	(—)	0.0	(—)
Sulfonamide	1.8	(0.8)	0.1	(0.1)	0.0	(—)		4.2	(2.2)	0.2	(0.2)	0.0	(—)
Tetracycline	16.7	(1.7)	17.7	(2.1)	13.3	(2.7)		41.2	(4.1)	44.4	(6.0)	10.7	(3.8)
Other	0.0	(0.0)	3.6	(1.3)	4.6	(1.8)		0.1	(0.1)	7.4	(4.5)	2.0	(1.3)
Any antimicrobial	42.1	(2.3)	52.9	(2.8)	58.8	(4.0)	Total	100.0		100.0		100.0	
Disease but no treatment	10.4	(1.4)	21.8	(2.5)	41.2*	(4.0)	Pct. all cows treated (table F.1.b.)	4.9	(0.3)	7.4	(0.7)	7.7	(1.0)
No disease or disorder	47.5	(2.3)	25.3	(2.5)									
Total	100.0		100.0		100.0								

Population: Operations with 30 or more dairy cows.
*Due to questionnaire design in 2014, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

The percentage of operations that used beta-lactam cephalosporins as the primary antimicrobial for treating cows with lameness increased from 18.3 percent in 2002 to 37.4 percent in 2014. Similar to what was observed for treating cows for mastitis and reproductive disease, a higher percentage of cows with lameness were treated with cephalosporins in 2014 than in 2007 (58.7 and 27.2 percent, respectively). A lower percentage of cows were treated for lameness in 2014 than in 2002 and 2007 (3.6 percent, 7.0 and 7.1 percent, respectively).

K.3.d. Percentage of operations by primary antimicrobial used to treat cows for lameness during the previous 12 months (including operations reporting no lameness), and percentage of treated cows by primary antimicrobial received:

Lameness

	Percent Operations							**Percent Treated Cows**					
	Dairy 2002		**Dairy 2007**		**Dairy 2014**			**Dairy 2002**		**Dairy 2007**		**Dairy 2014**	
Primary antimicrobial used	**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**		**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**
Aminoglycoside	0.1	(0.1)	0.0	(—)	0.0	(—)		0.1	(0.1)	0.0	(—)	0.0	(—)
Beta-lactam–cephalosporins	18.3	(1.6)	23.0	(2.2)	37.4	(3.8)		29.8	(4.4)	27.2	(3.8)	58.7	(7.8)
Beta-lactam–penicillins	14.7	(1.6)	13.6	(2.1)	8.5	(2.1)		17.3	(3.3)	19.5	(5.4)	8.6	(2.5)
Florfenicol	0.0	(—)	0.3	(0.2)	0.0	(—)		0.0	(—)	0.5	(0.3)	0.0	(—)
Macrolide	0.5	(0.3)	0.2	(0.1)	0.0	(—)		0.2	(0.1)	0.5	(0.3)	0.0	(—)
Sulfonamide	1.8	(0.5)	1.4	(0.4)	1.2	(0.5)		4.4	(1.1)	4.2	(1.4)	9.9	(6.3)
Tetracycline	13.9	(1.6)	18.6	(2.2)	11.4	(2.7)		42.4	(5.1)	42.1	(5.4)	20.5	(6.9)
Other	2.3	(0.7)	1.5	(0.6)	2.4	(1.1)		5.8	(1.8)	6.0	(3.0)	2.4	(2.1)
Any antimicrobial	51.6	(2.3)	58.6	(2.9)	61.0	(4.1)	Total	100.0		100.0		100.0	
Disease but no treatment	8.6	(1.5)	17.2	(2.4)	39.0*	(4.1)	Pct. all cows treated (table F.1.b.)	7.0	(0.6)	7.1	(0.7)	3.6	(0.4)
No disease or disorder	39.8	(2.3)	24.2	(2.6)									
Total	100.0		100.0		100.0								

Population: Operations with 30 or more dairy cows.
*Due to questionnaire design in 2014, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

No operations in 2014 used aminoglycosides or macrolides to treat cows for respiratory disease. Across study years, about one-half of operations used any antimicrobial to treat respiratory disease, while the percentage of treated cows remained between 2.2 and 2.8 percent.

K.3.e. Percentage of operations by primary antimicrobial used to treat cows for respiratory disease during the previous 12 months (including operations reporting no respiratory disease) and percentage of treated cows by primary antimicrobial received:

Respiratory Disease

	Percent Operations							**Percent Treated Cows**					
	Dairy 2002		**Dairy 2007**		**Dairy 2014**			**Dairy 2002**		**Dairy 2007**		**Dairy 2014**	
Primary antimicrobial used	**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**		**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**
Aminocyclitol			1.0	(0.5)						3.3	(1.6)		
Aminoglycoside	0.5	(0.4)	0.3	(0.3)	0.0	(—)		0.4	(0.4)	0.6	(0.5)	0.0	(—)
Beta-lactam–cephalosporins	27.6	(2.0)	33.0	(2.7)	31.7	(3.5)		67.3	(3.1)	70.5	(3.9)	77.6	(6.0)
Beta-lactam–penicillins	9.0	(1.4)	10.5	(1.8)	10.7	(2.7)		13.0	(1.9)	11.0	(2.5)	12.1	(4.1)
Florfenicol	1.3	(0.4)	2.4	(0.9)	3.0	(1.2)		2.1	(0.8)	1.9	(0.7)	3.0	(1.4)
Fluoroquinolone					0.3	(0.3)						1.4	(1.4)
Macrolide	1.9	(0.8)	1.2	(0.6)	0.0	(—)		1.3	(0.5)	1.1	(0.5)	0.0	(—)
Sulfonamide	1.9	(0.7)	1.7	(0.8)	0.7	(0.7)		3.1	(1.0)	2.8	(1.4)	1.0	(1.0)
Tetracycline	6.2	(1.0)	4.7	(1.0)	5.8	(1.8)		11.6	(2.0)	6.4	(1.6)	4.8	(1.9)
Other	0.6	(0.3)	1.0	(0.5)	2.0	(1.2)		1.2	(0.5)	2.4	(1.3)	0.2	(0.2)
Any antimicrobial	49.0	(2.3)	55.8	(2.9)	54.1	(4.1)	Total	100.0		100.0		100.0	
Disease but no treatment	1.5	(0.5)	3.5	(1.2)	45.9*	(4.1)	Pct. all cows treated (table F.1.b.)	2.2	(0.1)	2.8	(0.2)	2.6	(0.5)
No disease or disorder	49.5	(2.3)	40.7	(2.9)									
Total	100.0		100.0		100.0								

Population: Operations with 30 or more dairy cows.
*Due to questionnaire design in 2014, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

A lower percentage of operations used beta-lactam cephalosporins for diarrhea/digestive disease in 2014 compared with 2007 (4.5 and 11.3 percent, respectively). Approximately 25 percent of operations used any antimicrobial to treat cows for diarrhea or other digestive problem across all three study years.

There were no substantial changes across study years in the percentages of treated cows by primary antimicrobial received to treat diarrhea/digestive problems. The highest percentage of treated cows received beta-lactam cephalosporins or penicillins to treat digestive/diarrhea problems from 2002 to 2014.

K.3.f. Percentage of operations by primary antimicrobial used to treat cows for diarrhea/digestive disease during the previous 12 months (including operations reporting no diarrhea/digestive disease), and percentage of treated cows by primary antimicrobial received:

Diarrhea/digestive Disease

	Percent Operations							**Percent Treated Cows**					
	Dairy 2002		**Dairy 2007**		**Dairy 2014**			**Dairy 2002**		**Dairy 2007**		**Dairy 2014**	
Primary antimicrobial used	**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**		**Pct.**	**(SE)**	**Pct.**	**(SE)**	**Pct.**	**(SE)**
Aminoglycoside	1.0	(0.5)	0.6	(0.3)	0.7	(0.7)		3.2	(1.7)	6.4	(4.4)	1.7	(1.3)
Beta-lactam–cephalosporins	10.1	(1.3)	11.3	(1.8)	4.5	(1.0)		37.9	(4.3)	36.0	(5.9)	57.4	(13.5)
Beta-lactam–penicillins	11.4	(1.4)	8.8	(1.6)	6.3	(1.8)		41.2	(4.3)	30.3	(5.7)	24.8	(7.2)
Florfenicol	0.2	(0.1)	0.3	(0.2)	0.0	(—)		0.4	(0.3)	0.4	(0.4)	0.0	(—)
Fluoroquinolone					0.1	(0.1)						0.3	(0.3)
Macrolide	0.3	(0.3)	0.6	(0.4)	0.0	(—)		0.7	(0.7)	1.1	(0.8)	0.0	(—)
Sulfonamide	2.8	(0.6)	1.3	(0.4)	1.0	(0.8)		11.9	(2.4)	15.6	(6.6)	10.8	(8.9)
Tetracycline	2.1	(0.6)	1.1	(0.4)	0.1	(0.1)		4.6	(1.7)	7.0	(2.9)	1.7	(1.7)
Other	0.0	(0.0)	1.1	(0.6)	6.2	(1.5)		0.1	(0.1)	3.2	(2.2)	3.2	(1.8)
Any antimicrobial	27.9	(2.0)	25.0	(2.4)	19.1	(2.6)	Total	100.0		100.0		100.0	
Disease but no treatment	15.2	(1.7)	31.6	(2.7)	80.9*	(2.6)	Pct. all cows treated	2.0	(0.2)	1.9	(0.2)	1.1	(0.3)
No disease or disorder	56.9	(2.2)	43.4	(2.9)									
Total	100.0		100.0		100.0		(table F.1.b.)						

Population: Operations with 30 or more dairy cows.
*Due to questionnaire design in 2014, it was not possible to distinguish between operations without disease and those that had disease but did not treat with antimicrobials.

L. Surgical Procedures

1. Disbudding/dehorning

Across study years, a lower percentage of large operations routinely dehorned heifer calves compared with small and medium operations, which might be because a higher percentage of large operations than medium or small operations send their heifers to an off-site rearing facility at a young age.

L.1.a. Percentage of operations that routinely dehorned heifer calves while they were on the operation, by herd size:

Percent Operations

Herd size (number of cows)	Dairy 2007 Pct.	Dairy 2007 Std. error	Dairy 2014 Pct.	Dairy 2014 Std. error
Small (30-99)	97.3	(1.6)	99.3	(0.7)
Medium (100-499)	92.6	(2.8)	95.7	(2.1)
Large (500 or more)	64.3	(6.3)	77.0	(5.4)
All operations	94.0	(1.4)	94.3	(1.3)

Population: Operations with 30 or more dairy cows.

