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Dairy 2007

Biosecurity Practices on U.S. Dairy Operations, 1991-2007

Items of Note

Dairy 2007 marks the fourth time that the National Animal Health Monitoring System has conducted a national study of the U.S. dairy industry. This report contains the latest information on the biosecurity practices used on U.S. dairies and, when possible, provides comparisons of these practices over time.

Preventing and reducing the presence of disease on dairy operations is important and often difficult. Biosecurity and biocontainment practices can significantly reduce the risk of introducing or spreading diseases. Biosecurity is a system of management practices used to prevent the entry of disease-causing agents. Biocontainment is a system of management practices used to prevent the spread of disease between groups of animals on an operation. Sources of potential disease include the introduction of cattle from outside sources and contact with other animals, employees, visitors, vehicles, or equipment.

Disease familiarity

The implementation of biosecurity and biocontainment practices aimed at a specific disease requires that producers have a basic knowledge of the disease or consult with a veterinarian to design an appropriate disease-prevention system. In 2002 and 2007, most producers were fairly knowledgeable or knew some basics about foot-and-mouth disease, BSE, Johne's disease, and *Mycoplasma* mastitis; however, the majority of producers were unfamiliar with heartwater, screwworm, bluetongue, vesicular stomatitis, and hemorrhagic bowel syndrome.

Information sources

In 2002 and 2007, most producers indicated that they would use their private veterinarian for disease information if a foreign animal disease occurred in the United States. Similarly, most producers would contact their veterinarian if they suspected that a foreign animal disease was on their operation. The fact that producers would first turn to their veterinarian in the case of a foreign animal disease occurrence highlights the continuing need to educate veterinary practitioners on foreign animal diseases and provide training on how to handle animals suspected of having a foreign animal disease.

New additions

From 1996 to 2007, approximately one of four operations brought any cattle onto the operation from outside sources. Biosecurity practices that can reduce the risk of new cattle introducing disease to an operation include having knowledge of the disease status of the source operation, testing new cattle for specific diseases before or immediately after arrival, implementing a quarantine period, and vaccinating for specific diseases. Of operations that introduced new cattle to their operation in 2007, 47.2 percent required vaccination for new additions, 23.3 percent required testing, and 20.3 percent quarantined newly introduced cattle.

Contact with wildlife

Cattle on many dairy operations frequently have contact with cats, dogs, and deer, all of which are capable of spreading disease to cattle. Deer can transmit tuberculosis to cattle and vice versa and are difficult to exclude from cattle pastures. Wildlife access to hay stacks and other stored feed can be limited through the use of buildings and fences. Almost one-half of dairy operations in 2007 limited cattle contact with wildlife or other livestock (48.5 percent) or controlled access to cattle feed (49.9 percent).

Employees and visitors

Employees or visitors—especially those who have contact with animals from other operations—can introduce disease agents via their boots, clothing, vehicles, or other equipment. As people travel more frequently throughout the world, the risk of inadvertent or intentional introduction of disease agents foreign to the United States increases. Establishing written policies or guidelines pertaining to travel and animal contact by visitors and employees will help reduce the risk of disease introduction. The percentage of operations that had employees increased from 47.2 percent in 2002 to 75.7 percent in 2007. As expected, the number of full-time employees increased as herd size increased. More than one-half of all operations in 2007 had visitors 1 to 14 times per week. In 2007, 30.4 percent of operations had guidelines for determining which visitors were allowed in animal areas, and 51.3 percent had restrictions on vehicles entering animal areas.

Vaccination

Vaccination can reduce the prevalence and/or severity of specific diseases. The percentage of operations that vaccinated heifers against any disease decreased from 91.3 percent in 1991 to 83.0 percent in 2007. The percentage of operations that vaccinated heifers against brucellosis decreased from 1991 to 2007 (66.8 and 41.6 percent, respectively). This decrease may be due to the fact that from 1991 to 2007 many States switched from a mandatory to a voluntary brucellosis vaccination program. In addition, the number of States certified brucellosis-free increased from 34 in 1996 to 49 in 2007, which may have impacted the number of operations that vaccinated against brucellosis. Overall, vaccine use in cows remained at approximately 80 percent from 1996 to 2007. The highest percentage of vaccines administered to heifers and cows were primarily for viral respiratory diseases.

Disease conditions

The three most common diseases/conditions in dairy cattle identified by producers in 2007 were clinical mastitis, lameness, and infertility problems (16.5, 14.0, and 12.9 percent of cows, respectively). In addition, these diseases/conditions accounted for the majority of cows permanently removed from the herd and for about one-third of cow deaths.

Mortality

Animal deaths represent the least desirable health outcome. Once a death has occurred, determining cause is important in preventing future deaths and improving the health of the herd. The percentage of preweaned heifer deaths decreased from 10.8 percent in 1996 to 7.8 percent in 2007. Weaned heifer-calf deaths increased from 2.2 percent in 1991 to 2.8 percent in 2002 then decreased to 1.8 percent in 2007. In contrast to heifer deaths, cow deaths increased from 3.8 percent in 1996 to 5.7 percent in 2007. A relatively low percentage of operations performed necropsies on dead preweaned heifers, weaned heifers, or cows (8.0, 7.1, and 13.0 percent, respectively).

Selected Highlights of Biosecurity Practices on U.S. Dairy Operations, 1991–2007

Most producers were fairly knowledgeable or knew some basics about foot-and-mouth disease, BSE, Johne's disease, and *Mycoplasma* mastitis; however, the majority of producers were unfamiliar with heartwater, screwworm, bluetongue, vesicular stomatitis, and hemorrhagic bowel syndrome in 2002 and 2007.

Most producers in 2002 and 2007 indicated that they would use their private veterinarian for disease information if a foreign animal disease occurred in the United States or contact their veterinarian if they suspected that a foreign animal disease was on their operation.

In Dairy 2007, the most common classes of cattle brought on the operation from outside sources were: lactating dairy cows, added by 13.8 percent of operations; weaned dairy bulls, added by 12.5 percent of operations; and bred dairy heifers, added by 12.2 percent of operations.

Almost one-half of cow replacements for large operations (47.8 percent) were born on the operation but raised off-site. In 2007, nearly two-thirds of operations that sent heifers off-site to be raised (63.8 percent) used a rearing facility in which the heifers had contact with cattle from other operations.

Of operations bringing dairy cattle from outside sources onto the operation, less than one-half (47.2 percent) required vaccination of new additions prior to arrival; approximately one of five operations (20.3 percent) quarantined new additions, and nearly one of four operations (23.3 percent) required testing for new additions.

The percentage of operations that had employees increased from 47.2 percent in 2002 to 75.7 percent in 2007. In addition to employees, dairy operations had regular and frequent visits from a variety of people doing business with the operation, including delivery people, milk haulers, cattle haulers, artificial insemination technicians, nutritionists, and veterinarians. These people, who may or may not have had contact with cattle on the operation and multiple other operations, can carry diseases from one operation to another. In an average week, over one-half of all operations (51.6 percent) had between 1 and 14 visits by people coming onto the operation.

In 2007, 3 of 10 operations (30.4 percent) had guidelines for determining which visitors were allowed in animal areas. Of operations that had visitors in the 12 months prior to the 2007 interview, 6.9 percent had footbaths for visitors entering animal areas. A higher percentage of operations in 2007 than in 2002 required disposable or clean boots for visitors entering animal areas and had

restrictions on vehicles entering animal areas. The percentage of operations that had guidelines about which visitors were allowed in animal areas or that had footbaths for visitors entering animal areas remained unchanged from 2002 to 2007.

Dogs, cats, and members of the deer family were the three animal types most often reported as having contacts with dairy cattle. On operations in which deer or other members of the deer family had contact with cattle and/or their feed or water in 2007, 90.8 percent of operations reported that cattle could possibly or sometimes have face-to-face contact with deer. There were no differences by region in the percentages of operations that reported face-to-face contact between cattle and deer.

The percentage of operations that separated newborn calves from their dams immediately after they were born doubled from 1991 to 2007 (28.0 to 55.9 percent of operations, respectively).

Overall, only 2.1 percent of operations routinely measured passive transfer status via serum total proteins.

In 2007, about one-third of operations (32.2 percent) routinely used the same equipment to handle manure and to feed cattle; another one-third (35.6 percent) rarely used the same equipment; and another one-third (32.2 percent) never used the same equipment to handle both manure and feed. In 2002 and 2007, about one of three operations shared equipment with other livestock operations.

The percentage of operations that administered any vaccine to heifers decreased from 91.3 percent in 1991 to 83.0 percent in 2007. The percentage of operations that vaccinated heifers against brucellosis decreased from 66.8 percent in 1991 to 41.6 percent in 2007. In cows, the use of the most common vaccines (BVD, IBR, PI3, BRSV, and leptospirosis) has remained steady since 1996.

The three most common disease conditions in cows identified by producers in 2007 were clinical mastitis, lameness, and infertility problems (16.5, 14.0, and 12.9 percent of cows, respectively).

The percentages of preweaned and weaned heifer calves that died decreased from 1996 to 2007, while the percentage of cows that died increased. The percentage of cow deaths due to lameness or injury increased from 12.7 percent in 1996 to 20.0 percent in 2007.

In 2007, a relatively low percentage of operations performed necropsies on dead preweaned heifers, weaned heifers, or cows (8.0, 7.1, and 13.0 percent, respectively) to determine cause of death.

Although rendering remained the primary method of dead-cow disposal, the percentage of operations that used this method decreased from 62.4 percent in 2002 to 56.9 percent in 2007.

Acknowledgements

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The NAHMS dairy studies were cooperative efforts between State and Federal agricultural statisticians, animal health officials, university researchers, and extension personnel. We want to thank the National Agricultural Statistics Service (NASS) enumerators, State and Federal veterinary medical officers (VMOs), and animal health technicians (AHTs) who visited the farms and collected the data. Their hard work and dedication to the National Animal Health Monitoring System (NAHMS) are invaluable. The roles of the producer, Area Veterinarian in Charge (AVIC), NAHMS Coordinator, VMO, AHT, and NASS enumerator were critical in providing quality data for all the dairy reports. Thanks also to the personnel at the Centers for Epidemiology and Animal Health (CEAH) for their efforts in generating and distributing valuable reports from the data. Additional support was afforded by the generous contributions of collaborators for the Dairy studies, including

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(Click on “FEEDBACK on NAHMS reports.”)

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Introduction

Biosecurity and Biocontainment

Biosecurity and biocontainment methods can significantly reduce the risk of introducing new diseases to an operation or of spreading disease among animals on the operation. Biosecurity is a system of management practices used to prevent the entry of disease-causing agents. Biocontainment is a system of management practices used to prevent the spread of disease between groups of animals on an operation (Villarroel et al., 2007). A good biocontainment plan can limit the spread of disease already present on the operation and also serve to back up the biosecurity plan in the event that a new disease is introduced to an operation. Biosecurity and biocontainment measures are both necessary to reduce the potential impacts of a disease outbreak.

Recognizing and understanding all aspects of potential biosecurity breaches are essential to managing a successful biosecurity program. Generally, the biosecurity issues that receive the most attention are: the process of introducing new animals to the operation, which includes knowing the source and health history of new animals; isolating new animals from the main herd and testing them for appropriate diseases; designing strategic vaccination programs; and sanitation practices, including milking procedures, disinfection of equipment, and manure management. Many other key components of disease control are often overlooked. For example, minimizing stress helps animals resist and overcome disease challenges. Animal stress can be reduced by providing a comfortable and clean environment, sufficient housing space, adequate bunk space, and by segregating cattle into appropriate age and/or size groups. Providing quality feed and water, maintaining a balanced ration with proper nutrient levels, and providing transition diets to cows around the time of calving also help decrease nutritional stress and ensure optimal immune function for disease resistance. Managing and regulating visitors, service personnel, employees, and animal traffic are also essential aspects of biosecurity. Finally, controlling animals' exposure to wildlife, insects, and wind-borne pathogens are other areas for consideration.

Importance of Biosecurity

Infectious diseases can have a devastating impact on the productivity of any dairy operation. Virtually every disease results in productivity losses, and in some cases these losses can be substantial, particularly on larger operations in which more animals are at risk. Milk production and quality can decrease, resulting in immediate financial consequences. Reproductive efficiency can decline, compounding the financial strain by increasing days open and culling rates. As a result, calf numbers are negatively affected and replacement costs rise. Furthermore, treatment expenses, debilitated animals, and increased death losses certainly have financial implications, but also may limit animal

marketing options. Finally, depending on the nature of the pathogen, public health issues may arise, such as the spread of zoonoses, antimicrobial resistance, drug residues, and impaired or reduced food safety.

On a national level, biosecurity programs are crucial in keeping the country free from numerous animal diseases exotic to the United States. Due to the threat of bioterrorism and the recent international outbreaks of infectious diseases such as foot-and-mouth and bovine spongiform encephalopathy, strict import and trade restrictions have been implemented as components of a national biosecurity plan. In addition, there are current and past eradication programs for many diseases familiar to most livestock producers, such as tuberculosis, brucellosis, classical swine fever (hog cholera), and pseudorabies. These programs include national-level biosecurity protections.

Whether motivation stems from risk of decreased productivity on individual operations or producer responsibility to exclude or eradicate disease on a national level, the net benefit of biosecurity is improved animal and public health.

Biosecurity Development

Developing a formal biosecurity plan is an exercise in risk assessment. As such, there are four steps to include in the assessment process:

1. Hazard identification,
2. Exposure assessment,
3. Risk characterization, and
4. Mitigation plan.

1. Hazard identification—The preliminary step in designing a biosecurity plan is to assess the specific risks for the operation. Wells (2000) suggests that the operation first identify its chief source of income. For example, on most dairies milk is the primary product. Diseases that cause decreased milk production and quality and result in early culling should have the highest priority. In contrast, dairies that market primarily animal semen or embryos should concentrate biosecurity efforts against reproductive diseases, as well as diseases with international trade implications such as bovine leukosis virus and bluetongue virus (Dargatz et al., 2002; McCluskey, 2002).

2. Exposure assessment—Operations must identify which specific diseases are most likely to be hazards for their particular farms and identify the most probable means by which cattle would be exposed. Many factors should be considered, including: the addition of new animals; disease history; proximity to other livestock operations; potential contact with wildlife; prospective visitors; off-farm animal travel; geographic location; rodent, insect, and bird populations; and wind and weather patterns (Wells, 2000; BAMN, 2001a; Kirk, 2009).

3. Risk characterization—Once potential hazards have been assessed, the degree of risk must be characterized for the operation. This qualitative assessment can be done simultaneously with the exposure assessment.

Operations that purchase replacement heifers have a higher risk of introducing infectious diseases to the premises than those that do not make off-site animal purchases. In addition, dairies that allow the same employees to work with calves, sick cows, and milk cows have a higher potential risk of transferring disease agents between groups of animals than dairies that assign employees to one specific group of animals. The risk of transmitting *Mycobacterium avium*, subspecies *paratuberculosis* (the causative agent of Johne's disease) is increased on operations that feed pooled colostrum and/or unpasteurized pooled milk to calves (Nielsen et al., 2008). This risk is compounded if the colostrum comes from cows with unknown Johne's disease status.

Another component of characterizing an operation's greatest risks is evaluating the potential means of disease control and how the mitigation plan will be implemented on the operation. Vaccine availability and efficacy for certain diseases also must be considered. Vaccination is relatively efficacious for diseases such as infectious bovine rhinotracheitis, but vaccines are not generally available for other diseases, such as anaplasmosis and Johne's disease.

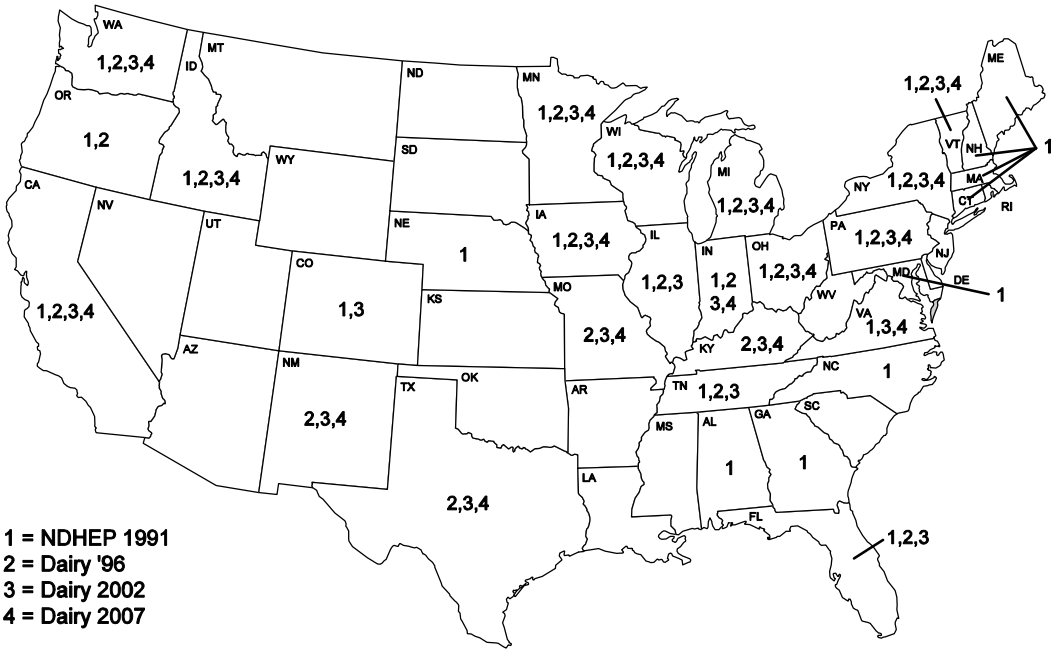
4. Mitigation plan—All information obtained from steps 1 through 3 should be assimilated into a final plan for mitigation. The mitigation plan should include: the diseases of utmost importance; where control efforts are to be directed; a detailed plan to assess the current levels of disease on the operation (serologic or fecal testing, for example); and written strategies detailing what will be done to prevent the introduction or spread of these diseases (McCluskey, 2002).

Numerous checklists and scorecards have been developed to aid in the analysis process. These assessments can serve as guidelines to help identify potential hazards and the degree of risk for disease acquisition or transmission on an operation. Risk assessments are available for specific diseases or situations. For example, The Center for Food Security and Public Health at Iowa State University has a series of risk assessment tools available for veterinarians and dairy producers: http://www.cfsph.iastate.edu/Infection_Control/index.php (Center for Food Safety and Public Health). The New York State Cattle Health Assurance Program provides a risk assessment tailored to herd expansion biosecurity concerns (New York State Cattle Health Assurance Program), and a Johne's disease risk assessment is available at: http://johnesdisease.orgHandbook%20for%20Vets%20&%20Beef%20Producers.pdf.

This report, "Biosecurity Practices on U.S. Dairy Operations, 1991–2007", provides national estimates of dairy cattle health and management practices for comparable populations from the National Dairy Heifer Evaluation Project (NDHEP) 1991, NAHMS Dairy 1996, Dairy 2002, and Dairy 2007 studies (see map, next page). The latest study, Dairy 2007, was conducted in 17 of the Nation's major dairy States and provides participants, stakeholders, and the industry as a whole with

valuable information representing 79.5 percent of U.S. dairy operations and 82.5 percent of U.S. dairy cows. State and Federal veterinary medical officers (VMOs) and animal health technicians (AHTs) conducted the questionnaire interviews. Due to educational efforts, producer awareness and recognition of some diseases have increased and may be partially responsible for changes observed in disease prevalence.

States Participating in NAHMS Dairy Studies, 1991, 1996, 2002, 2007



Terms Used in This Report

Biocontainment: Management practices used to prevent the spread of disease between groups of animals on an operation.

Biosecurity: Management practices used to prevent the entry of disease-causing agents onto an operation.

Bovine viral diarrhea (BVD): An infectious disease of cattle caused by a pestivirus. Infection can result in early embryonic death, abortion, stillbirths, and congenital defects such as cerebellar agenesis, which results in ataxia or lack of coordination. Cattle infected with BVD virus in utero are referred to as persistently infected. Persistently infected animals continuously shed large quantities of the virus via nasal discharge, saliva, semen, urine, feces, tears, and milk, thereby serving as a source of persistently infected cattle.

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

Heifer: Female dairy bovine that has not yet calved.

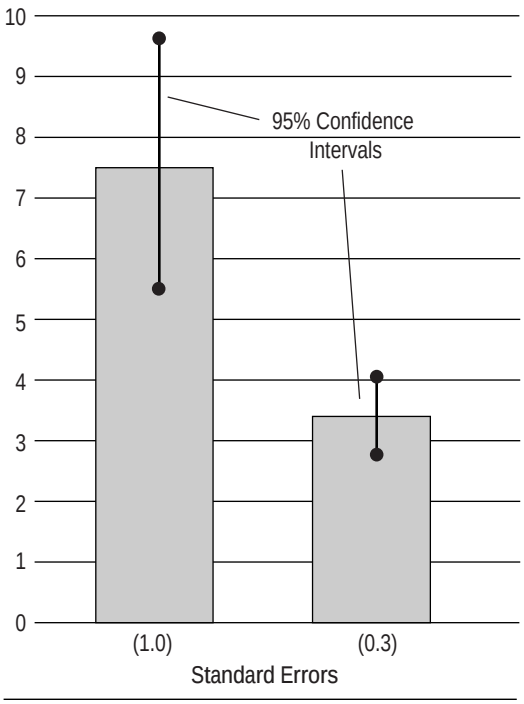
Herd size: Herd size is based on the respective January 1 cow inventory. Small herds are those with fewer than 100 cows; medium herds are those with 100 to 499 cows; and large herds are those with 500 or more cows.

Operation average: The average value for all operations. A single value for each operation is summed over all operations reporting divided by the number of operations reporting. For example, operation average number of shipments (see table a., p 21) is calculated by summing reported average number of shipments over all operations divided by the number of operations.

Population estimates: The estimates in this report make inference to all of the operations with dairy cows in the target population (see Section II: Methodology, p 130). Data from the operations responding to the survey are weighted to reflect their probability of selection during sampling and to account for any survey nonresponse.

Precision of 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. In the example to the right, 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). The second estimate of 3.4 shows a standard error of 0.3 and results in limits of 2.8 and 4.0. Alternatively, the 90-percent confidence interval would be created by multiplying the standard error by 1.65 instead of 2. Most estimates in this report are rounded to the nearest tenth. If rounded to 0, the standard error was reported (0.0). If there were no reports of the event, no standard error was reported (--). References to estimates being higher or lower than other estimates are based on the 95-percent confidence intervals not overlapping.

Examples of a 95% Confidence Interval



Regions (2007):

- **West:** California, Idaho, New Mexico, Texas, Washington
- **East:** Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Vermont, Virginia, Wisconsin

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

Section I: Population Estimates

NOTE: Unless otherwise specified, estimates in the following tables represent only operations with 30 or more dairy cows.

A. Producer Familiarity with Disease

1. Knowledge of specific diseases

Familiarity with the signs of various diseases is an important part in developing an effective biosecurity plan. Familiarity with diseases may also help limit the spread of a disease, should it be introduced into the herd.

Producer familiarity with diseases varied greatly. In 2002 and 2007, most producers were fairly knowledgeable or knew some basics about foot-and-mouth disease, bovine spongiform encephalopathy, Johne's disease, and *Mycoplasma* mastitis; however, the majority of producers were unfamiliar with heartwater, screwworm, bluetongue, vesicular stomatitis, and hemorrhagic bowel syndrome. In 2002, the percentage of producers that were fairly knowledgeable about foot-and-mouth disease was about twice that of producers in 2007 (16.5 and 8.9 of operations, respectively). The percentage of operations that were fairly knowledgeable about Johne's disease, *Mycoplasma* mastitis, and hemorrhagic bowel syndrome increased from 2002 to 2007.

Percentage of operations by level of familiarity with specific cattle diseases in 2007

	Percent Operations							
	Level of Familiarity							
	Fairly Knowledge-able		Know Some Basics		Recognized the Name, Not Much Else		Had Not Heard of it Before	
	Dairy 2002	Dairy 2007	Dairy 2002	Dairy 2007	Dairy 2002	Dairy 2007	Dairy 2002	Dairy 2007
Disease	Pct. (SE)	Pct. (SE)	Pct. (SE)	Pct. (SE)	Pct. (SE)	Pct. (SE)	Pct. (SE)	Pct. (SE)
Foot-and-mouth disease	16.5 (1.5)	8.9 (1.2)	54.6 (2.1)	49.3 (2.9)	28.1 (1.9)	40.7 (2.9)	0.8 (0.3)	1.1 (0.7)
Heartwater	0.3 (0.2)	0.6 (0.3)	0.9 (0.3)	1.0 (0.4)	3.7 (0.7)	4.5 (1.0)	95.1 (0.8)	93.9 (1.1)
Bovine spongiform encephalopathy (BSE)	13.9 (1.5)	19.6 (2.0)	46.5 (2.2)	60.8 (2.7)	38.0 (2.1)	18.8 (2.2)	1.6 (0.5)	0.8 (0.6)
Screwworm	5.9 (1.0)	4.0 (0.8)	11.5 (1.2)	15.1 (1.9)	45.1 (2.2)	37.4 (2.6)	37.5 (2.2)	43.5 (2.7)
Johne's disease (*Mycobacterium* paratuberculosis)	45.3 (2.1)	57.9 (2.9)	42.3 (2.1)	36.2 (2.8)	11.4 (1.4)	4.4 (1.2)	1.0 (0.3)	1.5 (0.6)
Bluetongue	2.6 (0.6)	2.2 (0.9)	5.2 (0.8)	8.5 (1.2)	40.7 (2.0)	41.0 (2.8)	51.5 (2.1)	48.3 (2.8)
Vesicular stomatitis	1.1 (0.3)	0.7 (0.3)	2.8 (0.5)	3.4 (0.8)	12.9 (1.3)	14.1 (1.7)	83.2 (1.4)	81.8 (1.9)
Anthrax	9.6 (1.2)	5.1 (1.2)	32.6 (2.0)	28.4 (2.6)	54.0 (2.2)	56.3 (2.8)	3.8 (0.8)	10.2 (1.8)
Mycoplasma mastitis	8.7 (1.0)	20.3 (1.8)	21.8 (1.7)	39.9 (2.8)	46.6 (2.2)	30.4 (2.8)	22.9 (2.0)	9.4 (1.8)
Hemorrhagic bowel syndrome (HBS)	1.0 (0.2)	8.2 (1.1)	2.5 (0.4)	17.6 (1.9)	8.7 (1.3)	22.6 (2.3)	87.8 (1.3)	51.6 (2.7)

() = standard error.

2. Information sources in case of a foreign animal disease outbreak

The introduction of a foreign animal disease into the United States could be catastrophic. Knowing where producers would turn for information in the event of a foreign animal disease outbreak is critical to planning for the control of an outbreak.

Most producers in 2002 and 2007 indicated they would use their private veterinarian as an information source if a foreign animal disease outbreak occurred in the United States (92.8 and 93.6 percent, respectively). Other resources would be used, but not to the extent of the private veterinarian.