A hot iron/electric dehorner was the most common method used to dehorn heifer calves during both study years. The percentage of operations that used a tube, spoon, or gouge dehorner decreased from 28.2 percent in 2007 to 14.0 percent in 2014.

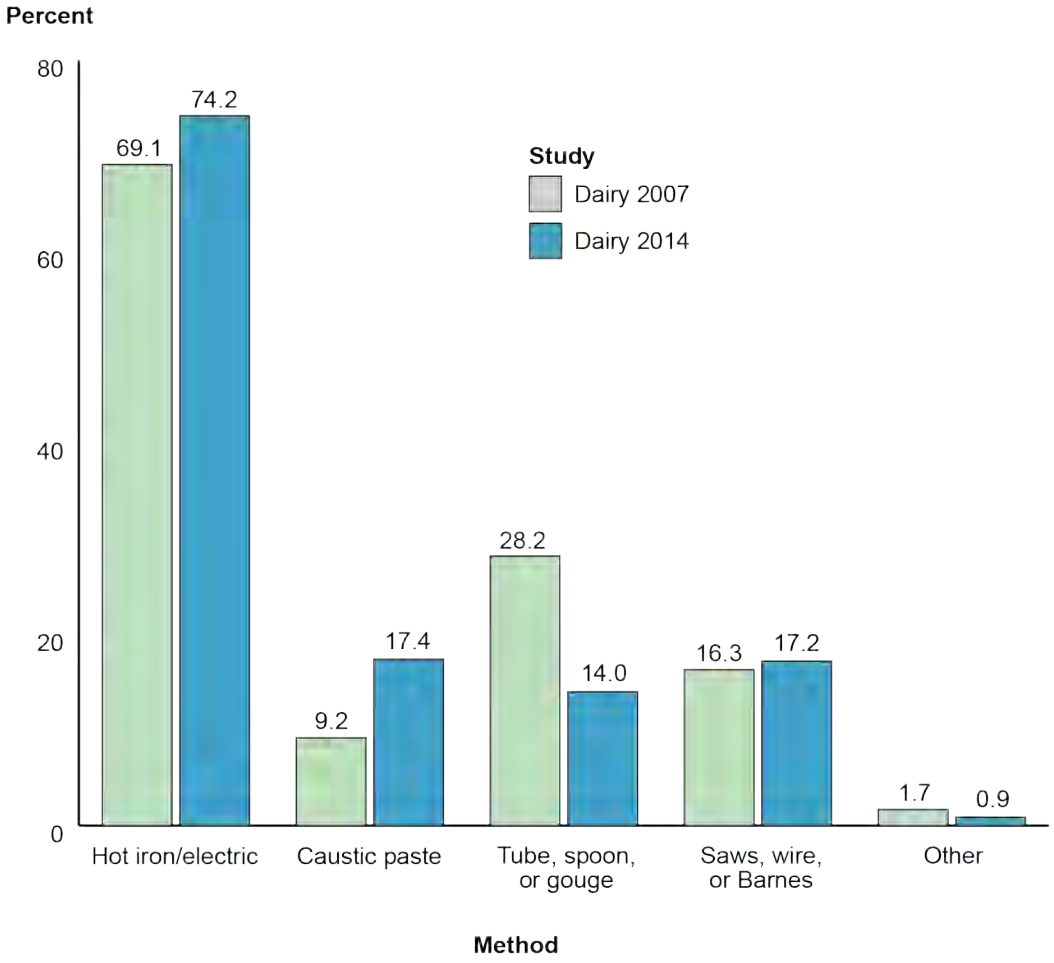
L.1.b. For operations that routinely dehorned heifer calves (table L.1.a), percentage of operations by method used to dehorn them:

Percent Operations

Method	Dairy 2007 Pct.	Dairy 2007 Std. error	Dairy 2014 Pct.	Dairy 2014 Std. error
Hot iron/electric	69.1	(2.8)	74.2	(3.4)
Caustic paste	9.2	(1.8)	17.4	(2.9)
Tube, spoon, or gouge	28.2	(2.9)	14.0	(2.6)
Saws, wire, or Barnes	16.3	(2.3)	17.2	(3.3)
Other	1.7	(0.9)	0.9	(0.6)

Population: Operations with 30 or more dairy cows.

For operations that routinely dehorned heifer calves, percentage of operations by method used to dehorn heifer calves



Population: Operations with 30 or more dairy cows.

On operations that routinely dehorned heifer calves, a higher percentage of heifers were dehorned via caustic paste in 2014 than in 2007 (32.5 and 12.2 percent, respectively). Alternatively, a lower percentage of heifers were dehorned via tube, spoon or gouge in 2014 than in 2007 (3.9 and 13.0 percent, respectively).

L.1.c. For operations that routinely dehorned heifer calves (table L.1.a), percentage of heifer calves by method(s) used to dehorn them:

	Percent Heifer Calves[1]			
	Dairy 2007		Dairy 2014	
Method	Pct.	Std. error	Pct.	Std. error
Hot iron/electric	67.5	(3.1)	54.6	(5.3)
Caustic paste	12.2	(2.6)	32.5	(5.6)
Tube, spoon, or gouge	13.0	(1.7)	3.9	(1.0)
Saws, wire, or Barnes	7.1	(1.1)	7.7	(2.6)
Other	0.2	(0.1)	0.9	(0.7)
Total	100.0		[2]	

Population: Operations with 30 or more dairy cows.
[1]As a percentage of dairy heifer calves born alive.
[2]Totals don't add to 100.0 percent because some operations that dehorned heifers didn't dehorn all calves.

For operations that routinely dehorned heifer calves, there were no changes from 2007 to 2014 in the operation average age of heifers at dehorning by primary dehorning method or overall average age.

L.1.d. For operations that routinely dehorned heifer calves (table L.1.a), operation average age at dehorning by method used:

	Operation Average Age (wk)			
	Dairy 2007		**Dairy 2014**	
Method	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Hot iron/electric	7.6	(0.5)	7.1	(0.4)
Caustic paste	2.9	(0.5)	2.3	(0.4)
Tube, spoon, or gouge	18.6	(1.3)	13.5	(1.3)
Saws, wire, or Barnes	22.2	(2.5)	21.8	(3.0)
Other	35.7	(7.6)	*	
Average age	10.3	(0.6)	8.8	(0.7)

Population: Operations with 30 or more dairy cows.
*Too few to report

For operations that routinely dehorned heifer calves, the percentage that used analgesics/anesthetics when dehorning heifer calves with a hot iron/electric dehorner increased from 13.8 percent in 2007 to 30.0 percent in 2014. There were no differences in analgesics/anesthetic use among the other dehorning methods.

L.1.e. For operations that routinely dehorned heifer calves (table L.1.a), percentage of operations that used analgesics/anesthetics when dehorning, by method used:

Percent Operations

	Dairy 2007		Dairy 2014	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Hot iron/electric	13.8	(2.6)	30.0	(4.6)
Caustic paste	14.2	(5.8)	5.6	(4.1)
Tube, spoon, or gouge	21.5	(5.1)	21.4	(7.9)
Saws, wire, or Barnes	21.5	(6.7)	16.2	(7.7)
Other	17.1	(16.5)	6.3	(6.4)
Any	17.7	(2.3)	28.2	(3.8)

Population: Operations with 30 or more dairy cows.

In 2007 and 2014, slightly more than 45 percent of operations chemically disinfected surgical dehorning equipment between animals, if the dehorning equipment caused bleeding.

L.1.f. For operations that routinely dehorned heifer calves (table L.1.a), percentage of operations that used surgical dehorning equipment that caused bleeding, and percentage of operations that chemically disinfected equipment between each animal:

Percent Operations

	Dairy 2007		Dairy 2014	
Measure	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Caused bleeding	42.0	(3.1)	31.5	(3.8)
Disinfected	46.4	(4.9)	47.9	(7.3)

Population: Operations with 30 or more dairy cows.

For operations that routinely dehorned heifer calves, employees on a higher percentage of operations in 2014 (20.4 percent) than in 2007 (8.4 percent) performed the majority of calf dehornings.

L.1.g. For operations that routinely dehorned heifer calves (table L.1.a), percentage of operations by person who dehorned the majority of heifer calves on the operation:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Person	Pct.	Std. error	Pct.	Std. error
Owner/operator	64.4	(2.9)	53.4	(4.2)
Veterinarian	21.1	(2.6)	21.7	(3.8)
Employee	8.4	(1.1)	20.4	(2.8)
Other	6.1	(1.6)	4.4	(1.6)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

2. Extra teat removal

The percentages of operations that routinely removed extra teats were similar across herd sizes and study years.

L.2.a Percentage of operations that routinely removed extra teats from heifer calves:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	46.4	(4.0)	41.6	(6.4)
Medium (100-499)	57.1	(4.4)	50.1	(6.2)
Large (500 or more)	66.4	(6.2)	56.1	(6.1)
All operations	50.3	(3.0)	46.7	(4.0)

Population: Operations with 30 or more dairy cows.

For operations that routinely removed extra teats from heifer calves, more than twice the percentage of operations removed extra teats from heifer calves when they were less than 12 weeks old (44.1 and 20.3 percent, respectively) in 2014 compared to 2007.

L.2.b. For operations that routinely removed extra teats from heifer calves (table L.2.a), percentage of operations by age of calves at removal:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Age (wk)	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 12.0	20.3	(3.4)	44.1	(5.8)
12.0–17.9	32.2	(3.8)	24.6	(5.0)
18.0–23.9	20.1	(3.4)	12.8	(3.0)
24.0–29.9	18.6	(3.5)	10.9	(3.4)
30.0 or more	8.8	(1.9)	7.6	(2.8)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that routinely removed extra teats from heifer calves, about 10 percent in 2007 and 2014 gave heifer calves with extra teats analgesics or anesthesia when removing teats. There were no changes by herd size from 2007 to 2014 in the percentage of operations that gave calves analgesics or anesthesia when removing teats.

L.2.c. For operations that routinely removed extra teats from heifer calves (table L.2.a), percentage of operations that gave calves analgesics or anesthesia at removal:

Percent Operations

	Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	11.4	(4.2)	10.6	(7.4)
Medium (100-499)	11.7	(4.5)	14.7	(6.2)
Large (500 or more)	0.9	(0.9)	5.4	(3.2)
All operations	10.6	(3.0)	10.8	(4.0)

Population: Operations with 30 or more dairy cows.

3. Tail docking

No changes were observed from 2002 to 2014 in the percentages of operations by percentage of cows on the operation with docked tails. This finding is somewhat surprising, given that the science has not supported tail docking as an effective method for improving udder health. About one-half of operations across study years did not have any cows with docked tails. The National Milk Producers Federations' Farmers Assuring Responsible Management (FARM) program banned tail docking of any calf born on or after January 1, 2017.

L.3.a. Percentage of operations by percentage of tail-docked cows on the operation:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Percent cows	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
0	49.5	(2.1)	51.4	(2.9)	50.5	(4.1)
0.1 to 24.9	17.5	(1.6)	10.8	(1.9)	16.0	(3.1)
25.0 to 75.9	9.1	(1.3)	8.9	(1.6)	9.7	(2.0)
76.0 to 99.9	8.0	(1.1)	14.3	(2.2)	7.7	(1.6)
100.0	15.9	(1.5)	14.6	(2.0)	16.1	(3.0)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.

Across study years, about one-third of cows had docked tails. In 2002 and 2007, a higher percentage of cows on medium operations than on small or large operations had docked tails.

L.3.b. Percentage of cows with the tail docked, by herd size:

	Percent Cows*					
	Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	27.0	(2.3)	27.8	(3.3)	25.7	(5.5)
Medium (100-499)	44.1	(2.6)	55.6	(3.5)	41.7	(6.0)
Large (500 or more)	26.4	(2.8)	32.6	(4.3)	32.3	(4.6)
All operations	32.4	(1.5)	38.3	(2.4)	33.3	(3.7)

Population: Operations with 30 or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

For operations with tail-docked cows, bands were used to dock tails on a higher percentage of operations in 2014 than in 2007 (97.0 and 87.2 percent, respectively). There were no changes from 2007 to 2014 in the percentages of tail-docked cows by procedure used to dock tails.

L.3.c. For operations with tail-docked cows (table L.3.a), percentage of operations and percentage of tail-docked cows on those operations, by procedure used to dock tails:

	Percent Operations				Percent Tail-Docked Cows*			
	Dairy 2007		Dairy 2014		Dairy 2007		Dairy 2014	
Procedure	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Band	87.2	(2.9)	97.0	(1.6)	89.7	(3.1)	95.9	(1.8)
Surgical removal	2.0	(1.0)	0.6	(0.5)	5.8	(2.7)	2.1	(1.4)
Hot knife	0.0	(—)			0.0	(—)		
Other	1.9	(0.9)	2.4	(1.5)	2.7	(1.2)	2.0	(1.2)
Unknown	8.9	(2.7)			1.7	(1.2)		
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

For operations with tail-docked cows, a higher percentage of operations in 2014 than in 2007 docked the tails of the majority of calves when they were less than two months old (31.4 and 10.2 percent, respectively); even so, there were no substantial differences in the percentages of calves by age at tail docking.

L.3.d. For operations with tail-docked cows (table L.3.a), percentage of operations and percentage of tail-docked cows on those operations by age of the majority of cattle when the tail was docked:

	Percent Operations				Percent Tail-Docked Calves*			
	Dairy 2007		Dairy 2014		Dairy 2007		Dairy 2014	
Age	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Less than 2 months	10.2	(2.0)	31.4	(5.4)	28.9	(5.0)	38.8	(6.2)
2 months to less than 6 months	10.5	(2.6)	8.2	(2.5)	17.4	(3.3)	14.2	(4.1)
6 months to less than 2 years	9.5	(2.0)	14.5	(4.2)	16.7	(3.6)	21.5	(4.4)
2 years or older	61.0	(4.0)	45.9	(6.2)	36.4	(4.2)	25.5	(5.9)
Unknown	8.8	(2.7)			0.5	(0.3)		
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

For operations with tail-docked cows, analgesia or anesthesia was used when docking tails by the same percentage of operations in 2007 and 2014. A similar percentage of cows received anesthesia or analgesia during tail docking during the two study years.

L.3.e. For operations with tail-docked cows (table L.3.a), percentage of operations that routinely used analgesia or anesthesia during the procedure, and the percentage of tail-docked cows that routinely received analgesia or anesthesia during the procedure:

Percent Operations				Percent Tail-Docked Cows*			
Dairy 2007		Dairy 2014		Dairy 2007		Dairy 2014	
Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
1.1	(0.6)	1.1	(0.6)	0.9	(0.7)	5.1	(2.8)

Population: Operations with 30 or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

4. Castration

About 40 percent of operations in 2007 and 2014 routinely castrated bull calves. There were no differences by herd size from 2007 to 2014 in the percentage of operations that routinely castrated bull calves.

L.4.a. Percentage of operations that routinely castrated bull calves on the operation:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	45.7	(3.9)	38.7	(6.2)
Medium (100-499)	32.0	(4.1)	37.3	(6.6)
Large (500 or more)	16.9	(4.1)	22.6	(4.8)
All operations	40.5	(2.9)	35.5	(3.9)

Population: Operations with 30 or more dairy cows.

For operations that routinely castrated bull calves, there were no substantial differences from 2007 to 2014 in the percentages of operations by primary method used to castrate bull calves.

L.4.b. For operations that routinely castrated bull calves (table L.4.a), percentage of operations by primary method used to castrate bull calves:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Band	60.8	(4.9)	72.5	(6.4)
Knife	26.9	(4.6)	20.2	(5.9)
Burdizzo	12.2	(3.2)	7.3	(3.8)
Other	0.1	(0.1)		
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that routinely castrated bull calves, the average age of bull calves at castration was about 8 weeks in 2007 and 2014.

L.4.c. For operations that routinely castrated bull calves (table L.4.a), operation average age (weeks) at castration:

Operation Average Age (wk)

Dairy 2007		Dairy 2014	
Avg.	**Std. error**	**Avg.**	**Std. error**
8.9	(0.6)	7.5	(0.6)

Population: Operations with 30 or more dairy cows.

For operations that routinely castrated bull calves, analgesics or anesthesia was given to bull calves during castration on about 4 percent of operations in 2007 and 2014.

L.4.d. For operations that routinely castrated bull calves (table L.4.a), percentage of operations that routinely used analgesics or anesthesia during the procedure:

Percent Operations

Dairy 2007		Dairy 2014	
Pct.	**Std. error**	**Pct.**	**Std. error**
3.2	(1.7)	4.0	(2.3)

Population: Operations with 30 or more dairy cows.

M. Hoof Health

1. Footbath use

In general, footbath use increased as herd size increased across study years.

M.1.a. Percentage of operations that used a footbath for cows during the previous 12 months, by herd size:

	Percent Operations					
	Dairy 1996		Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	18.6	(1.7)	23.0	(3.3)	16.9	(4.3)
Medium (100-499)	58.0	(2.8)	69.7	(3.9)	59.4	(6.4)
Large (500 or more)	75.5	(5.5)	88.9	(4.2)	93.0	(2.8)
All operations	27.9	(1.5)	38.9	(3.6)	43.1	(3.6)

Population: Operations with 30 or more dairy cows.

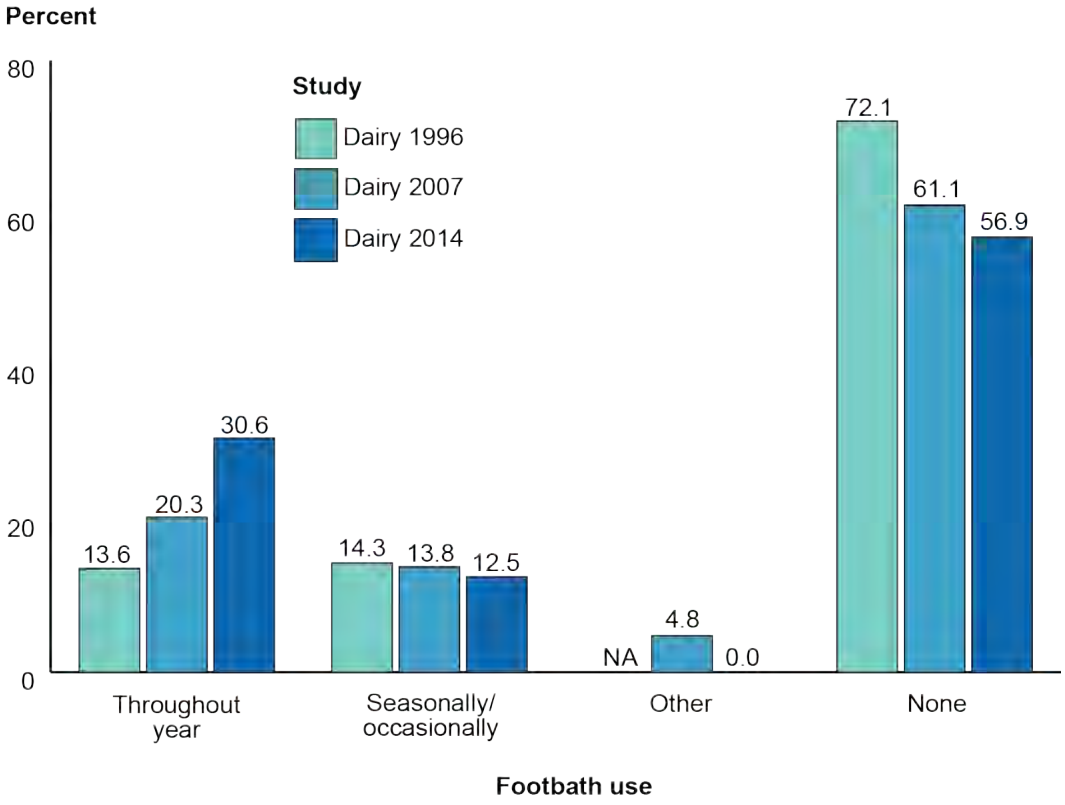
A higher percentage of operations in 2014 than in 1996 used a footbath for cows throughout the year (30.6 and 13.6 percent, respectively). A lower percentage of operations in 2014 than in 1996 did not use a footbath for cows (56.9 and 72.1 percent, respectively).

M.1.b. Percentage of operations by use of a footbath for cows during the previous 12 months:

	Percent Operations					
	Dairy 1996		Dairy 2007		Dairy 2014	
Footbath use	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Throughout year	13.6	(1.0)	20.3	(1.7)	30.6	(3.1)
Seasonally/ occasionally	14.3	(1.2)	13.8	(1.9)	12.5	(2.4)
Other			4.8	(1.5)	0.0	(—)
Any	27.9	(1.5)	38.9	(2.6)	43.1	(3.6)
None	72.1	(1.5)	61.1	(2.6)	56.9	(3.6)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.

Percentage of operations by use of a footbath for cows during the previous 12 months



Population: Operations with 30 or more dairy cows.