Percentage of operations by likelihood of using the following information sources if an outbreak of foreign animal disease occurred in the United States

	Percent Operations					
	Likelihood					
	Very Likely		Somewhat Likely		Not Likely	
	Dairy 2002	Dairy 2007	Dairy 2002	Dairy 2007	Dairy 2002	Dairy 2007
Information Source	Pct. Std. Error	Pct. Std. Error	Pct. Std. Error	Pct. Std. Error	Pct. Std. Error	Pct. Std. Error
Other dairy producers	40.5 (2.1)	41.4 (2.8)	34.5 (2.0)	37.8 (2.7)	25.0 (1.9)	20.8 (2.3)
Private veterinarian	92.8 (1.1)	93.6 (1.3)	6.6 (1.1)	5.4 (1.3)	0.6 (0.3)	1.0 (0.5)
Extension agent	34.2 (2.0)	32.5 (2.7)	36.9 (2.1)	38.9 (2.9)	28.9 (2.0)	28.6 (2.5)
Dairy organization or cooperative	30.3 (1.9)	30.7 (2.6)	41.8 (2.1)	42.3 (2.8)	27.9 (1.9)	27.0 (2.6)
Magazines	41.8 (2.1)	39.0 (2.8)	44.7 (2.1)	49.4 (2.8)	13.5 (1.5)	11.6 (1.5)
Internet	19.0 (1.6)	23.1 (2.2)	27.4 (1.9)	28.8 (2.6)	53.6 (2.1)	48.1 (2.8)
State Veterinarian's office	34.7 (2.1)	26.7 (2.4)	31.3 (2.0)	37.4 (2.8)	34.0 (2.1)	35.9 (2.9)
U.S. Department of Agriculture	25.1 (1.8)	22.6 (2.4)	38.1 (2.2)	42.5 (2.8)	36.8 (2.1)	34.9 (2.7)
Television/ newspapers	30.7 (2.1)	25.8 (2.5)	35.2 (2.0)	38.8 (2.8)	34.1 (2.0)	35.4 (2.6)
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)

3. Resource contacts

Most producers indicated they would contact their private veterinarian if they suspected a foreign animal disease on their operation. About 4 of 10 operations would contact the State Veterinarian's office. These responses highlight the continuing need to educate veterinary practitioners on the identification and handling of suspected foreign animal diseases on livestock operations.

Percentage of operations 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 Operations			
	Dairy 2002		Dairy 2007	
Resource	Percent	Std. Error	Percent	Std. Error
Extension agent/university	25.4	(1.8)	20.8	(2.3)
State Veterinarian's office	43.9	(2.2)	35.7	(2.6)
U.S. Department of Agriculture	25.5	(1.8)	21.8	(2.3)
Private veterinarian	97.9	(0.7)	98.6	(0.5)
Feed company or milk cooperative representative	28.0	(1.9)	25.7	(2.3)
Other	3.3	(0.7)	4.1	(1.3)

B. Herd Addition Risks

1. Classes of cattle brought onto dairy operations from outside sources

For most dairies, the introduction of new animals poses one of the greatest threats to biosecurity. All other factors being equal, the number of new animals introduced onto the operation and the number of times new animals are introduced (number of shipments) can help quantify the level of risk. Each age group or class of animals brought onto an operation poses its own biosecurity risks. Lactating cows can harbor contagious mastitis pathogens, which can easily be spread to other cows in the string. Bred cattle can harbor reproductive pathogens, and calves can introduce new strains of respiratory and enteric pathogens to other calves (Villarroel et al., 2007). A comprehensive biosecurity program examines the risks particular to each operation through the introduction of each group of cattle and institutes a series of controls to help reduce the risks.

In Dairy 2007, the most common classes of cattle brought onto the operation from outside sources were lactating dairy cows (13.8 percent of operations), weaned dairy bulls (12.5 percent of operations), and bred dairy heifers (12.2 percent of operations). The percentages of operations that introduced bred heifers or lactating cows decreased from 1996 to 2007.

From 1996 to 2007, about 4 of 10 operations brought any cattle from outside sources onto the operation. A lower percentage of operations in 2007 brought on any cattle compared with 2002.

a. Percentage of operations* that brought the following classes of cattle onto the operation

	Percent Operations			Percent Operations			
Cattle Class	Dairy 1996	Std. Error	Cattle Class	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Preweaned calves (dairy or beef)	5.0	(0.7)	Preweaned calves (dairy or beef)	5.1	(0.7)	3.4	(0.6)
Dairy heifers weaned, but not bred	7.3	(0.7)	Dairy heifers weaned, but not bred	6.7	(0.7)	6.4	(0.7)
Bred dairy heifers	18.5	(0.9)	Bred dairy heifers	15.8	(0.9)	12.2	(0.9)
Lactating dairy cows	19.9	(1.0)	Lactating dairy cows	16.4	(1.0)	13.8	(1.0)
Dry dairy cows	7.1	(0.8)	Dry dairy cows	5.9	(0.6)	4.3	(0.6)
Bulls (weaned)	8.7	(0.7)	Dairy bulls (weaned)	13.7	(0.9)	12.5	(0.9)
			Beef bulls (weaned)	2.3	(0.4)	1.7	(0.3)
Other heifers and cows (including beef)	1.9	(0.4)	Beef heifers and cows`	1.5	(0.3)	1.3	(0.3)
Steers (weaned)	2.0	(0.3)	Steers (weaned)	1.1	(0.3)	1.8	(0.4)
Any	43.9	(1.3)	Any	45.7	(1.4)	38.9	(1.4)

*Operations with any dairy cows.

Only 1.0 percent of large operations and 3.8 percent of small operations added preweaned calves from outside sources in 2007. A higher percentage of large operations brought on dairy heifers, bred dairy heifers, dairy bulls, and any beef or dairy cattle compared with medium or small operations.

b. Percentage of operations* that brought the following classes of cattle onto the operation, by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Cattle Class	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Preweaned calves (dairy or beef)	3.8	(0.8)	2.5	(0.6)	1.0	(0.3)	3.4	(0.6)
Dairy heifers weaned, but not bred	5.3	(0.8)	7.6	(1.2)	16.3	(2.6)	6.4	(0.7)
Bred dairy heifers	8.9	(1.0)	18.1	(1.8)	34.7	(2.6)	12.2	(0.9)
Lactating dairy cows	13.2	(1.3)	16.0	(1.7)	13.0	(1.9)	13.8	(1.0)
Dry dairy cows	4.1	(0.8)	4.3	(0.9)	5.5	(1.5)	4.3	(0.6)
Beef heifers and cows	0.9	(0.3)	2.5	(0.7)	1.1	(0.6)	1.3	(0.3)
Dairy bulls (weaned)	11.4	(1.1)	14.1	(1.6)	22.5	(2.4)	12.5	(0.9)
Beef bulls (weaned)	1.5	(0.4)	2.2	(0.6)	1.5	(0.5)	1.7	(0.3)
Steers (weaned)	2.0	(0.5)	1.3	(0.5)	0.7	(0.6)	1.8	(0.4)
Any	35.6	(1.7)	44.3	(2.3)	61.6	(2.8)	38.9	(1.4)

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

A higher percentage of operations in the West region added any cattle from outside sources compared with operations in the East region (49.3 and 38.0 percent of operations, respectively).

c. Percentage of operations* that brought the following classes of cattle onto the operation, by region

	Percent Operations			
	Region			
	West		East	
Cattle Class	Percent	Std. Error	Percent	Std. Error
Preweaned calves (dairy or beef)	0.6	(0.3)	3.6	(0.6)
Dairy heifers weaned, but not bred	12.6	(2.2)	5.9	(0.7)
Bred dairy heifers	21.1	(2.3)	11.5	(0.9)
Lactating dairy cows	8.5	(1.5)	14.3	(1.1)
Dry dairy cows	2.3	(0.7)	4.4	(0.7)
Beef heifers and cows	1.5	(0.7)	1.3	(0.3)
Dairy bulls (weaned)	21.8	(2.6)	11.8	(0.9)
Beef bulls (weaned)	2.8	(0.9)	1.6	(0.3)
Steers (weaned)	0.3	(0.3)	1.9	(0.4)
Any	49.3	(3.0)	38.0	(1.5)

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

2. Source of replacements

Many diseases are initially introduced into a herd by the purchase of an infected animal. Knowing the source of purchased cattle may provide the buyer the opportunity to directly inquire about diseases on the source operation. Almost two-thirds of operations (64.2 percent) did not introduce cattle into their herds during the previous 12 months, which is slightly higher than the 61.1 percent reported in table b., p 13. The difference between the two estimates is likely the result of the different populations used to make the estimates: the 64.2 percent represents operations with 30 or more cows, while 61.1 percent represents operations with any dairy cows.

Only 2.6 percent of operations did not know the source of any cattle introduced in 2007, while 24.2 percent knew the source of all cattle introduced. A higher percentage of small operations than large operations had no incoming cattle. Of small operations, 67.4 percent had no incoming cattle, and 22.0 percent knew the source of all incoming cattle. About one-third of large operations (32.0 percent) knew the source of all incoming cattle, while 43.5 percent had no incoming cattle.

a. Percentage of operations in which the producer was aware of the source and geographic origin of all, some, or none of the incoming cattle during the previous 12 months, by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Knew the Source and Geographic Origin of …	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
All incoming cattle	22.0	(3.3)	28.0	(3.8)	32.0	(5.2)	24.2	(2.4)
Some incoming cattle	8.6	(2.3)	7.8	(2.3)	19.1	(3.7)	9.0	(1.7)
None of the incoming cattle	2.0	(1.2)	3.6	(1.6)	5.4	(2.9)	2.6	(0.9)
No incoming cattle*	67.4	(3.7)	60.6	(4.2)	43.5	(5.7)	64.2	(2.8)
Total	100.0		100.0		100.0		100.0	

*If the operation sent heifers off-site but cattle were not commingled with cattle from other operations, these operations were considered to have no incoming cattle.
Source: NAHMS Dairy 2007.

Almost all operations (97.0 percent) had some replacement cows enter the milking herd. Replacement cows entering the milking herd accounted for over one-third (38.4 percent) of the January 1, 2007, cow inventory. Calves born and raised on the operation entered the milking herd as replacements on the majority of operations (89.8 percent). Cow replacements were born off the operation on 14.1 percent of operations, while 6.8 percent of operations had replacements born on the operation but raised elsewhere. Estimates for the percentage of cows entering the milking herd in table b. below and in table c. on the next page differ slightly because table b. represents operations with any dairy cows and table c. represents operations with 30 or more dairy cows; however, when considering the standard errors, the difference in the estimates are not statistically significant.

b. Percentage of operations[1] (and percentage of cow inventory), by source of cow replacements that entered the milking herd

Replacement Source	Percent Operations	Standard Error	Percent Cows[2]	Standard Error
Born and raised on operation	89.8	(0.8)	27.8	(0.8)
Born on operation, raised off operation	6.8	(0.6)	8.0	(0.7)
Born off operation	14.1	(1.0)	2.6	(0.2)
Any replacements	97.0	(0.5)	38.4	(0.8)

[1]Operations with any dairy cows.
[2]Number of replacements that entered the milking herd during 2006, as a percentage of the January 1, 2007, cow inventory.
Source: NAHMS Dairy 2007.

On operations with 30 or more dairy cows, over one-third of the milking herd inventory (36.2 percent) consisted of cow replacements that had entered the milking herd during the previous 12 months. There were no substantial differences by herd size.

c. Cow replacements that entered the milking herd during the previous 12 months, as a percentage of cow inventory on the day of interview, by herd size

Percent Cow Inventory							
Herd Size (Number of Cows)							
Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Pct.	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
33.0	(1.1)	34.5	(1.1)	39.0	(2.6)	36.2	(1.2)

Source: NAHMS Dairy 2007.

Heifers born and raised on the operation constituted the highest percentage of cow replacements (58.8 percent) on all operations, over four-fifths of replacements on small operations (81.5 percent), three-fourths of replacements on medium operations (73.8 percent), and two-fifths of replacements on large operations (40.5 percent).

Some operations sent their heifer calves to off-site raising facilities—operations dedicated to raising dairy replacement calves. There are several advantages to off-site calf raising. The potential for contact between calves and older cattle is greatly reduced, decreasing the risk that young calves will contract diseases from older animals. The work force is dedicated solely to raising calves and, as a result, closer attention may be paid to the calves' care and feeding. In addition, off-site calf raising frees up space on the milking operation, creating more space for lactating cows. One disadvantage of off-site calf raising is the risk that calves will be exposed to infectious agents while off-site and return to their home operations carrying diseases which are new to the home herd. This is especially true if calves from more than one operation are commingled at a calf raising site (Villarroel et al., 2007).