For operations that used footbaths for cows, copper sulfate was the primary medication used in footbaths in 2007 and 2014. A higher percentage of operations in 2007 than in 2014 used oxytetracycline as a footbath medication (10.9 and 0.6 percent, respectively).

M.1.c. For operations that used footbaths for cows (table M.1.a), percentage of operations by primary medication used in footbaths:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Footbath medication	Pct.	Std. error	Pct.	Std. error
Copper sulfate	66.6	(3.9)	80.9	(3.4)
Formalin/formaldehyde	10.9	(2.0)	12.0	(2.6)
Oxytetracycline	10.9	(3.3)	0.6	(0.6)
Hydrogen peroxide	0.0	(—)	0.9	(0.9)
Other	11.6	(2.3)	5.6	(2.1)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

2. Hoof trimming

Hoof trimming was performed on a higher percentage of operations in 2014 than in 1996 (88.6 and 75.9 percent, respectively).

M.2.a. Percentage of operations that trimmed any hooves during the previous 12 months:

Percent Operations

Dairy 1996		Dairy 2007		Dairy 2014	
Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
75.9	(1.6)	84.8	(2.4)	88.6	(2.7)

Population: Operations with 30 or more dairy cows.

For operations that had cows' hooves trimmed, professional hoof trimmers were used by a higher percentage of operations in 2014 than in 1996 (80.2 and 50.8 percent, respectively). A lower percentage of operations in 2014 than in 1996 used a veterinarian or owner/operation personnel to trim the majority of hooves. The percentage of cows in which a veterinarian trimmed decreased from 11.5 percent in 1996 to 0.9 percent in 2014.

M.2.b. For operations that had cows' hooves trimmed during the previous 12 months (table M.2.a), percentage of operations and percentage of cows on these operations by the person who trimmed the **majority** of hooves:

	Percent Operations						**Percent Cows***					
	Dairy 1996		**Dairy 2007**		**Dairy 2014**		**Dairy 1996**		**Dairy 2007**		**Dairy 2014**	
Hoof trimmer	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Professional hoof trimmer (not the operation's personnel)	50.8	(2.0)	76.7	(2.8)	80.2	(3.7)	68.0	(1.8)	80.0	(3.1)	78.0	(6.7)
Owner or the operation's personnel	28.9	(1.9)	17.2	(2.4)	13.9	(3.2)	20.2	(1.7)	17.5	(3.1)	21.2	(6.7)
Veterinarian (not the operation's personnel)	20.2	(1.8)	5.5	(1.8)	5.9	(2.4)	11.5	(1.0)	1.6	(0.5)	0.9	(0.4)
Other	0.1	(0.1)	0.6	(0.4)	0.0	(—)	0.3	(0.2)	0.9	(0.6)	0.0	(—)
Total	100.0		100.0		100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

For operations that had cows' hooves trimmed, the operation average number of visits made by a professional hoof trimmer increased from 2.1 in 1996 to 10.5 in 2014.

M.2.c. For operations that had cows' hooves trimmed during the previous 12 months (table M.2.a), operation average number of visits made by a professional hoof trimmer or veterinarian for the purpose of routine hoof trimming or evaluating lame cows* during the previous 12 months:

	Operation Average Number of Visits					
	Dairy 1996		Dairy 2007		Dairy 2014	
Professional	Avg.	Std. error	Avg.	Std. error	Avg.	Std. error
Hoof trimmer	2.1	(0.1)	5.3	(0.4)	10.5	(1.0)
Veterinarian	1.7	(0.2)	0.8	(0.1)	1.3	(1.3)
Either	3.8	(0.2)	6.1	(0.4)	11.6	(1.0)

Population: Operations with 30 or more dairy cows.
*Question variation: 1996 questionnaire asked for how many visits for the purpose of trimming hooves only

N. Injection practices

1. Number of annual injections

Although the operation average number of annual injections an individual cow typically receives was lower on medium operations in 2014 than in 2007 (8.3 and 14.4, respectively), the operation average number of injections for all operations was similar across study years.

N.1.a. Operation average number of annual injections an individual cow typically received by herd size:

	Operation Average Number of Annual Injections			
	Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Avg.**	**Std. error**	**Avg.**	**Std. error**
Small (30-99)	6.4	(0.7)	15.7	(10.8)
Medium (100-499)	14.4	(1.0)	8.3	(0.9)
Large (500 or more)	17.3	(1.6)	15.7	(1.2)
All operations	13.8	(0.8)	13.5	(5.7)

Population: Operations with 30 or more dairy cows.

The percentage of operations by number of annual injections an individual cow typically received was similar in 2007 and 2014. Almost all cows across study years received at least one injection.

N.1.b. Percentage of operations and percentage of cows on these operations by number of annual injections of any kind that individual cows typically received:

	Percent Operations				Percent Cows*			
	Dairy 2007		Dairy 2014		Dairy 2007		Dairy 2014	
Typical number of injections	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
1–4	50.5	(3.0)	44.8	(4.1)	26.0	(2.7)	12.4	(2.5)
5–9	22.6	(2.6)	29.1	(3.7)	24.7	(3.8)	33.6	(6.7)
10–24	16.0	(1.9)	16.7	(2.5)	29.2	(3.6)	40.9	(6.5)
25–49	9.4	(1.4)	5.7	(1.4)	17.2	(2.4)	10.3	(2.7)
50 or more	0.9	(0.4)	2.2	(1.1)	2.7	(1.2)	2.3	(0.9)
Any	99.4	(0.4)	98.5	(1.0)	99.8	(0.2)	99.5	(0.4)
None	0.6	(0.4)	1.5	(1.0)	0.2	(0.2)	0.5	(0.4)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

There were no changes from 2007 to 2014 in the percentages of operations by number of injections given to cows before needles were changed; about one-half of operations across study years gave 2 to 10 injections before changing needles.

N.1.c. Percentage of operations and percentage of cows on these operations by number of injections usually given before changing needles:

	Percent Operations				Percent Cows*			
	Dairy 2007		Dairy 2014		Dairy 2007		Dairy 2014	
Number injections	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
New needle for every injection	13.2	(2.1)	9.5	(2.2)	9.6	(1.5)	7.6	(1.6)
2–10	49.7	(3.0)	51.1	(4.1)	50.0	(4.0)	40.5	(6.0)
11–20	26.0	(2.7)	22.0	(3.1)	24.9	(3.2)	33.1	(7.7)
21–30	5.0	(1.1)	5.8	(1.6)	6.7	(1.9)	8.6	(3.0)
31 or more	3.8	(1.0)	8.0	(2.3)	8.0	(2.3)	9.3	(4.0)
No injections by farm personnel	2.2	(0.9)	3.6	(1.9)	0.9	(0.3)	0.9	(0.4)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
*As a percentage of January 1 dairy cow inventory.

2. Injection route and location

For operations that administered any injections, there were no differences from 2007 to 2014 in the percentages of operations by injection routes for heifers and cows.

N.2.a. For operations that administered any injections (table N.1.b), percentage of operations that administered injections to heifers and percentage that administered injections to cows, by injection route:

	Percent Operations			
	Dairy 2007		Dairy 2014	
Injection route	Pct.	Std. error	Pct.	Std. error
Heifers				
Intramuscular (IM)	94.0	(1.4)	89.5	(2.6)
Subcutaneous (SQ)	62.2	(3.0)	61.3	(4.1)
Intravenous (IV)	51.6	(3.0)	40.4	(3.9)
Any	96.9	(1.1)	93.1	(2.4)
Cows				
Intramuscular (IM)	96.1	(1.0)	95.3	(1.4)
Subcutaneous (SQ)	66.8	(3.0)	68.5	(4.0)
Intravenous (IV)	65.9	(2.9)	66.9	(3.9)
Any	98.8	(0.6)	99.4	(0.4)

Population: Operations with 30 or more dairy cows.

The operation average percentages of injections given were similar by injection route in 2007 and 2014. About two-thirds of injections were administered intramuscularly in both study years.

N.2.b. Operation average percentage of injections given, by injection route:

	Operation Average Percent Injections			
	Dairy 2007		Dairy 2014	
Injection route	Pct.	Std. error	Pct.	Std. error
Intramuscular (IM)	68.7	(1.7)	68.6	(2.2)
Subcutaneous (SQ)	23.9	(1.6)	25.2	(2.0)
Intravenous (IV)	7.4	(0.8)	6.2	(0.7)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that administered IM injections, the operation average percentages of IM injections were similar by purpose of injection in 2007 and 2014. Vaccinations represented about 40 percent of all IM injections in both study years.

N.2.c. For operations that administered IM injections (table N.2.a), operation average percentage of IM injections administered for the following purposes:

	Operation Average Percent IM Injections			
	Dairy 2007		Dairy 2014	
Purpose	Pct.	Std. error	Pct.	Std. error
Vaccination	41.3	(2.1)	39.3	(2.9)
Reproductive injection	27.3	(1.6)	30.9	(2.4)
Antimicrobial injection	23.1	(1.6)	18.7	(2.0)
Production enhancement	4.7	(1.1)	7.5	(1.7)
Other	3.6	(1.0)	3.6	(1.4)
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that administered IM injections, there were no changes in the operation average percentages of IM injections by location of primary injection. The hind leg was the primary injection location for about 60 percent of IM injections in 2007 and 2014.

N.2.d. For operations that administered IM injections (table N.2.a), operation average percentage of IM injections by primary location of injection:

Operation Average Percent IM Injections

	Dairy 2007		Dairy 2014	
Primary location	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Hind leg	59.3	(2.8)	59.1	(3.8)
Neck	14.8	(1.6)	22.1	(3.1)
Upper hip	17.4	(2.1)	14.2	(2.6)
Shoulder	4.0	(1.4)	4.6	(1.3)
Other	4.5	(1.4)		
Total	100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that administered IM injections, about one-half of IM injections given as vaccines were administered in the hind leg in both study years. There were no changes in the operation average percentages of IM injections by primary location of IM injections given as vaccines, for reproduction, or as antimicrobials from 2007 to 2014.

N.2.e. For operations that administered IM injections for the following purposes (table N.2.c), operation average percentage of IM injections by primary location administered:

Operation Average Percent IM Injections

	Purpose					
	Vaccinations		Reproduction		Antimicrobials	
	Dairy 2007	Dairy 2014	Dairy 2007	Dairy 2014	Dairy 2007	Dairy 2014
Primary location	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)	Pct. (Std. error)
Hind leg	56.1 (3.3)	53.5 (4.5)	72.2 (2.9)	65.1 (4.5)	59.4 (3.2)	51.2 (4.6)
Neck	17.9 (2.1)	22.0 (3.3)	7.4 (1.4)	16.4 (3.5)	17.8 (2.3)	26.6 (4.0)
Upper hip	18.4 (2.5)	17.4 (3.5)	17.6 (2.5)	16.8 (3.5)	16.5 (2.4)	15.5 (3.3)
Shoulder	4.4 (1.7)	7.1 (2.1)	2.0 (1.1)	1.7 (0.9)	4.7 (1.5)	6.7 (2.9)
Other	3.2 (1.3)		0.8 (0.6)		1.7 (0.7)	
Total	100.0	100.0	100.0	100.0	100.0	100.0

Population: Operations with 30 or more dairy cows.