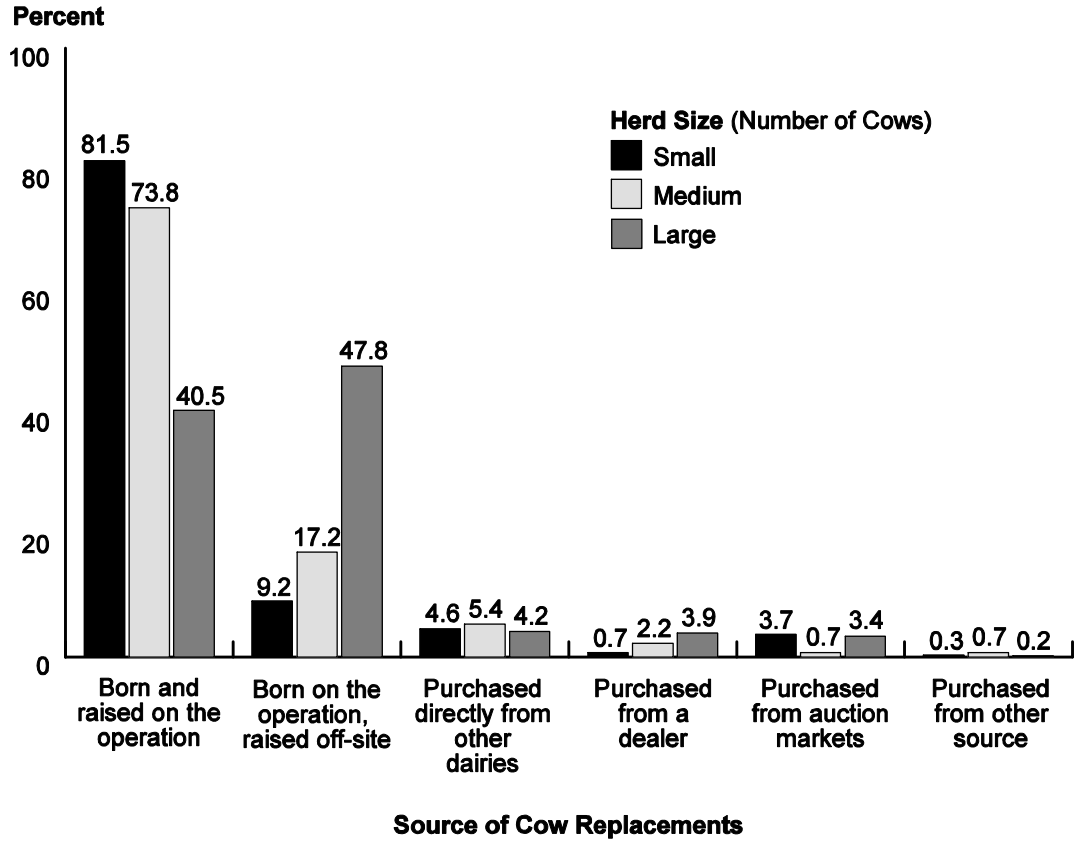
Heifers born on the operation and raised off-site accounted for the second highest percentage of cow replacements for all operations. Almost one-half of cow replacements for large operations (47.8 percent) were born on the operation but raised off-site. Heifers born on-site and raised off-site constituted much lower percentages of cow replacements for medium and small operations (17.2 and 9.2 percent, respectively).

d. Percentage of cow replacements that entered the milking herd during the previous 12 months, by source and by herd size

	Percent Cow Replacements							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Source of Cow Replacements	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Born and raised on the operation	81.5	(3.3)	73.8	(3.5)	40.5	(6.3)	58.8	(3.5)
Born on operation, raised off-site	9.2	(2.2)	17.2	(3.4)	47.8	(6.0)	30.8	(3.3)
Purchased directly from other dairies	4.6	(1.6)	5.4	(1.1)	4.2	(1.2)	4.6	(0.8)
Purchased from a dealer	0.7	(0.4)	2.2	(0.6)	3.9	(1.0)	2.7	(0.5)
Purchased from auction markets	3.7	(1.4)	0.7	(0.3)	3.4	(1.9)	2.7	(1.0)
Purchased from other source	0.3	(0.2)	0.7	(0.5)	0.2	(0.1)	0.4	(0.1)
Total	100.0		100.0		100.0		100.0	

Source: NAHMS Dairy 2007.

Percentage of Cow Replacements that Entered the Milking Herd During the Previous 12 Months, by Source and by Herd Size



Source: NAHMS Dairy 2007.

There were no substantial regional differences in the source of dairy cow replacements.

e. Percentage of cow replacements that entered the milking herd during the previous 12 months, by source and by region

	Percent Cow Replacements			
	Region			
	West		East	
Source of Cow Replacements	Percent	Std. Error	Percent	Std. Error
Born and raised on the operation	50.6	(7.4)	64.3	(3.1)
Born on operation, raised off-site	40.4	(7.1)	24.3	(2.8)
Purchased directly from other dairies	2.3	(1.2)	6.2	(1.0)
Purchased from a dealer	2.2	(0.7)	3.1	(0.7)
Purchased from auction markets	4.2	(2.4)	1.7	(0.6)
Purchased from other source	0.3	(0.2)	0.4	(0.2)
Total	100.0		100.0	

Source: NAHMS Dairy 2007.

3. Number of cow-replacement shipments

Each shipment of cattle arriving at an operation presents the risk of introducing new pathogens to the operation, and more shipments mean more opportunities for disease introduction. Large operations received an average of 48.1 cow-replacement shipments during the previous 12 months compared with medium and small operations (6.0 and 2.6 shipments, respectively). Heifers born on-site and raised off-site constituted the most shipments of incoming cattle to operations of any size. Animals purchased from auction markets comprised the second largest average number of shipments received by large operations, which had an average of 28.3 shipments from auction markets during the previous 12 months. The operation average number of shipments for all cow-replacement sources was 9.7.

a. Operation average number of shipments by source of cow replacements during the previous 12 months, and by herd size

	Operation Average Number of Shipments							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Source of Cow Replacements	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
Born on operation, raised off-site	5.5	(1.6)	11.1	(1.3)	55.9	(16.2)	20.9	(5.1)
Purchased directly from other dairies	1.5	(0.2)	2.3	(0.3)	5.3	(1.0)	2.1	(0.2)
Purchased from a dealer	1.4	(0.3)	2.9	(0.5)	6.0	(1.0)	3.3	(0.5)
Purchased from auction markets	3.0	(1.0)	2.0	(0.7)	28.3	(17.1)	7.8	(3.9)
Purchased from other source	4.0	(0.0)	3.0	(1.1)	2.8	(0.8)	3.3	(0.5)
All	2.6	(0.6)	6.0	(0.8)	48.1	(12.3)	9.7	(1.9)

Source: NAHMS Dairy 2007.

Operations in the West region had more shipments of heifers born on the operation but raised off-site (65.8 per year) than operations in the East region (10.9 per year). The number of shipments received from other sources was similar for the West and East regions. Although the average number of shipments from auction markets for operations in the West region was higher than the East region, the standard error is large and suggests a large variability in shipments among operations in the West region.

b. Operation average number of shipments by source of cow replacements during the previous 12 months, and by region

	Operation Average Number of Shipments			
	Region			
	West		East	
Source of Cow Replacements	Average	Std. Error	Average	Std. Error
Born on operation, raised off-site	65.8	(24.0)	10.9	(1.3)
Purchased directly from other dairies	5.9	(1.8)	1.9	(0.2)
Purchased from a dealer	5.5	(1.1)	2.7	(0.4)
Purchased from auction markets	28.3	(17.3)	2.9	(0.9)
Purchased from other source	3.7	(1.3)	3.2	(0.6)
All	45.5	(14.4)	5.0	(0.5)

Source: NAHMS Dairy 2007.

4. Replacement heifer calves

The percentage of operations in which heifers were born and raised on the operation decreased from 2002 to 2007. Accordingly, the percentage of heifers that were born on the operation and raised off the operation increased from 2002 to 2007, while the percentage of heifers born off the operation decreased. In 2002 and 2007, the majority of heifers were born and raised on the same operation, and the majority of operations had heifers that were born and raised on the operation. In 2007, more than 9 of 10 operations (96.5 percent) had some heifers that were born and raised on the operation; these operations accounted for 87.4 percent of heifers. On 4.7 percent of operations, heifers were born on the operation and raised off-site; these operations accounted for 11.5 percent of heifers. Of the January 1, 2007, heifer inventory, 12.6 percent of heifers spent part of their lives at another facility; they were either born on the operation and raised elsewhere (11.5 percent) or born off the operation (1.1 percent).

a. Percentage of operations[1] and percentage of heifers[2], by source of heifer replacements

	Dairy 2002				Dairy 2007			
	Operations		Heifers		Operations		Heifers	
Source of Replacement Heifers	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Born and raised on operation	98.1	(0.3)	89.5	(1.0)	96.5	(0.4)	87.4	(1.2)
Born on operation, raised off operation	3.6	(0.4)	7.2	(0.8)	4.7	(0.5)	11.5	(1.2)
Born off operation	6.7	(0.7)	3.3	(0.8)	6.6	(0.8)	1.1	(0.2)
Total			100.0				100.0	

[1]Operations with any dairy cows.
[2]As a percentage of January 1 heifer inventory.

Less than 1 of 10 operations (9.3 percent) raised heifers off-site in 2007. The percentage of operations using off-site heifer raisers increased as herd size increased, which was true for all heifer classes. Nearly one-half of large operations (46.0 percent) raised heifers off-site, compared with a noticeably smaller percentage of medium (15.5 percent) and small (4.7 percent) operations. Preweaned heifers were raised off-site by over one-third of large operations (35.3 percent), compared with 7.1 percent of medium and 1.7 percent of small operations. Similar herd-size differences were also seen in the percentages of operations that raised weaned and bred heifers off-site.

b. Percentage of operations* that raised any heifers off-site, by heifer class and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Heifer Class	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Preweaned	1.7	(0.5)	7.1	(1.2)	35.3	(2.9)	4.6	(0.5)
Weaned	4.3	(0.7)	14.6	(1.6)	44.2	(2.9)	8.6	(0.7)
Bred	4.1	(0.7)	11.5	(1.5)	22.5	(2.3)	6.7	(0.6)
Any	4.7	(0.7)	15.5	(1.7)	46.0	(2.9)	9.3	(0.7)

***Operations with any dairy cows.
Source: NAHMS Dairy 2007.

A major biosecurity concern related to off-site rearing facilities is the potential for heifers from one operation to have contact with animals from another operation. These contacts increase the likelihood that heifers will be exposed to new pathogens that can be carried back to their operations of origin. Ideally, only calves from a single operation would be housed at an off-site rearing facility. In 2007, about one-third of operations (36.2 percent) sent heifers to rearing facilities where they had no contact with cattle from other operations. Nearly two-thirds of operations that sent heifers off-site to be raised (63.8 percent) sent heifers to rearing facilities where they had contact with cattle from other operations.

c. Percentage of operations* that sent heifers off-site to be raised, by primary off-site rearing facility

Off-site Rearing Facility	Percent Operations	Standard Error
Heifers sent to a single rearing facility and did not have contact with cattle from other operations	27.7	(3.3)
Heifers sent to multiple rearing facilities and did not have contact with cattle from other operations	8.5	(2.1)
Heifers sent to a single rearing facility and had contact (commingled) with cattle from other operations	51.3	(4.0)
Heifers sent to multiple rearing facilities and had contact (commingled) with cattle from other operations	12.5	(3.0)
Total	100.0	

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

5. Vaccination requirements

There are several ways to decrease the risk associated with introducing new animals. Vaccination, quarantine, pre-introduction screening tests, testing of the source herd, and preventive treatments are all management practices that can reduce the disease risks associated with introducing new animals.

Knowing the vaccination history and status of new cattle entering the operation and requiring vaccination of new cattle against specific diseases prior to entry can protect the herd from the risk of diseases introduced by the new cattle. In addition, the new cattle can be protected from diseases endemic to the operation through vaccination.

Of operations bringing dairy cattle from outside sources onto the operation, less than one-half (47.2 percent) required vaccination of new additions prior to arrival. The vaccinations most commonly required were: bovine viral diarrhea (BVD) [42.9 percent of operations]; infectious bovine rhinotracheitis (IBR) [41.9 percent of operations]; leptospirosis (38.8 percent of operations); and brucellosis (35.6 percent of operations). For the diseases listed in the following table, a lower percentage of small operations required vaccination of new additions prior to arrival than medium or large operations.

No change occurred from 1996 to 2007 in the percentages of operations that vaccinated new additions for BVD, IBR, and leptospirosis before the cattle were brought onto the operation. With the exception of *Neospora*, about one-third to one-half of operations vaccinated for the diseases mentioned in the following table. The percentage of operations that vaccinated for brucellosis decreased for each herd size from 1996 to 2007. Since many different ages of cattle were brought onto operations, the lower brucellosis vaccination percentages may partially be due to cattle too old for vaccination or to cattle that were already vaccinated for brucellosis at the time of purchase. *Neospora* vaccination remained unchanged in purchased cattle since 2002 for small, large, and all operations. The percentages of operations that vaccinated for any disease decreased for small, large, and all operations.