For operations that administered any injections to heifers, headlocks or fence line stanchions were used when administering IM injections to heifers on a higher percentage of operations in 2014 than in 2007 (52.0 and 30.4 percent, respectively). Conversely, stanchion/tie stalls were used by a lower percentage of operations in 2014 than in 2007 (16.0 and 28.8 percent, respectively). Subcutaneous injections were administered to heifers in headlocks or fence line stanchions on a higher percentage of operations in 2014 than in 2007 (56.7 and 36.4 percent, respectively). There were no changes from 2007 to 2014 in the primary facility used when administering IV injections to heifers.

N.2.f. For operations that administered any injections to **heifers** (table N.2.a), percentage of operations by primary cattle-handling facility used when giving injections, and by injection route:

Percent Operations

	Injection Route					
	Intramuscular (IM)		**Subcutaneous (SQ)**		**Intravenous (IV)**	
	Dairy 2007	**Dairy 2014**	**Dairy 2007**	**Dairy 2014**	**Dairy 2007**	**Dairy 2014**
Primary cattle-handling facility	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**
Headlock/ fence line stanchion	30.4 (2.5)	52.0 (4.3)	36.4 (3.3)	56.7 (4.8)	31.6 (3.6)	48.0 (6.1)
Chute/ headgate	22.6 (2.5)	16.5 (3.3)	23.4 (2.8)	18.5 (3.9)	20.1 (3.0)	25.6 (5.1)
Stanchion/ tie stall	28.8 (2.9)	16.0 (3.3)	24.2 (3.4)	15.6 (4.0)	36.3 (4.1)	20.2 (5.6)
Loose in freestalls	10.2 (2.0)	9.5 (2.4)	7.5 (2.1)	5.7 (2.0)	5.7 (1.7)	3.1 (1.6)
Parlor	5.5 (1.2)	3.9 (2.1)	4.3 (1.3)	1.8 (1.4)	2.4 (1.2)	1.7 (1.7)
Palpation rail	0.3 (0.1)	2.1 (1.1)	0.5 (0.2)	1.7 (0.9)	0.2 (0.2)	1.4 (1.2)
Other	2.2 (1.1)		3.7 (1.7)		3.7 (1.6)	
Total	100.0	100.0	100.0	100.0	100.0	100.0

Population: Operations with 30 or more dairy cows.

For the operations that administered any injections to cows, headlocks were used for IM, SQ, and IV injections in cows on a higher percentage of operations in 2014 than in 2007. Stanchions and tie stalls were used for IV injections for cows on a lower percentage of operations in 2014 than in 2007 (43.0 and 64.0, respectively).

N.2.g. For the operations that administered any injections to **cows** (table N.2.a), percentage of operations by primary cattle-handling facility used when giving injections, and by injection route:

Percent Operations

	Injection Route					
	Intramuscular (IM)		Subcutaneous (SQ)		Intravenous (IV)	
	Dairy 2007	Dairy 2014	Dairy 2007	Dairy 2014	Dairy 2007	Dairy 2014
Primary cattle-handling facility	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**
Stanchion/tie stall	59.0 (2.7)	47.7 (4.0)	52.4 (3.3)	41.6 (4.6)	64.0 (3.1)	43.0 (4.8)
Headlock/ fence line stanchion	12.4 (1.4)	26.3 (3.0)	17.0 (2.1)	33.0 (3.7)	11.5 (1.8)	27.1 (3.6)
Parlor	17.4 (1.8)	17.3 (3.1)	18.5 (2.3)	16.7 (3.4)	5.0 (1.4)	6.4 (2.1)
Loose in freestalls	4.1 (1.3)	5.0 (1.6)	2.7 (1.5)	0.6 (0.4)	4.7 (1.5)	6.3 (2.3)
Chute/ headgate	5.3 (1.2)	2.1 (0.9)	7.6 (1.6)	5.1 (1.7)	11.9 (1.7)	16.2 (2.9)
Palpation rail	1.6 (0.5)	1.6 (0.6)	1.6 (0.5)	3.0 (0.9)	0.5 (0.2)	1.0 (0.7)
Other	0.2 (0.2)		0.2 (0.2)		2.4 (1.0)	
Total	100.0	100.0	100.0	100.0	100.0	100.0

Population: Operations with 30 or more dairy cows.

O. Nutrient Management

1. Manure-handling methods

Lower percentages of operations in 2014 than in 2007 left manure on pasture, scraped a dry lot, or used an alley scraper in housing areas for weaned heifers. Lower percentages of operations in 2014 than in 2007 left manure on pasture, scraped a dry lot, or used a gutter cleaner in housing areas for cows.

O.1.a. Percentage of operations by method(s) used to handle manure in housing areas for weaned heifers and cows:

Percent Operations

Housing Area

	Weaned-heifer*			Cow			
	Dairy 2002	Dairy 2007	Dairy 2014	Dairy 1996	Dairy 2002	Dairy 2007	Dairy 2014
Manure-handling method	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**	**Pct. Std. error**
Manure left on pasture	73.8 (1.8)	88.5 (1.9)	78.0 (1.3)		72.4 (1.8)	85.3 (2.3)	75.0 (1.3)
Dry lot scraped	50.3 (2.2)	75.3 (3.1)	55.6 (1.7)		57.0 (2.1)	82.5 (2.5)	63.1 (1.7)
Gutter cleaner	18.1 (1.8)	23.6 (2.8)	17.1 (1.4)	63.2 (1.3)	52.6 (1.9)	58.0 (2.5)	47.8 (1.6)
Alley scraper (mechanical or tractor)	42.7 (2.1)	47.3 (3.1)	31.3 (1.6)	57.7 (1.7)	51.4 (2.0)	54.9 (2.9)	47.6 (1.7)
Alley flush with fresh water	0.9 (0.3)	1.0 (0.4)		2.8 (0.3)	2.5 (0.5)	1.5 (0.4)	
Alley flush with recycled water	2.3 (0.5)	3.5 (0.7)	3.8 (0.3)		4.4 (0.6)	5.0 (0.8)	6.8 (0.5)
Slotted floor	2.9 (0.7)	4.9 (1.2)	3.4 (0.7)		3.9 (0.6)	6.2 (1.2)	5.3 (0.7)
Bedded pack (manure pack)	62.1 (2.1)	60.6 (3.0)	65.0 (1.6)		31.6 (2.0)	40.0 (2.9)	32.2 (1.6)
Manure vacuum		0.6 (0.2)	0.9 (0.3)			1.5 (0.8)	1.6 (0.3)
Other method	4.8 (1.0)	6.5 (1.7)	2.5 (0.6)	1.1 (0.4)	3.9 (0.8)	5.3 (1.5)	4.7 (0.8)

Population: Operations with 30 or more dairy cows. Estimates from 2014 were recalculated to only include operations with 30 or more cows to match previous study estimates.
*For operations that housed weaned heifers.

Bedded pack was the primary manure handling method used for weaned heifer housing areas on 36.4 percent of operations in 2014, which is an increase over previous study years. A higher percentage of operations scraped dry lots in heifer housing in 2014 compared with 2002 (20.0 and 14.0 percent, respectively). Alley scrapers were used on a lower percentage of operations for weaned heifers in 2014 (15.8 percent) compared with 2002 (26.7 percent).

For cow housing areas, scraping dry lots was used by a higher percentage of operations in 2014 compared with 2002 (13.4 and 7.5 percent, respectively). The use of gutter cleaners in cow housing areas was lower in 2014 compared with 2002 (35.8 and 43.4 percent, respectively).

O.1.b. Percentage of operations by method used to handle the ***majority*** of manure in weaned-heifer and cow housing areas:

Percent Operations

Housing Area

	Weaned-heifer*						**Cow**					
	Dairy 2002		**Dairy 2007**		**Dairy 2014**		**Dairy 2002**		**Dairy 2007**		**Dairy 2014**	
Manure-handling method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Gutter cleaner	9.1	(1.4)	14.6	(2.5)	8.7	(1.1)	43.4	(2.0)	42.8	(3.0)	35.8	(1.6)
Alley scraper (mechanical or tractor)	26.7	(1.9)	23.5	(2.5)	15.8	(1.2)	34.2	(1.9)	30.1	(2.4)	29.6	(1.4)
Dry lot scraped	14.0	(1.5)	17.5	(2.3)	20.0	(1.4)	7.5	(1.0)	10.1	(1.5)	13.4	(1.0)
Manure left on pasture	18.1	(1.7)	15.4	(2.1)	14.0	(1.2)	8.6	(1.2)	5.7	(1.3)	9.7	(1.0)
Alley flush with recycled water	0.9	(0.2)	0.9	(0.3)	2.0	(0.2)	2.1	(0.3)	2.5	(0.5)	3.7	(0.5)
Bedded pack (manure pack)	27.1	(2.0)	22.6	(2.6)	36.4	(1.7)	1.1	(0.5)	3.2	(1.2)	3.3	(0.6)
Slotted floor	1.3	(0.5)	1.5	(0.6)	1.8	(0.5)	1.1	(0.4)	1.4	(0.6)	1.3	(0.4)
Manure vacuum			0.0	(0.0)	0.2	(0.2)			1.9	(1.1)	0.6	(0.2)
Alley flush with fresh water	0.3	(0.2)	0.0	(—)			0.6	(0.3)	0.2	(0.1)		
Other	2.5	(0.7)	4.0	(1.4)	1.0	(0.4)	1.4	(0.6)	2.1	(0.8)	2.6	(0.7)
Total	100.0		100.0		100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows. Estimates from 2014 were recalculated to include only operations with 30 or more cows.
*For operations that housed weaned heifers.