Percentage of operations* that normally required vaccination against the following diseases before bringing animals onto the operation, by herd size

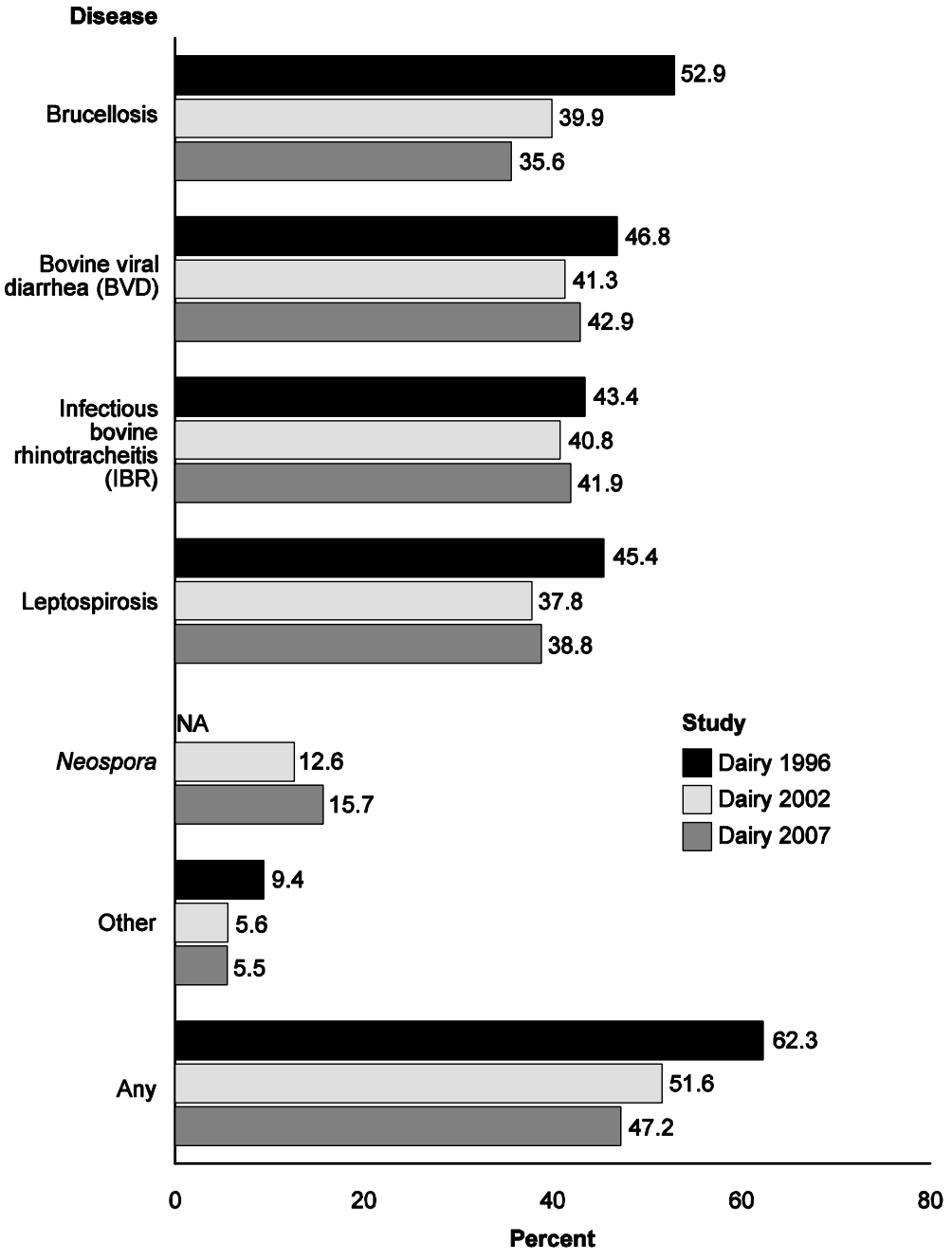
Percent Operations

Herd Size (Number of Cows)

	Small (Fewer than 100)			**Medium** (100-499)			**Large** (500 or More)			**All Operations**		
Disease	**1996**	**2002**	**2007**	**1996**	**2002**	**2007**	**1996**	**2002**	**2007**	**1996**	**2002**	**2007**
Brucellosis	48.9 (2.5)	33.4 (2.5)	28.0 (2.6)	63.6 (2.9)	51.3 (2.7)	50.2 (3.5)	85.2 (3.0)	60.0 (3.1)	52.2 (3.9)	52.9 (2.0)	39.9 (1.9)	35.6 (2.0)
Bovine viral diarrhea (BVD)	43.1 (2.4)	36.2 (2.5)	34.8 (2.8)	59.4 (2.9)	51.2 (2.7)	59.9 (3.4)	58.8 (4.8)	53.9 (3.2)	56.7 (3.7)	46.8 (2.0)	41.3 (1.9)	42.9 (2.1)
Infectious bovine rhinotracheitis (IBR)	39.2 (2.3)	35.8 (2.6)	34.2 (2.8)	57.9 (2.9)	50.5 (2.7)	57.3 (3.4)	57.4 (4.8)	51.2 (3.2)	57.1 (3.7)	43.4 (1.9)	40.8 (1.9)	41.9 (2.1)
Leptospirosis	41.9 (2.4)	32.5 (2.5)	32.0 (2.7)	57.7 (2.9)	48.5 (2.7)	53.6 (3.4)	54.3 (4.8)	47.5 (3.2)	48.4 (3.8)	45.4 (2.0)	37.8 (1.8)	38.8 (2.1)
Neospora	NA	11.1 (1.6)	10.8 (1.7)	NA	15.5 (1.8)	26.6 (3.1)	NA	16.1 (2.3)	22.4 (3.3)	NA	12.6 (1.2)	15.7 (1.5)
Other	8.2 (1.1)	4.3 (0.8)	4.2 (1.1)	12.8 (2.2)	8.4 (1.4)	8.7 (1.8)	16.5 (3.6)	7.7 (1.5)	6.5 (1.6)	9.4 (1.0)	5.6 (0.7)	5.5 (0.9)
Any	58.0 (2.5)	44.6 (2.7)	37.7 (2.9)	74.8 (2.6)	64.0 (2.7)	65.2 (3.3)	88.8 (2.9)	71.9 (3.0)	68.5 (3.2)	62.3 (2.0)	51.6 (2.0)	47.2 (2.2)

*Operations with any dairy cows.
()=standard error.

Percentage of Operations* that Normally Required Vaccination Against the Following Diseases Before Bringing Animals onto the Operation



*Operations with any dairy cows.

6. Quarantine

For the purpose of this report, quarantine is defined as the physical separation of an animal or group of animals from other cattle on the operation. Purchased cattle should be quarantined for a minimum of 10 days and, ideally, up to 3 weeks (Villarroel et al., 2007). Quarantining can reduce the likelihood that new diseases will be introduced to the operation and usually provides sufficient time for the incubation and detection of some infectious diseases, namely: salmonellosis, vesicular stomatitis, foot-and-mouth disease, clinical BVD virus infections, and infections due to IBR virus. Quarantining is not effective in detecting infectious diseases with long incubation periods, such as Johne's disease and *Neospora* (Villarroel et al., 2007).

The objective of implementing a quarantine period is to prevent the transmission of respiratory, gastrointestinal, reproductive, and mastitis pathogens between animals. Quarantined animals should have no physical contact with other animals. Physical contact includes sniffing, touching, licking, nose-to-nose contact, shared fence lines, and shared waterers or feeders. Additionally, resident cattle should not have contact with the secretions, fluids, or manure of quarantined cattle, or the pen runoff from quarantined cattle. Moreover, the quarantine area should be far enough away from resident cattle to prevent airborne disease transmission.

In addition to the prevention of physical contact between new additions and resident cattle, attention must be paid to the people and equipment entering and leaving the quarantine area. Dedicating equipment and personnel exclusively to the quarantine area is the best way to prevent the spread of agents from quarantined animals. However, dedicating equipment and personnel exclusively to the quarantine area is not always feasible. In this case, equipment should be cleaned and disinfected before it is used outside the quarantine area. Personnel that care for both resident animals and quarantined new additions should work with the quarantined animals last and should wash their hands, change clothes, and clean and disinfect their boots before entering and leaving the quarantine area. Finally, personnel should be trained to recognize signs of illness in animals and frequently monitor the quarantined animals for signs of illness or disease.

Of operations that brought on new cattle in 2002 and 2007, approximately one of five (20.6 and 20.3 percent, respectively) quarantined new cattle. On operations that quarantined new cattle in 2007, the most common age groups quarantined were preweaned dairy or beef calves (44.2 percent of operations), beef heifers and cows (30.1 percent of operations), weaned steers (30.0 percent of operations), and dairy heifers, weaned but not bred (23.0 percent of operations). The most common additions to herds—bred dairy heifers, lactating cows, and dairy bulls—were quarantined on less than 20 percent of operations (14.5, 12.1, and 17.1 percent, respectively). There were no differences in the percentages of operations that quarantined new cattle of any class from 1996 to 2007.

a. Percentage of operations* that quarantined the following classes of cattle on arrival

	Percent Operations			Percent Operations			
Cattle Class	Dairy 1996	Std. Error	Cattle Class	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Preweaned calves (dairy or beef)	26.9	(5.2)	Preweaned calves (dairy or beef)	37.0	(7.3)	44.2	(8.3)
Dairy heifers weaned, but not bred	24.9	(4.7)	Dairy heifers weaned, but not bred	23.9	(3.9)	23.0	(4.7)
Bred dairy heifers	16.0	(2.0)	Bred dairy heifers	19.6	(2.3)	14.5	(2.3)
Lactating dairy cows	6.2	(1.7)	Lactating dairy cows	9.5	(1.6)	12.1	(2.4)
Dry dairy cows	17.9	(4.8)	Dry dairy cows	7.1	(2.2)	15.9	(4.8)
Bulls (weaned)	11.2	(2.4)	Dairy bulls (weaned)	15.9	(2.4)	17.1	(2.9)
			Beef bulls (weaned)	23.6	(6.5)	20.3	(6.5)
Other heifers and cows (including beef)	15.7	(6.0)	Beef heifers and cows`	24.0	(8.5)	30.1	(9.8)
Steers (weaned)	21.0	(6.6)	Steers (weaned)	40.0	(11.4)	30.0	(9.6)
Any	16.2	(1.5)	Any	20.6	(1.6)	20.3	(1.7)

*Operations with any dairy cows.

The operation average number of days in quarantine for preweaned calves and weaned but not bred heifers were similar from 1996 to 2007. Preweaned calves spent about 40 days in quarantine and weaned but not bred heifers were quarantined for about 20 days. The length of quarantine for dry cows increased from an average of 8.9 days in 1996 to an average of 16.5 days in 2007.

b. Operation* average number of days new arrivals were quarantined, by cattle class

	Average Number of Days			Average Number of Days			
Cattle Class	**Dairy 1996**	**Std. Error**	**Cattle Class**	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
Preweaned calves (dairy or beef)	40.8	(5.7)	Preweaned calves (dairy or beef)	49.2	(9.3)	42.4	(4.8)
Dairy heifers weaned, but not bred	21.5	(4.2)	Dairy heifers weaned, but not bred	28.2	(6.0)	20.0	(3.6)
Bred dairy heifers	16.8	(2.3)	Bred dairy heifers	23.7	(4.0)	22.0	(3.1)
Lactating dairy cows	11.7	(2.3)	Lactating dairy cows	20.1	(4.1)	15.6	(2.5)
Dry dairy cows	8.9	(2.1)	Dry dairy cows	21.4	(4.3)	16.5	(4.3)
Bulls (weaned)	21.0	(3.1)	Dairy bulls (weaned)	19.0	(2.5)	25.3	(3.5)
			Beef bulls (weaned)	32.0	(12.9)	31.9	(12.6)
Other heifers and cows (including beef)	24.3	(9.1)	Beef heifers and cows`	31.1	(6.6)	33.3	(12.1)
Steers (weaned)	41.5	(22.0)	Steers (weaned)	41.3	(14.0)	40.7	(18.7)

*Operations with any dairy cows.

7. Testing requirements

Testing individual animals for specific diseases before introducing them to the operation reduces the risk of introducing new diseases to the operation.

Nearly one-fourth of operations (23.3 percent) required testing for new additions in 2007. Of operations that brought beef or dairy cattle onto the operation, a higher percentage of large and medium operations (34.7 and 28.2 percent, respectively) than small operations (20.2 percent) required pre-introduction testing. The diseases most frequently tested for by all operations included: brucellosis, bovine tuberculosis (TB), and BVD (14.3, 13.8, and 13.3 percent of operations, respectively). There was no substantial change from 2002 to 2007 in the percentages of operations that tested new additions for brucellosis, Johne's disease, BVD, or TB.

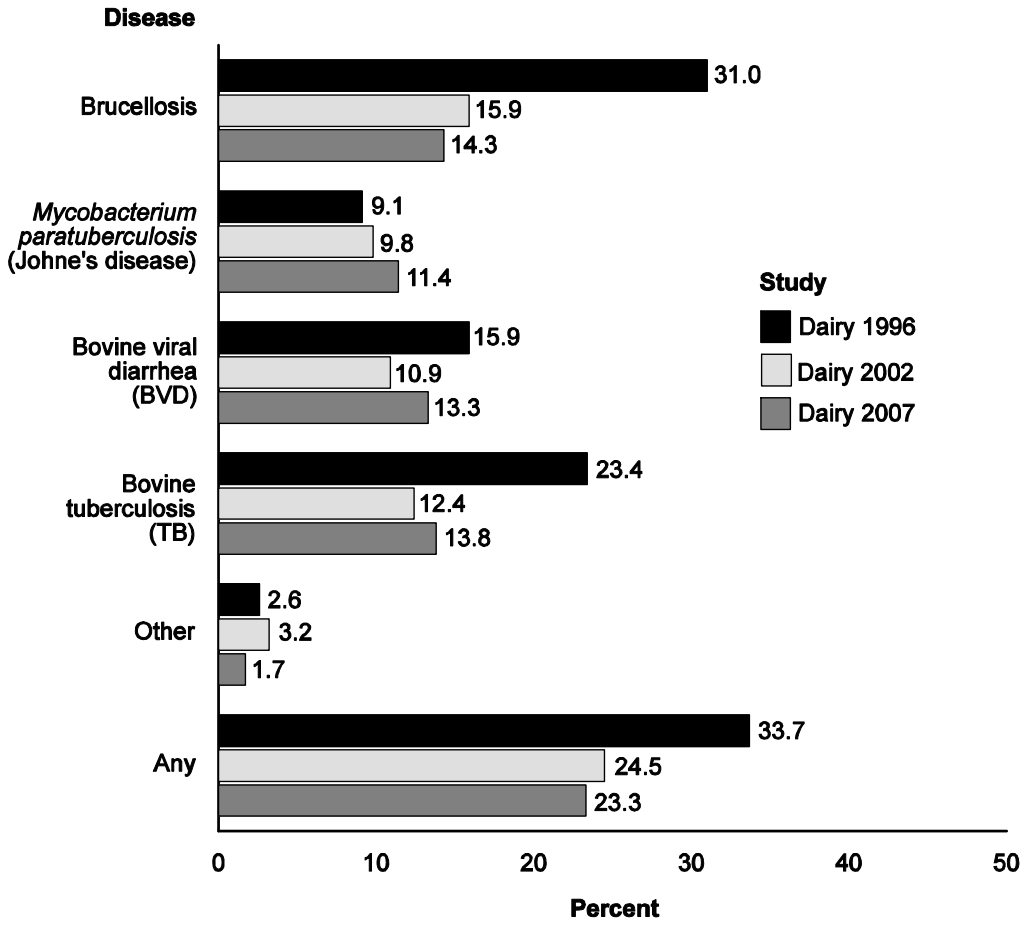
Brucellosis testing for new additions decreased across herd sizes from 1996 to 2007. TB testing also decreased for small, large, and all operations from 1996 to 2007. Testing for *Mycobacterium avium* subspecies *paratuberculosis* and BVD remained unchanged for all operations from 1996 to 2007. The percentage of operations that performed any testing decreased for small, large, and all operations from 1996 to 2007. Less than one of four operations that added new additions (23.3 percent) performed any testing during 2007.

a. Percentage of operations* that required testing of individual animals before introduction to the herd, by disease and by herd size

	Percent Operations											
	Herd Size (Number of Cows)											
	Small (Fewer than 100)			**Medium** (100-499)			**Large** (500 or More)			**All Operations**		
Disease	**1996**	**2002**	**2007**	**1996**	**2002**	**2007**	**1996**	**2002**	**2007**	**1996**	**2002**	**2007**
Brucellosis	28.5 (2.1)	13.1 (1.8)	11.6 (1.9)	38.3 (2.9)	19.5 (2.1)	19.8 (2.8)	50.6 (4.4)	29.9 (2.7)	19.0 (3.0)	31.0 (1.7)	15.9 (1.3)	14.3 (1.5)
Mycobacterium avium subspecies *paratuberculosis* (Johne's disease)	8.5 (1.3)	8.3 (1.4)	9.9 (1.8)	11.0 (2.3)	12.7 (1.9)	16.6 (2.7)	9.6 (2.9)	12.2 (1.9)	7.2 (1.8)	9.1 (1.1)	9.8 (1.1)	11.4 (1.4)
Bovine viral diarrhea (BVD)	15.1 (1.6)	8.6 (1.4)	10.7 (1.8)	18.4 (2.5)	15.6 (2.1)	19.4 (2.8)	19.4 (3.9)	15.0 (2.1)	15.8 (2.7)	15.9 (1.3)	10.9 (1.1)	13.3 (1.4)
Bovine tuberculosis (TB)	22.3 (1.9)	10.8 (1.5)	12.0 (1.8)	26.8 (2.7)	14.3 (1.7)	17.8 (2.7)	31.4 (4.2)	20.7 (2.3)	15.8 (2.3)	23.4 (1.6)	12.4 (1.1)	13.8 (1.4)
Contagious mastitis pathogens	NA	NA	10.5 (1.8)	NA	NA	13.1 (2.3)	NA	NA	16.3 (3.3)	NA	NA	11.7 (1.4)
Other	2.3 (0.5)	2.8 (0.8)	1.6 (0.6)	3.6 (1.4)	4.3 (1.3)	2.2 (1.0)	3.9 (2.1)	3.5 (1.1)	0.4 (0.2)	2.6 (0.5)	3.2 (0.6)	1.7 (0.5)
Any	31.3 (2.1)	21.2 (2.2)	20.2 (2.4)	40.0 (2.9)	29.4 (2.5)	28.2 (3.2)	54.3 (4.5)	38.8 (2.9)	34.7 (3.8)	33.7 (1.8)	24.5 (1.6)	23.3 (1.8)

*Operations with any dairy cows.
()=standard error.

Percentage of Operations* that Required Testing of Individual Animals Before Introduction to the Herd, by Disease



*Operations with any dairy cows.

Of operations that in 2007 did not require that new cattle be tested before introduction into the herd regardless of disease, about one-fourth reported that testing had been performed at the herd of origin or that the disease was not a concern to their operation. "Other" reasons for not requiring testing included: animals were not eligible for testing; animals were not at risk for disease transmission (such as testing weaned heifers or bulls for contagious mastitis pathogens); owners trusted the herd of origin; owners vaccinated and tested after the animals arrived; owners did not know how to vaccinate and/or test; and owners were bringing back their own cattle.

b. For operations that brought beef or dairy cattle onto the operation and did not require individual animal testing, percentage of operations* by reason for not testing and by disease

	Percent Operations									
	Disease									
	Brucellosis		Johne's Disease		BVD		TB		Contagious Mastitis Pathogens	
Reason	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Tests already performed by herd of origin	25.6	(2.0)	22.3	(1.9)	25.9	(2.1)	25.1	(2.0)	23.8	(1.9)
Too expensive to test	4.3	(1.1)	5.9	(1.3)	4.1	(1.0)	4.2	(1.1)	4.3	(1.0)
Not enough time to test	9.5	(1.7)	8.9	(1.5)	9.9	(1.6)	9.4	(1.6)	10.7	(1.7)
Not recommended by veterinarian	7.7	(1.3)	6.8	(1.2)	6.1	(1.2)	7.4	(1.3)	5.7	(1.1)
Too many sources to test	2.5	(0.9)	1.8	(0.6)	2.7	(0.9)	2.3	(0.9)	2.8	(0.9)
Tests not reliable	0.2	(0.2)	4.4	(1.0)	1.0	(0.4)	0.7	(0.3)	0.7	(0.3)
Disease is not a concern to my operation	28.0	(2.3)	28.6	(2.2)	27.5	(2.2)	29.1	(2.3)	27.9	(2.2)
Other	22.2	(1.9)	21.3	(1.9)	22.8	(2.0)	21.8	(1.9)	24.1	(2.0)
Total	100.0		100.0		100.0		100.0		100.0	

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

8. Herd-of-origin disease status

Test results from the herd of origin can provide an indication of whether cattle from a particular herd may be infected with certain disease organisms. For many diseases, such as Johne's disease and contagious mastitis, knowing the disease status of the herd of origin can be more reliable than testing individual animals (Wells, 2000). In 2007 almost 3 of 10 operations (28.7 percent) required some information on the disease status of the herd of origin. The most commonly requested information was bulk-tank somatic cell count. The second and third most often requested test results were BVD status and Johne's disease status (18.9 and 17.2 percent of operations, respectively). The percentage of operations that required bulk-tank cultures for mastitis-causing organisms varied between small and large operations, with a lower percentage of small operations than large operations requiring cultures (10.1 and 20.9 percent, respectively).

a. Percentage of operations* by herd-of-origin information normally required by operation, and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Herd-of-origin Information	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
BVD status	16.7	(2.3)	24.5	(3.0)	19.8	(3.0)	18.9	(1.7)
Johne's disease (*Mycobacterium paratuberculosis*) status	16.0	(2.2)	21.9	(2.9)	12.7	(2.3)	17.2	(1.7)
Bulk-tank milk somatic cell count	18.8	(2.4)	24.4	(3.1)	19.8	(2.9)	20.3	(1.8)
Bulk-tank milk culture	10.1	(1.7)	17.8	(2.8)	20.9	(2.9)	13.0	(1.4)
Other	2.8	(1.0)	2.3	(1.2)	1.3	(0.8)	2.6	(0.7)
Any information	25.4	(2.7)	36.0	(3.4)	32.9	(3.3)	28.7	(2.0)

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

For operations that did not require herd-of-origin information on the disease status for new arrivals in 2007, the most common reasons given for not requiring information (approximately 30 percent of operations across categories) were that the disease and/or bulk-tank milk somatic cell counts were not a concern to the operation. Additionally, 30.0 percent of these operations indicated that bulk-tank milk cultures from the herd of origin were not a concern to their operation, despite the fact that bulk-tank milk cultures are used to identify mastitis pathogens. Mastitis was the most prevalent disease-causing illness in cows, the second highest reported reason for removing cows from the herd, and the second highest reported cause of death. Similarly, 30.5 percent of operations that did not require herd-of-origin information indicated that BVD was not a concern to their operation, even though infertility—which can be associated with BVD—was the third most prevalent disease on operations. Moreover, reproductive problems, which include infertility, were the most common reason for permanently removing cows from the operation.

Other reasons for not evaluating herd-of-origin information were similar to reasons for not testing incoming cattle: trusted the herd of origin, owned the herd of origin, would address disease issues after cattle arrived, and did not know to test or inquire about these diseases.

b. For operations that brought beef or dairy cattle onto the operation and did not require the following herd-of-origin information, percentage of operations* by reason for not requiring information

	Percent Operations							
	Herd-of-origin Information							
	BVD Status		Johne's Disease Status		Bulk-tank Milk Somatic Cell Count		Bulk-Tank Milk Culture	
Reason Not Required	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Tests already performed by herd of origin	18.6	(1.8)	15.2	(1.6)	15.2	(1.6)	15.7	(1.6)
Too expensive to test	3.9	(1.1)	4.4	(1.2)	3.2	(1.0)	3.8	(1.1)
Not enough time to test	9.3	(1.6)	9.3	(1.5)	9.2	(1.6)	10.6	(1.6)
Not recommended by veterinarian	8.1	(1.4)	8.9	(1.4)	8.6	(1.4)	8.4	(1.4)
Too many sources to test	3.0	(1.0)	3.0	(1.0)	3.5	(1.1)	3.1	(1.0)
Tests not reliable	1.1	(0.4)	3.3	(0.9)	1.5	(0.5)	1.4	(0.5)
Not a concern to the operation	30.5	(2.4)	31.6	(2.3)	30.2	(2.3)	30.0	(2.3)
Other	25.5	(2.2)	24.3	(2.1)	28.6	(2.2)	27.0	(2.1)
Total	100.0		100.0		100.0		100.0	

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

C. On-farm Biosecurity and Biocontainment Practices

1. Employees and visitors

Employees or visitors—especially those who have contact with animals off the operation—can introduce disease agents via their boots, clothing, vehicles, or other equipment. As people travel more frequently throughout the world, the risk increases for inadvertent or intentional introduction of disease agents foreign to the United States. Establishing written policies or guidelines pertaining to visitor and employee animal contacts and travel is an important step in reducing the risk of disease introduction.

The percentage of operations that had employees increased from 47.2 percent in 2002 to 75.7 percent in 2007. The percentage of small operations with employees doubled from 32.2 percent in 2002 to 65.6 percent in 2007.

a. Percentage of operations that had employees during the previous 12 months, by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Study Year	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
2002	32.2	(2.5)	84.2	(2.4)	99.0	(0.6)	47.2	(2.0)
2007*	65.6	(4.1)	95.0	(2.0)	98.0	(1.9)	75.7	(2.8)

*Question variation: 2007 estimates specifically exclude owners and family members.
Source: NAHMS Dairy 2007.

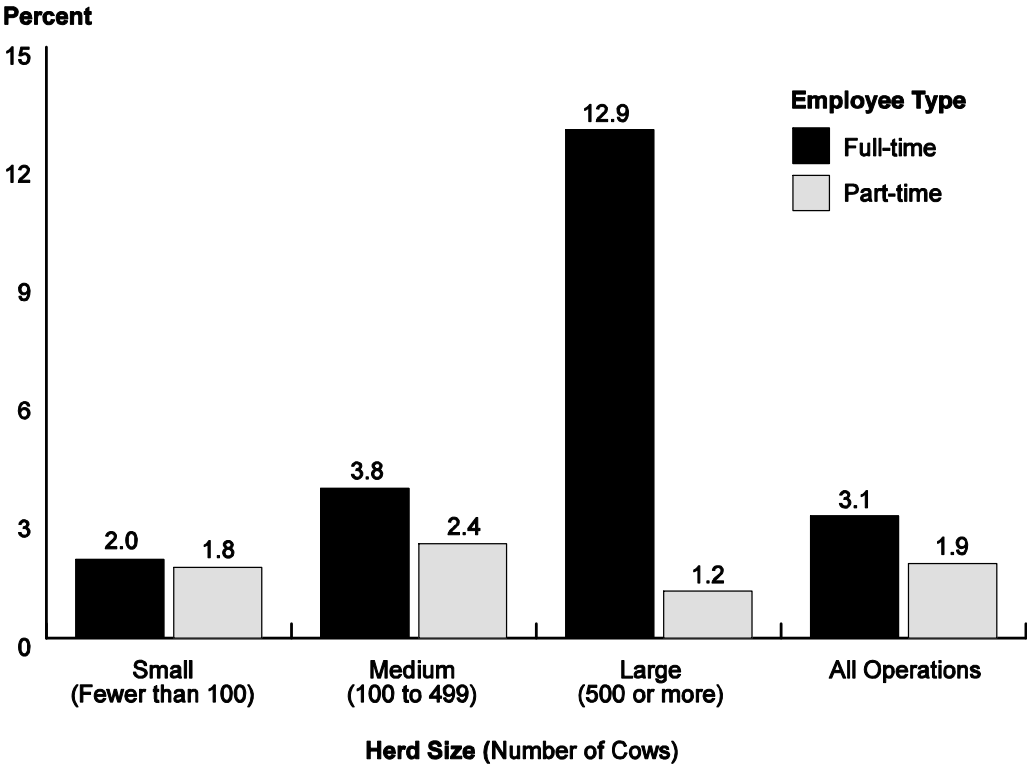
Not surprisingly, the number of full-time employees increased as herd size increased. Small operations averaged 2.0 full-time employees compared with 3.8 and 12.9 full-time employees on medium and large operations, respectively. Medium operations employed more part-time people on average than large operations (2.4 and 1.2 employees, respectively).

b. Operation average number of employees, by employee type and by herd size

	Operation Average Number Employees*							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Employee Type	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
Full-time	2.0	(0.1)	3.8	(0.1)	12.9	(0.8)	3.1	(0.1)
Part-time	1.8	(0.1)	2.4	(0.2)	1.2	(0.2)	1.9	(0.1)

*Paid and unpaid, including owners and family members assigned work duties directly related to the dairy's operation.
Source: NAHMS Dairy 2007.