2. Waste-storage and treatment systems

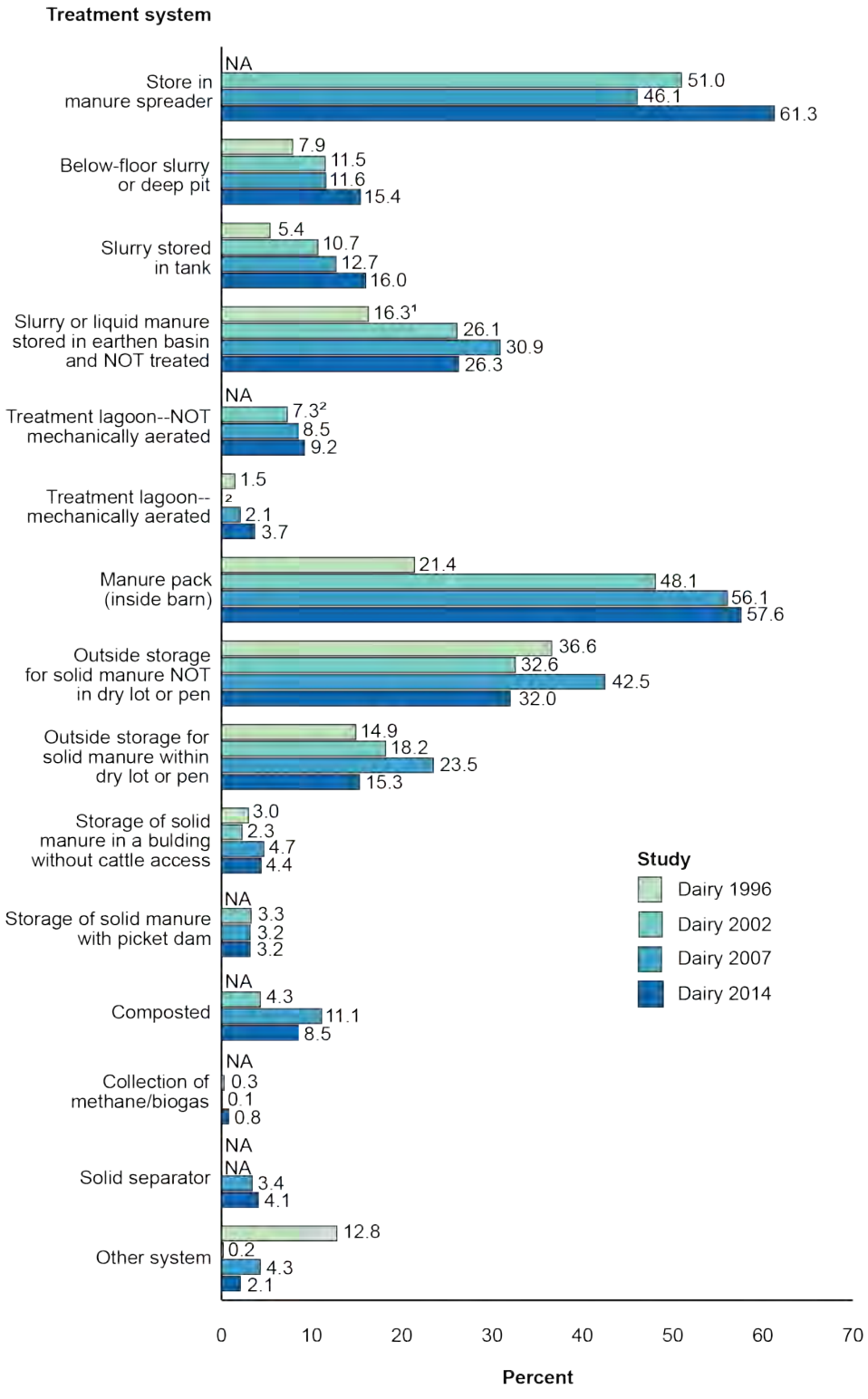
Manure was stored in a manure spreader on a higher percentage of operations in 2014 than in other study years. The use of a below-floor slurry or deep pit increased from 7.9 percent of operations in 1996 to 15.4 percent in 2014; slurry stored in a tank showed the same trend, increasing from 5.4 percent in 1996 to 16.0 percent of operations in 2014. The percentage of operations that used a manure pack increased from 21.4 percent in 1996 to 57.6 percent in 2014. Outside storage of solid manure within a dry lot or pen decreased from 23.5 percent in 2007 to 15.3 percent in 2014.

O.2. Percentage of operations by waste-storage and/or treatment system used:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Waste storage/treatment system	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Store in manure spreader			51.0	(2.0)	46.1	(2.9)	61.3	(1.6)
Below-floor slurry or deep pit	7.9	(0.8)	11.5	(1.2)	11.6	(1.6)	15.4	(1.2)
Slurry stored in tank	5.4	(0.7)	10.7	(1.2)	12.7	(1.8)	16.0	(1.3)
Slurry or liquid manure stored in earthen basin and NOT treated	16.3[1]	(1.2)	26.1	(1.8)	30.9	(2.6)	26.3	(1.4)
Treatment lagoon–NOT mechanically aerated			7.3[2]	(0.8)	8.5	(1.1)	9.2	(0.8)
Treatment lagoon–mechanically aerated	1.5	(0.3)			2.1	(0.5)	3.7	(0.5)
Manure pack (inside barn)	21.4	(1.5)	48.1	(2.1)	56.1	(2.9)	57.6	(1.7)
Outside storage for solid manure NOT in dry lot or pen	36.6	(1.8)	32.6	(2.0)	42.5	(3.0)	32.0	(1.6)
Outside storage for solid manure within dry lot or pen	14.9	(1.4)	18.2	(1.6)	23.5	(2.5)	15.3	(1.2)
Storage of solid manure in a building without cattle access	3.0	(0.6)	2.3	(0.6)	4.7	(1.0)	4.4	(0.7)
Storage of solid manure with picket dam			3.3	(0.7)	3.2	(0.9)	3.2	(0.6)
Composted			4.3	(0.9)	11.1	(2.0)	8.5	(0.8)
Collection of methane/ biogas			0.3	(0.2)	0.1	(0.0)	0.8	(0.2)
Solid separator					3.4	(0.5)	4.1	(0.4)
Other system	12.8	(0.9)	0.2	(0.1)	4.3	(1.2)	2.1	(0.4)

Population: Operations with 30 or more dairy cows.
[1]Question variation: In 1996, questionnaire only asked about slurry storage in earthen basin.
[2]Question variation: In 2002, questionnaire only asked about treatment lagoon.

Percentage of operations by waste-storage and/or treatment system used



Population: Operations with 30 or more dairy cows.
[1]Question variation: In 1996, questionnaire only asked about slurry storage in earthen basin.
[2]Question variation: In 2002, questionnaire only asked about treatment lagoon.

3. Maximum manure storage capacity

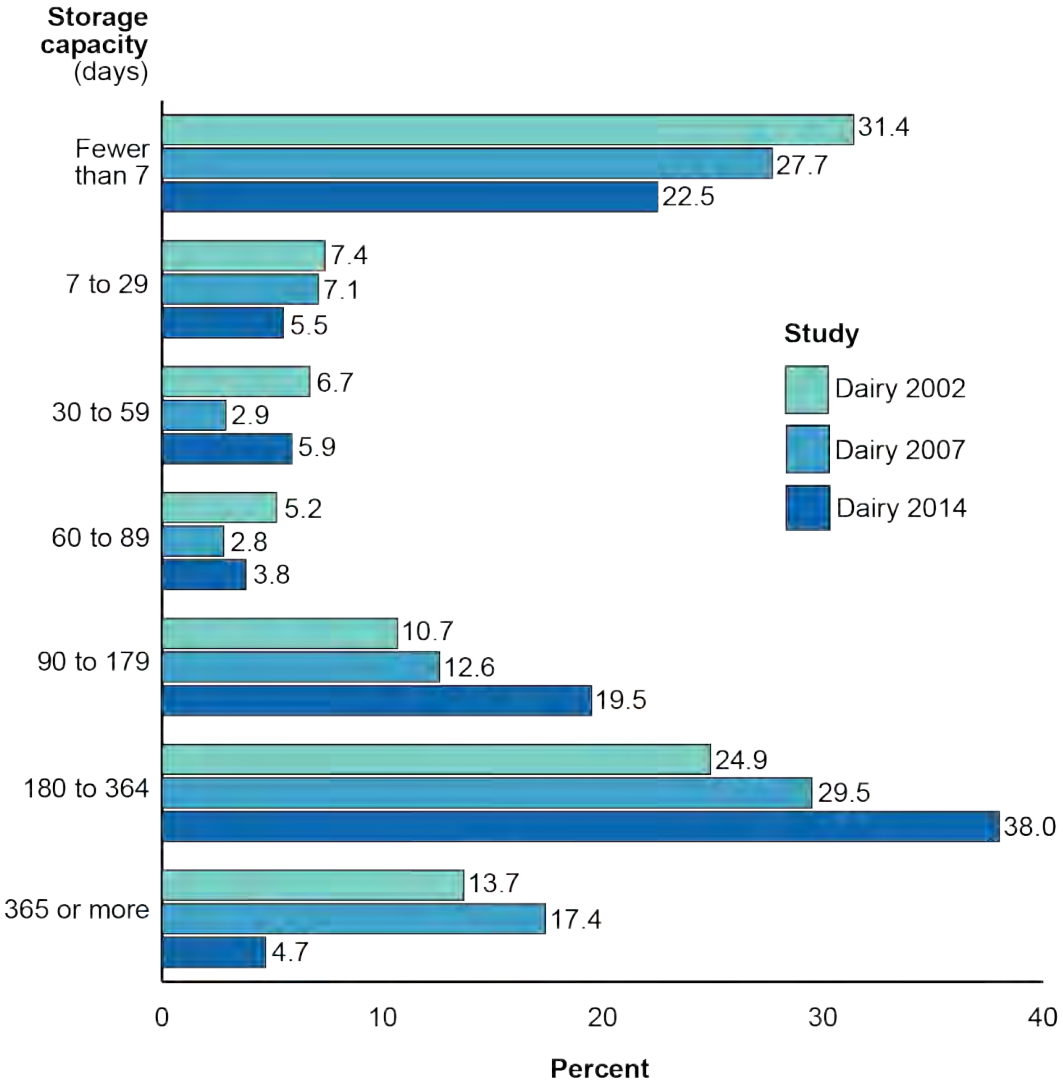
In general, a higher percentage of operations in 2014 than in 2002 had a maximum manure storage capacity of 90 days or more. In 2002, 31.4 percent of operations had a maximum storage capacity of fewer than 7 days compared with 22.5 percent of operations in 2014. Higher percentages of operations in 2014 than in 2002 had a maximum storage capacity from 90 to 179 or from 180 to 364 days. A lower percentage of operations in 2014 had a maximum storage capacity of 365 days or more compared with previous study years.