Operation Average Number of Employees*, by Employee Type and by Herd Size



*Paid and unpaid, including owners and family members assigned work duties directly related to the dairy's operation.
Source: NAHMS Dairy 2007.

Operations in the West region averaged more full-time employees (7.8) than operations in the East region (2.7). Operations in the East region averaged more part-time employees than operations in the West region. These differences were likely related to the larger herd sizes in the West region.

c. Operation average number of employees, by employee type and by region

	Operation Average Number Employees*			
	Region			
	West		East	
Employee Type	Average	Std. Error	Average	Std. Error
Full-time	7.8	(0.7)	2.7	(0.1)
Part-time	1.0	(0.1)	2.0	(0.1)

*Paid and unpaid, including owners and family members assigned work duties directly related to the dairy's operation.
Source: NAHMS Dairy 2007.

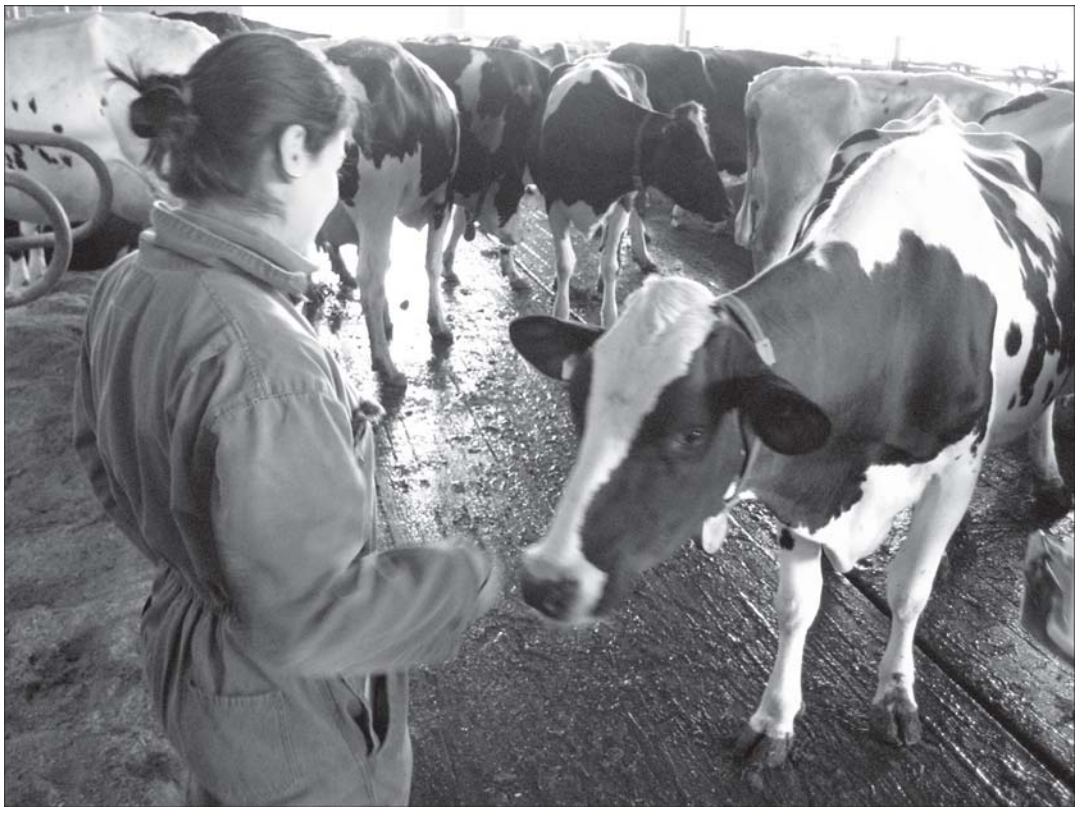


Photo courtesy of Dr. Jason Lombard.

In addition to employees, dairy operations have regular and frequent visits from a variety of people doing business with the operation, including delivery people, milk haulers, cattle haulers, artificial insemination technicians, nutritionists, and veterinarians. These people, who may or may not have contact with cattle on the operation and multiple other operations, have the potential to carry diseases from one operation to another.

In an average week, over one-half of all operations (51.6 percent) had between 1 and 14 visits by people coming onto the operation. Nearly two-thirds of small operations reported between 1 and 14 visits, and one-fifth of small operations reported 29 or more visits per week. As expected, the number of visits per week increased as herd size increased. Nearly three-fourths of large operations (72.2 percent) reported 29 or more visits per week compared with about one-half of medium operations (47.6 percent) and one-fifth of small operations (20.0 percent).

d. Percentage of operations by number of visits* per week and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Number of Visits (per Week)	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
1 to 7	35.6	(3.7)	13.7	(3.0)	1.2	(0.7)	28.0	(2.7)
8 to 14	28.4	(3.6)	16.5	(3.3)	0.8	(0.5)	23.6	(2.6)
15 to 21	9.0	(2.0)	12.5	(2.8)	13.7	(4.8)	10.2	(1.6)
22 to 28	7.0	(1.7)	9.7	(2.6)	12.1	(4.0)	8.0	(1.4)
29 or more	20.0	(3.1)	47.6	(4.1)	72.2	(5.3)	30.2	(2.4)
Total	100.0		100.0		100.0		100.0	

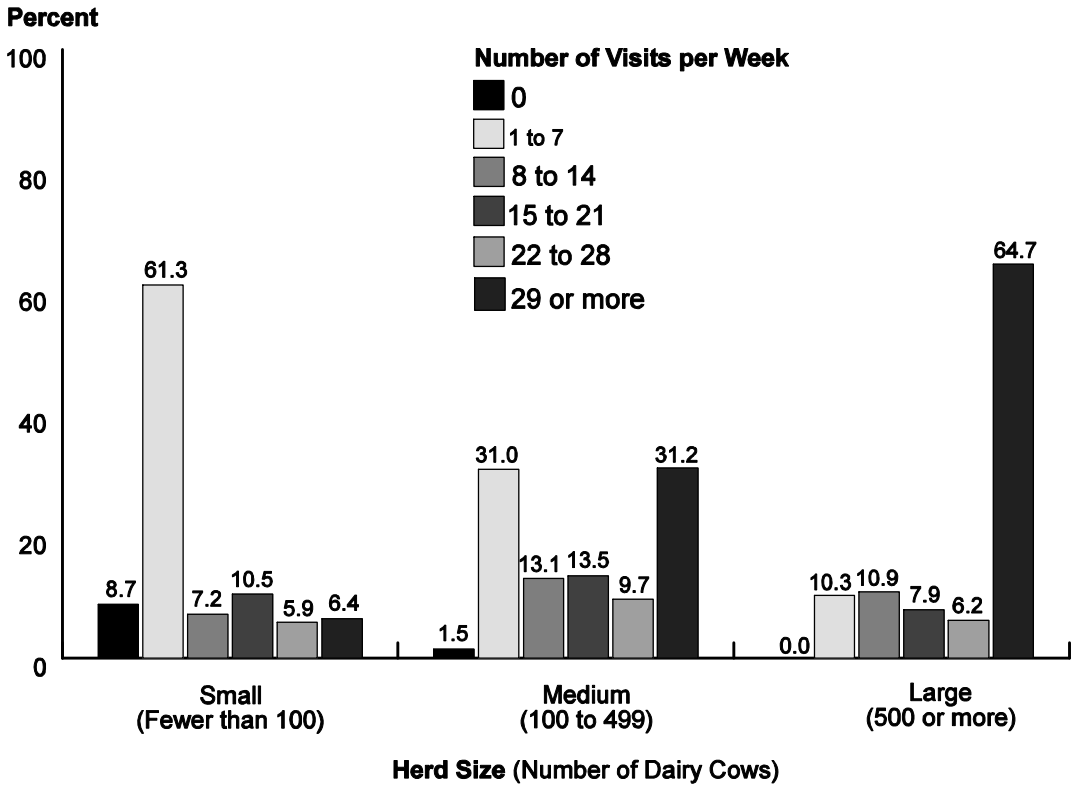
*Includes employees, veterinarians, neighbors, nutritionists, milk haulers, etc.
Source: NAHMS Dairy 2007.

For operations in which any visits to the operation involved contact with animals on the operation, about one-half of operations (50.7 percent) had one to seven visits per week that involved contact with animals on the operation. About 1 of 6 operations (16.0 percent) had 29 or more visits that resulted in contact with animals. The number of visits that involved animal contact increased as herd size increased.

e. Percentage of operations by number of visits per week that involved animal contact, and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Number of Visits (Per Week)	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
0 or None	8.7	(1.9)	1.5	(0.7)	0.0	(0.0)	6.4	(1.3)
1 to 7	61.3	(3.7)	31.0	(3.8)	10.3	(3.7)	50.7	(2.8)
8 to 14	7.2	(1.9)	13.1	(2.8)	10.9	(3.8)	8.9	(1.5)
15 to 21	10.5	(2.4)	13.5	(3.1)	7.9	(3.4)	11.1	(1.8)
22 to 28	5.9	(1.8)	9.7	(2.2)	6.2	(3.1)	6.9	(1.4)
29 or more	6.4	(1.8)	31.2	(3.6)	64.7	(5.4)	16.0	(1.6)
Total	100.0		100.0		100.0		100.0	

Percentage of Operations by Number of Visits per Week that Involved Animal Contact, and by Herd Size



2. Specific biosecurity practices

Implementing biosecurity practices reduces the introduction of disease. Since employees and visitors are potential sources of disease, operations should have restrictions and guidelines for employees and visitors designed to limit disease introduction.

Specific biosecurity practices that help keep human and vehicle traffic in animal areas to a minimum include: controlling the number of visitors and their contact with animals, establishing a designated farm entrance and visitor parking, and requiring that visitors check in at the office. In addition, locating feed storage areas and areas for carcass pickup at the perimeter of the operation restricts vehicle contact with animal areas on the operation. Requiring visitors who enter animal areas to have clean boots and clothing, or providing them with boots and coveralls, also helps reduce the risk of disease introduction.

Approximately one of five operations with employees (18.1 percent) had restrictions on employee ownership of livestock outside the operation in 2007. Overall, about 1 of 10 operations had guidelines regarding foreign travel by employees: 14.7 percent of large, 16.0 percent of medium, and 9.7 percent of small operations had such guidelines.

Biosecurity plans are easiest to implement if they are in writing and reviewed and adjusted periodically to meet the changing needs of the operation (Center for Food Security and Public Health-b). Written plans can be referred to at any time for review and to address questions about the plan's requirements. In 2007, only 1 of 10 operations (12.2 percent) had written standard operating procedures (SOPs) for procedures other than milking. A higher percentage of large operations (23.0 percent) had written SOPs than medium and small operations (13.2 and 10.9 percent, respectively).

Training employees in proper practices is also critical to the success of any biosecurity program. For a plan to be successful, all team members must understand and support the plan. A higher percentage of large operations (47.3 percent) trained employees in performing biosecurity practices in 2007 compared with medium and small operations (23.7 and 17.8 percent, respectively).

The percentage of operations that placed restrictions on employee ownership of livestock outside the operation, had guidelines regarding foreign travel by employees, and trained employees in performing biosecurity practices declined from 2002 to 2007. Alternatively, the percentage of operations that had written SOPs (other than milking procedures) increased from 5.1 percent in 2002 to 12.2 percent in 2007.

a. Percentage of operations by employee biosecurity practices used and by herd size

Percent Operations

Herd Size (Number of Cows)

	Small (Fewer than 100)				**Medium** (100-499)				**Large** (500 or More)				**All Operations**			
	2002		**2007**		**2002**		**2007**		**2002**		**2007**		**2002**		**2007**	
Employee Biosecurity Practice	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Restrictions on employee livestock ownership outside this operation	19.7	(3.5)	17.4	(3.7)	34.6	(3.1)	18.6	(3.5)	38.6	(4.1)	20.1	(4.7)	27.7	(2.2)	18.1	(2.5)
Guidelines regarding foreign travel by employees	19.9	(4.1)	9.7	(2.7)	22.6	(2.6)	16.0	(3.6)	28.8	(3.9)	14.7	(3.7)	21.8	(2.3)	12.0	(2.0)
Written SOP (other than milking procedures)	7.4	(2.4)	10.9	(2.7)	6.7	(1.4)	13.2	(2.9)	18.9	(13.1)	23.0	(4.8)	5.1	(0.8)	12.2	(2.0)
Training for employees in performing biosecurity practices	35.0	(4.5)	17.8	(3.4)	48.5	(3.3)	23.7	(3.6)	50.9	(4.2)	47.3	(6.2)	42.1	(2.7)	21.9	(2.5)

In 2007, 3 of 10 operations (30.4 percent) had guidelines for determining which visitors were allowed in animal areas, and 6.9 percent had footbaths for visitors entering animal areas. About twice the percentage of large operations (12.1 percent) had footbaths compared with medium and small operations (7.2 and 6.3 percent, respectively). Over one-fourth of operations that had visitors (28.3 percent) provided disposable or clean boots to visitors entering animal areas. A higher percentage of medium and large operations (42.1 and 36.3 percent, respectively) provided footwear compared with small operations (22.7 percent). Over one-half of operations (51.3 percent) had restrictions on vehicles entering animal areas.