O.3. Percentage of operations by maximum manure storage capacity (days):

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Storage capacity (days)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Fewer than 7	31.4	(2.1)	27.7	(2.7)	22.5	(1.5)
7 to 29	7.4	(1.1)	7.1	(1.7)	5.5	(0.8)
30 to 59	6.7	(1.2)	2.9	(0.7)	5.9	(0.9)
60 to 89	5.2	(1.0)	2.8	(0.9)	3.8	(0.7)
90 to 179	10.7	(1.2)	12.6	(1.7)	19.5	(1.4)
180 to 364	24.9	(1.7)	29.5	(2.6)	38.0	(1.7)
365 or more	13.7	(1.4)	17.4	(2.2)	4.7	(0.7)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.

Percentage of operations by maximum manure storage capacity



Population: Operations with 30 or more dairy cows.

4. Manure use

Manure was applied to land either owned or rented on nearly all operations across study years. A higher percentage of operations in 2014 than in 1996 sold manure or received other compensation or gave manure away.

O.4. Percentage of operations by method used for manure use:

	Percent Operations							
	Dairy 1996*		Dairy 2002		Dairy 2007		Dairy 2014	
Method	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Applied manure to land either owned or rented	98.9	(0.3)	98.3	(0.4)	99.1	(0.4)	98.3	(0.4)
Gave manure away	6.8	(0.8)	16.2	(1.5)	16.8	(2.0)	11.9	(1.0)
Sold manure or received other compensation	2.3	(0.3)	4.8	(0.7)	7.1	(1.3)	7.4	(0.7)
Used composted manure as bedding	4.7*	(0.7)	1.8	(0.3)	5.1	(1.4)	4.7	(0.5)
Other			0.1	(0.1)	0.9	(0.4)	0.8	(0.3)

Population: Operations with 30 or more dairy cows.
*Question variation: In 1996, questionnaire inquired about composting manure, not using it as bedding.

5. Manure application

For operations that applied manure to land, the use of a broadcast/solid spreader to apply manure to land was used by more than 85 percent of operations across study years. Surface application of slurry liquid almost doubled from 22.7 percent of operations in 1996 to 41.6 percent in 2014. Similarly, subsurface application of slurry liquid increased from 4.3 percent of operations in 1996 to 10.2 percent in 2014.

O.5.a. For operations that applied manure to land (table O.4), percentage of operations by method used to apply manure:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Method	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Broadcast/solid spreader	88.7	(1.1)	90.0	(1.2)	91.5	(1.7)	87.2	(1.1)
Surface application of slurry/liquid	22.7	(1.4)	30.1	(1.8)	40.7	(2.8)	41.6	(1.6)
Subsurface application of slurry/liquid	4.3	(0.7)	6.1	(0.8)	8.8	(1.5)	10.2	(0.8)
Irrigation/sprinkler	7.0	(0.6)	7.6	(0.7)	7.3	(0.8)	7.7	(0.6)
Other	0.1	(0.1)	0.3	(0.2)	1.3	(0.7)	0.8	(0.2)

Population: Operations with 30 or more dairy cows.

For operations that applied manure to land, manure was incorporated into the soil within 24 hours after application on a higher percentage of operations in 2014 than in 1996. A higher percentage of operations in 1996 (82.1 percent) than in 2014 (35.9 percent) never incorporated manure into the soil within 24 hours of application.

O.5.b. For operations that applied manure to land (table O.4), percentage of operations by frequency that manure was incorporated into the soil within 24 hours after application, including subsurface injection:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Frequency	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Always or almost always	17.9*	(1.3)	13.9	(1.4)	22.0	(2.2)	21.3	(1.3)
Sometimes			42.6	(2.2)	42.0	(3.0)	42.8	(1.8)
Never	82.1	(1.3)	43.5	(2.2)	36.0	(2.9)	35.9	(1.7)
Total	100.0		100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
*Question variation: In 1996, question was yes/no.

For operations that applied manure to land, approximately one-third of operations in 2014 analyzed manure for nitrogen, phosphorus, and potassium content compared with 14.0 percent of operations in 1996.

O.5.c. For operations that applied manure to land (table O.4), percentage of operations that analyzed manure for the following nutrients during the previous 12 months:

Percent Operations

	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Nutrient	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Nitrogen	14.0*	(1.2)	20.9	(1.6)	26.9	(2.4)	36.3	(1.5)
Phosphorus			20.4	(1.6)	26.4	(2.3)	36.3	(1.5)
Potassium			20.3	(1.6)	26.4	(2.3)	36.5	(1.5)

Population: Operations with 30 or more dairy cows.
*Question variation: In 1996, questionnaire asked if analyzed nutrient content of manure such as the nitrogen level.

For operations that applied manure to land, about 70 percent in 2007 and 2014 factored the manure volume/acreage available and the soil quality improvement criteria to determine how much and how frequently to apply manure to land.

O.5.d. For operations that applied manure to land (table O.4), percentage of operations by criteria used to determine how much or how frequently manure is applied to the land:

	Percent Operations							
	Dairy 1996		Dairy 2002		Dairy 2007		Dairy 2014	
Criteria	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Crop nitrogen requirement	43.2*	(1.8)	44.8	(2.1)	56.3	(3.0)	58.0	(1.7)
Crop phosphorus requirement			38.5	(2.1)	49.2	(3.1)	51.0	(1.7)
Manure volume/ acreage available			68.3	(2.1)	70.3	(2.8)	70.0	(1.6)
Soil quality improvement					70.7	(2.8)	65.7	(1.7)
Other criteria			6.5	(1.0)	6.2	(1.5)	3.3	(0.6)

Population: Operations with 30 or more dairy cows.
*Question variation: In 1996, questionnaire asked if manure application rate was established based on manure nutrients and/or crop needs.

For operations that applied manure to land, the percentage of operations by the minimum distance between location of manure application and surface water (e.g., lake, pond, stream, or river) did not change from 2002 to 2014. During each study year, about one-quarter of operations applied manure less than 100 feet from surface water, and about one-third of operations applied manure 1,000 or more feet from surface water.

O.5.e. For operations that applied manure to land (table O.4), percentage of operations by minimum distance (in feet) between location of manure application and surface water such as a lake, pond, stream, or river:

Percent Operations

Minimum distance (feet)	**Dairy 2002**		**Dairy 2007**		**Dairy 2014**	
	Pct.	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Less than 100	24.3	(1.8)	24.4	(2.5)	20.4	(1.5)
100 to 199	14.9	(1.6)	16.7	(2.2)	16.8	(1.4)
200 to 499	16.3	(1.6)	20.3	(2.5)	19.3	(1.5)
500 to 999	7.2	(1.1)	7.8	(1.7)	9.4	(1.1)
1,000 or more	37.3	(2.1)	30.8	(2.9)	34.1	(1.7)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.

For operations that applied manure to land, manure was applied to any actively growing plants on a higher percentage of operations in 2014 than in 2002 (72.0 and 63.9 percent, respectively).

O.5.f. For operations that applied manure to land (table O.4), percentage of operations that applied manure to actively growing plants, by crop type:

Percent Operations

	Dairy 2002		Dairy 2007		Dairy 2014	
Crop type	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Pasture or hay	55.6	(2.2)	52.5	(3.0)	60.5	(1.7)
Forage to be ensiled	30.6	(2.0)	28.0	(2.5)	27.7	(1.5)
Other forage	9.0	(1.1)	13.3	(1.9)	16.0	(1.3)
Grain or oilseed	9.2	(1.2)	10.6	(1.7)	11.2	(1.2)
Other	0.4	(0.2)	3.9	(1.4)	1.5	(0.5)
Any	63.9	(2.1)	64.6	(2.9)	72.0	(1.6)

Population: Operations with 30 or more dairy cows.

6. Written nutrient management plan

The percentage of operations that had a written nutrient management plan was higher within each herd size category and for all operations in 2014 than in 2002. Across study years, a higher percentage of large operations than small operations had a written nutrient management plan.

O.6.a. Percentage of operations that had a written nutrient management plan that addressed topics such as land treatment practices or manure storage structures, by herd size:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Herd size (number of cows)	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
Small (30-99)	23.3	(2.3)	35.1	(3.8)	37.1	(2.4)
Medium (100-499)	48.4	(3.0)	62.1	(4.4)	66.7	(2.5)
Large (500 or more)	55.8	(4.1)	62.7	(5.9)	82.2	(1.5)
All operations	30.6	(1.8)	43.6	(2.9)	50.8	(1.7)

Population: Operations with 30 or more dairy cows.

For operations that had a written nutrient management plan, the percentage of operations that developed a written nutrient management plan as part of a USDA voluntary cost share program decreased from 64.5 percent in 2007 to 37.9 percent in 2014.

O.6.b. For operations that had a written nutrient management plan (table O.6.a), percentage of operations that developed or implemented the plan in cooperation with Federal, State, or local agencies:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Plan was…	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Developed in cooperation with the USDA Natural Resource Conservation Service or a local conservation district	81.0	(2.6)	89.2	(2.2)	80.0	(1.9)
Implemented to help satisfy a State or local regulatory requirement	54.9	(3.8)	62.9	(4.2)	66.0	(2.3)
Part of a USDA voluntary cost share program	45.9	(3.5)	64.5	(3.6)	37.9	(2.3)

Population: Operations with 30 or more dairy cows.

7. Nutrient management consultant

Compared with 2002, a higher percentage of operations in 2007 and 2014 consulted with a private nutrient management consultant, natural resource conservation service personnel, or agronomist/crop consultant. Any nutrient management consultant was used on 57.0 percent of operations in 2002 compared with 71.9 percent of operations in 2014.

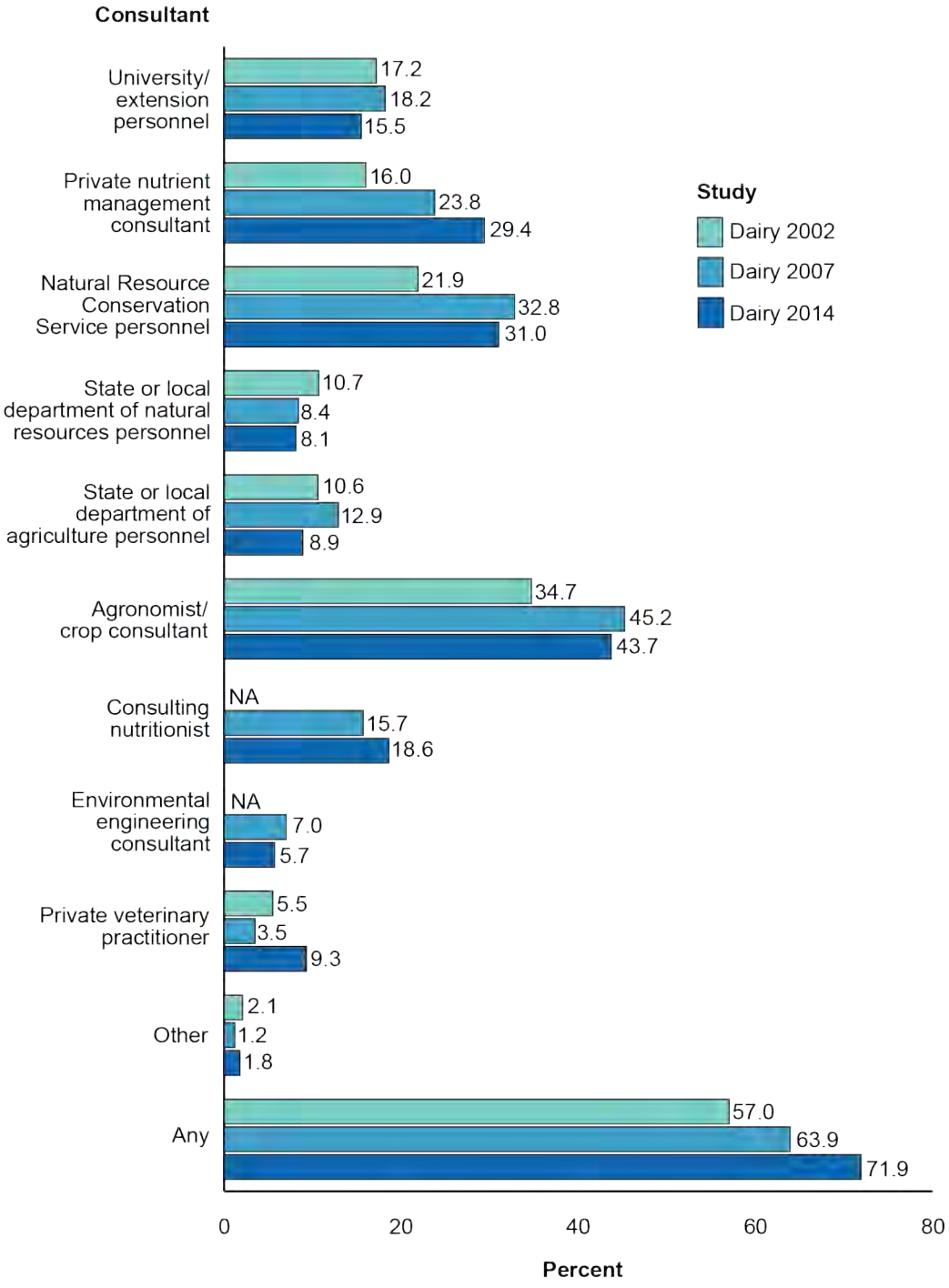
O.7. Percentage of operations in which the following people were consulted about nutrient management for their operation during the previous 12 months:

Percent Operations

	Dairy 2002		Dairy 2007		Dairy 2014	
Consultant	**Pct.**	**Std. error**	**Pct.**	**Std. error**	**Pct.**	**Std. error**
University/extension personnel	17.2	(1.6)	18.2	(2.2)	15.5	(1.2)
Private nutrient management consultant	16.0	(1.4)	23.8	(2.4)	29.4	(1.5)
Natural Resource Conservation Service personnel	21.9	(1.6)	32.8	(2.6)	31.0	(1.6)
State or local department of natural resources personnel	10.7	(1.3)	8.4	(1.2)	8.1	(0.8)
State or local department of agriculture personnel	10.6	(1.3)	12.9	(1.7)	8.9	(0.9)
Agronomist/crop consultant	34.7	(2.0)	45.2	(2.9)	43.7	(1.7)
Consulting nutritionist			15.7	(2.0)	18.6	(1.3)
Environmental engineering consultant			7.0	(1.3)	5.7	(0.6)
Private veterinary practitioner	5.5	(1.0)	3.5	(0.8)	9.3	(0.9)
Other	2.1	(0.5)	1.2	(0.7)	1.8	(0.5)
Any	57.0	(2.2)	63.9	(2.8)	71.9	(1.6)

Population: Operations with 30 or more dairy cows.

Percentage of operations in which the following people were consulted about nutrient management for their operation during the previous 12 months



Population: Operations with 30 or more dairy cows.

8. Knowledge of concentrated animal feeding operation (CAFO) classification

A higher percentage of owners in 2014 than in 2007 reported that their operation was not or will likely will not be classified as a CAFO (58.1 and 37.2 percent, respectively).

O.8. Percentage of operations by actual or perceived classification* under current Federal EPA guidelines regarding CAFOs:

	Percent Operations					
	Dairy 2002		Dairy 2007		Dairy 2014	
Classification category	Pct.	Std. error	Pct.	Std. error	Pct.	Std. error
Never heard of CAFO	38.1	(2.1)	31.2	(2.8)	32.1	(1.6)
Have heard of CAFO, but unsure how my operation is or will be classified	20.5	(1.8)	20.8	(2.7)		
My operation is not or will likely not be classified as a CAFO	33.3	(2.0)	37.2	(2.8)	58.1	(1.7)
My operation is or will likely be classified as a CAFO	8.1	(0.9)	10.8	(1.3)	9.8	(0.7)
Total	100.0		100.0		100.0	

Population: Operations with 30 or more dairy cows.
*Regulations of the CAFO rule revisions were proposed prior to 2002 and became effective in 2008.

Appendix I: Methodology Overview

NAHMS Dairy Studies – National Agricultural Statistics Service Phase					
	1991	**1996**	**2002**	**2007**	**2014**
Data collection dates	4/1991–7/1992	1/1–1/26 1996	12/31/2001–2/12/2002	1/1–1/31 2007	1/1-1/31 2014
Minimum number of dairy cattle	30	1	1	1	1
Number of States	28	20	21	17	17
Data collectors	National Agricultural Statistics Service enumerators				
States as a percentage of U.S. population coverage					
Operations	76.3	80.4	83.0	79.5	80.5
Cows	81.3	83.1	85.7	82.5	81.3
Respondent Sample profile (herd size by number of operations)					
Very small (fewer than 30 cows)	29	150	130	133	69
Small (30-99 cows)	902	1,330	1,001	895	397
Medium (100-499 cows)	705	873	820	691	343
Large (500 or more cows)	175	189	510	475	452
Response category (number of operations)					
Survey complete	1,811	2,542	2,461	2,194	1,261
Percent of total	54.1	56.3	63.5	61.7	36.0
No milk cows	NA	646	227	214	320
Out of business/ no milk sold		179	183	111	69
Out of scope		16	45	6	8
Refused		969	821	785	1,025
Did not contact		NA	2	126	113
Inaccessible		164	137	118	274
Refused or Inaccessible	NA	NA	NA	NA	430*
Total	3,346	4,516	3,876	3,554	3,500

*Operations surveyed with fewer than 30 cows received a separate mail-in questionnaire, and refused or inaccessible operations could not be distinguished.

NAHMS Dairy Studies – Veterinary Services Phase					
	1996	**2002**	**2007 Initial Visit**	**2007 Second Visit**	**2014**
Data collection dates	2/20-5/24 1996	2/25-4/30 2002	2/26-4/30 2007	5/01-8/31 2007	3/6-7/28 2014
Minimum number of dairy cattle	30	30	30	30	30
Number of States	20	21	17	17	17
Data collectors	Veterinary Medical Officers, and Animal Health Technicians				
States as a percentage of U.S. population coverage					
Operations	80.4*	85.6	86.6	84.7	87.8
Cows	78.0	82.7	85.5	82.5	81.4
Respondent Sample profile (herd size by number of operations)					
Small (30-100 cows)	645	400	233	211	75
Medium (100-499 cows)	486	392	215	188	76
Large (500 or more cows)	88	221	134	120	114
Response category (number of operations)					
Survey complete	1,219	1,013	582	519	265
Percent of total	76.0	70.4	54.0	89.0	50.3
No milk cows	29	14	NA	NA	2
Refused	341	335	380	47	245
Did not contact	16	76	111	15	15
Inaccessible	NA	NA	4	2	NA
Total	1,605	1,438	1,077	583	527

*Approximate percentage based on NASS operation counts

Appendix II: Study Objectives and Related Outputs

1. Describe trends in dairy cattle health and management practices
   - “Nutrient Management Practices on U.S. Dairy Operations, 2014”
   - “Colostrum Feeding and Management on U.S. Dairy Operations, 1991-2014,” info sheet
   - **"Trends in Dairy Cattle Health and Management Practices in the United States, 1991-2014”**
2. Describe management practices and production measures related to animal welfare
   - “Dairy Cattle Management Practices in the United States, 2014”
3. Estimate within-herd prevalence of lameness and evaluate housing and management factors associated with lameness
   - **“Associations Between Housing and Management Practices on the Prevalence of Lameness, Hock Lesions, and Thin Cows on U.S. Dairy Operations,” info sheet**
4. Evaluate heifer calf health from birth to weaning
   - “Dairy Cattle Management Practices in the United States, 2014”
   - “Colostrum Feeding and Passive Immunity of Preweaned Holstein Heifer Calves, 2014,” info sheet
   - “Morbidity and Mortality in U.S. Preweaned Dairy Heifer Calves, 2014” info sheet
   - “Prevalence of *Giardia* and *Cryptosporidium* in Preweaned Dairy Heifer Calves, 2014,” info sheet
   - “Average Daily Gain in Preweaned Holstein Heifer Calves, 2014,” info sheet
   - “Prevention of Scours in Preweaned Heifer Calves on U.S. Dairy Operations, 2014,” info sheet
5. Describe antimicrobial use and residue-prevention methods used to ensure milk and meat quality
   - “Milk Quality, Milking Procedures and Mastitis on U.S. Dairy Operations, 2014”
   - “Health and Management Practices on U.S. Dairy Operations, 2014”
   - "Antimicrobial Use on U.S. Dairy Operations, 2002–14,” info sheet
6. Estimate the prevalence and describe antimicrobial resistance patterns of select foodborne pathogens
   - “Prevalence of *Salmonella* Dublin Antibodies in Bulk Tank Milk on U.S. Dairy Operations, 2014,” info sheet
   - “*Campylobacter* on U.S. Dairy Operations, 2014,” info sheet
   - “*Salmonella* on U.S. Dairy Operations, 2014,” info sheet

Additional informational sheets
- “Off-Site Heifer Raising on U.S. Dairy Operations, 2014,”
- “Dairy Cattle and Herd Identification Practices in the United States, 2014”