A higher percentage of operations in 2007 than in 2002 required disposable or clean boots for visitors entering animal areas and had restrictions on vehicles entering animal areas. The percentage of operations that had guidelines regarding which visitors were allowed in animal areas or that had footbaths for visitors entering animal areas remained unchanged from 2002 to 2007.

b. Percentage of operations by visitor biosecurity practices used and by herd size

Percent Operations

Herd Size (Number of Cows)

	Small (Fewer than 100)				**Medium** (100-499)				**Large** (500 or More)				**All Operations**			
	2002		**2007**		**2002**		**2007**		**2002**		**2007**		**2002**		**2007**	
Visitor Biosecurity Practice	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Guidelines regarding which visitors are allowed in animal areas	33.3	(2.9)	28.0	(3.4)	49.9	(3.3)	35.2	(4.3)	55.2	(4.4)	39.9	(5.9)	38.6	(2.0)	30.4	(2.6)
Footbaths for visitors entering animal areas	4.6	(1.2)	6.3	(1.7)	10.1	(1.8)	7.2	(1.9)	12.7	(2.1)	12.1	(3.5)	6.3	(1.0)	6.9	(1.3)
Disposable or clean boots for visitors entering animal areas	13.2	(2.0)	22.7	(3.3)	31.5	(3.0)	42.1	(4.2)	39.0	(4.2)	36.3	(5.5)	18.9	(1.6)	28.3	(2.6)
Restrictions on vehicles entering animal areas	40.4	(3.0)	51.0	(3.8)	46.3	(3.2)	54.5	(4.1)	39.0	(4.3)	41.9	(6.1)	41.8	(2.3)	51.3	(2.9)

The majority of operations used insect and rodent control practices during 2002 and 2007. Nearly one-half of operations limited cattle contact with other livestock, elk, and deer and controlled access to feed by other livestock and wildlife. There were no differences in the percentages of all operations that implemented a specific biosecurity practice from 2002 to 2007.

In 2007, over one-half of operations (56.2 percent) had closed herds, defined as all replacements come from the operation and the herd has no contact with cattle from other operations. A higher percentage of small operations than large operations (60.1 and 40.6 percent, respectively) were closed herds.

c. Percentage of operations that used the following biosecurity practices during the previous 12 months to prevent disease, by herd size

Percent Operations

Herd Size (Number of Cows)

	Small (Fewer than 100)				**Medium** (100-499)				**Large** (500 or More)				**All Operations**			
	2002		**2007**		**2002**		**2007**		**2002**		**2007**		**2002**		**2007**	
Biosecurity Practice	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Insect control	93.8	(1.3)	86.5	(2.7)	88.7	(2.1)	88.3	(2.7)	92.8	(2.0)	93.6	(3.0)	92.5	(1.1)	87.4	(2.0)
Rodent control	96.0	(1.1)	95.7	(1.4)	91.7	(1.9)	91.8	(2.0)	88.6	(2.7)	90.3	(3.4)	94.7	(0.9)	94.4	(1.1)
Bird control	25.2	(2.4)	29.4	(3.6)	38.8	(3.0)	44.3	(4.2)	42.1	(4.0)	41.4	(5.6)	29.1	(1.9)	33.8	(2.7)
Limit cattle contact with other livestock, elk, and deer	36.4	(2.7)	44.8	(3.8)	53.7	(3.0)	55.7	(4.2)	58.9	(4.1)	59.6	(5.6)	41.4	(2.1)	48.5	(2.8)
Control access to cattle feed by other livestock and wildlife	52.1	(2.7)	52.0	(3.9)	58.7	(2.9)	46.8	(4.2)	52.0	(4.2)	40.1	(5.4)	53.7	(2.1)	49.9	(2.9)
Closed herd*	64.5	(2.7)	60.1	(3.9)	47.6	(3.1)	49.5	(4.2)	38.4	(4.2)	40.6	(5.6)	59.5	(2.1)	56.2	(2.9)

*All replacements are from the operation; no contact with cattle from other operations.

3. Calving/ maternity areas

Parturition presents disease risks to cows and newborn calves. Periparturient cows may be immunosuppressed, and newborn calves have immature immune systems, placing both groups at high risk for contracting disease (McGuirk and Collins, 2004). Newborn calves are susceptible to respiratory and enteric pathogens, including *Mycobacterium avium* subspecies *paratuberculosis*, which causes Johne's disease. Having a dedicated maternity area separate from lactating cows reduces the risk of disease transmission to both newborn calves and their dams.

Nearly two-thirds of operations (60.0 percent) had a separate maternity area from lactating cows in 2007. About 9 of 10 large operations and 8 of 10 medium operations (90.4 and 80.8 percent, respectively) had separate maternity areas compared with 5 of 10 small operations (51.5 percent). A higher percentage of small and medium operations in 2007 than in 1996 housed maternity cows separately from lactating cows. The use of separate maternity housing increased from 45.4 percent of operations in 1996 to 60.0 percent in 2007.

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

	Percent Operations					
Herd Size (Number of Cows)	**Dairy 1996**	**Std. Error**	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
Small (fewer than 100)	39.1	(1.3)	43.5	(1.6)	51.5	(1.7)
Medium (100 to 499)	72.6	(2.1)	81.6	(1.7)	80.8	(1.8)
Large (500 or more)	94.5	(1.8)	91.9	(1.5)	90.4	(2.0)
All operations	45.4	(1.2)	53.1	(1.3)	60.0	(1.3)

*Operations with any dairy cows.

The usual calving area was defined as an area designated specifically for calving and separate from housing for lactating cows. Tie stalls or stanchions were not considered usual calving areas for the purpose of this report. The percentage of operations with a usual calving area ranged from 62.5 percent of small operations to 98.2 percent of large operations.

b. Percentage of operations that had a usual calving area, by herd size

Percent Operations							
Herd Size (Number of Cows)							
Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Percent	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**
62.5	(3.8)	83.7	(3.3)	98.2	(1.2)	70.1	(2.7)

Source: NAHMS Dairy 2007.

In 2007 nearly 90 percent of calves on operations with a usual calving area were born in the calving area. Large operations had a higher percentage of calves born in a usual calving area (93.6 percent) than small operations (79.9 percent).

c. For the 70.1 percent of operations with a usual calving area, percentage of calves born in a usual calving area, by herd size

Percent Calves							
Herd Size (Number of Cows)							
Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Pct.	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
79.9	(2.0)	89.0	(1.3)	93.6	(1.3)	89.8	(0.9)

Source: NAHMS Dairy 2007.

A higher percentage of small operations (37.6 percent) had between 0.0 and 75.9 percent of calves born in a usual calving area compared with medium and large operations (14.9 and 7.3 percent, respectively). In addition, 91.0 percent or more of calves were born in a usual calving area on 33.8, 56.1, and 68.7 percent of small, medium, and large operations, respectively.

d. Percentage of operations by percentage of calves born in a usual calving area, and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Percent Calves	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
0.0 to 50.9	19.3	(3.8)	8.4	(2.5)	3.7	(2.0)	14.7	(2.5)
51.0 to 75.9	18.3	(3.9)	6.5	(2.3)	3.6	(2.0)	13.5	(2.5)
76.0 to 90.9	28.6	(4.3)	29.0	(4.2)	24.0	(4.5)	28.3	(3.0)
91.0 to 99.9	16.6	(3.2)	38.4	(4.5)	45.8	(5.7)	25.6	(2.5)
100	17.2	(3.3)	17.7	(3.3)	22.9	(5.5)	17.9	(2.3)
Total	100.0		100.0		100.0		100.0	

Source: NAHMS Dairy 2007.

In 2007, 70.0 percent of operations used multiple-animal areas or pens for calving. A higher percentage of medium operations (79.8 percent) used a multiple-animal area/pen for calving compared with small operations (65.6 percent).

Slightly more than one-fourth of operations (25.5 percent) used an individual calving area/pen that was cleaned between calvings, and one-fourth of operations (26.2 percent) used an individual calving area/pen that was cleaned after two or more calvings.

e. Percentage of operations by area usually used for calving and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Calving Area	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Multiple animal area/pen	65.6	(3.5)	79.8	(3.5)	78.5	(4.3)	70.0	(2.6)
Individual animal area/pen cleaned between each calving	30.6	(3.4)	14.6	(3.3)	13.5	(3.9)	25.5	(2.5)
Individual animal area/pen cleaned after two or more calvings	25.4	(3.3)	27.4	(3.7)	30.3	(5.6)	26.2	(2.5)
Other	5.1	(1.7)	3.6	(1.4)	3.1	(1.7)	4.6	(1.2)

Source: NAHMS Dairy 2007.

Of operations with a usual calving area in 2007, 39.9 percent moved cows into the calving area within a day prior to calving. Over 40 percent of operations in the East region (41.4 percent) placed cows in calving pens/areas within 1 day of calving compared with less than 3 of 10 operations in the West region (28.6 percent). Operations in the West region moved cows into calving pens earlier than operations in the East region.

f. For the 70.1 percent of operations with a usual calving area, percentage of operations by number of days cows remained in a usual calving area/pen *prior* to calving, and by region

	Percent Operations					
	Region					
	West		East		All Operations	
Number of Days	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
1 or less	28.6	(4.9)	41.4	(3.6)	39.9	(3.2)
1.1 to 3.0	8.3	(2.9)	15.4	(2.6)	14.6	(2.3)
3.1 to 14.0	36.4	(5.6)	25.3	(3.1)	26.6	(2.8)
14.1 or more	26.7	(4.9)	17.9	(2.5)	18.9	(2.3)
Total	100.0		100.0		100.0	

Source: NAHMS Dairy 2007.

In 2007, few operations (12.9 percent) removed cows from the calving area in the first hour after calving. A higher percentage of small operations (25.0 percent) left cows in the calving area for more than 14 hours compared with large operations (6.2 percent). On 41.4 percent of operations, cows spent 3.1 to 14.0 hours in a calving area/pen after calving.

g. For the 70.1 percent of operations with a usual calving area, percentage of operations by number of hours cows remained in the usual calving area/pen *after* calving, and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Number of Hours	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Removed immediately	4.4	(1.8)	2.7	(1.3)	7.2	(3.0)	4.2	(1.2)
0.25 to 1.0	8.0	(2.3)	7.8	(2.1)	16.5	(3.8)	8.7	(1.6)
1.1 to 3.0	22.5	(4.0)	26.1	(4.0)	28.0	(5.4)	24.1	(2.8)
3.1 to 14.0	40.1	(4.6)	44.0	(4.4)	42.1	(5.5)	41.4	(3.2)
14.1 or more	25.0	(4.2)	19.4	(3.9)	6.2	(3.2)	21.6	(2.8)
Total	100.0		100.0		100.0		100.0	

Source: NAHMS Dairy 2007.

No regional differences were observed in the length of time cows spent in the calving area after calving in 2007.

h. For the 70.1 percent of operations with a usual calving area, percentage of operations by number of hours cows remained in the usual calving area/pen *after* calving, and by region

	Percent Operations			
	Region			
	West		East	
Number of Hours	Percent	Std. Error	Percent	Std. Error
Removed immediately	6.7	(2.7)	3.9	(1.3)
0.25 to 1.0	7.3	(2.7)	8.9	(1.7)
1.1 to 3.0	22.6	(4.9)	24.3	(3.1)
3.1 to 14.0	44.6	(5.8)	41.0	(3.5)
14.1 or more	18.8	(4.9)	21.9	(3.2)
Total	100.0		100.0	

Source: NAHMS Dairy 2007.

Keeping sick cows in the calving area is a potential source of disease for dams and newborn calves. Over one-third of operations (34.2 percent) allowed sick cows in the calving area in 2007. A higher percentage of small operations (37.3 percent) allowed sick cows in the calving area compared with large operations (16.5 percent). Almost one-half of operations (51.6 percent) allowed lame cows into the calving area.

i. For the 70.1 percent of operations with a usual calving area, percentage of operations that allowed sick and/or lame cows in the calving area, by cattle class and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Cattle Class	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Sick cows	37.3	(4.6)	33.0	(4.5)	16.5	(4.4)	34.2	(3.2)
Lame cows	51.8	(4.6)	57.9	(4.4)	28.6	(4.5)	51.6	(3.1)
Other	5.4	(2.0)	5.8	(2.3)	4.1	(2.2)	5.4	(1.4)
Any of the above	56.4	(4.6)	62.3	(4.2)	30.7	(4.6)	55.8	(3.1)

Source: NAHMS Dairy 2007.

The percentage of operations participating in a Johne's disease control or certification program has increased for each herd size category and for all operations since 1996. Less than 1 percent of operations participated in a Johne's disease control or certification program in 1996 compared with 11.2 percent in 2002 and 31.7 percent in 2007.

j. Percentage of operations that participated in any Johne's disease control or certification program, by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Study	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Dairy 1996*	1.0	(0.4)	0.5	(0.4)	0.4	(0.4)	0.9	(0.3)
Dairy 2002*	9.5	(1.7)	16.5	(2.3)	11.3	(2.3)	11.2	(1.4)
Dairy 2007	27.7	(3.3)	42.1	(4.1)	33.3	(4.5)	31.7	(2.5)

*Question variation: In 1996: "Is this operation currently on a Johne's certification program." In 2002: "Does operation participate in a Johne's disease herd status, control, or certification program."

A Johne's disease control program may include testing individual animals in order to identify those shedding *Mycobacterium avium* subspecies *paratuberculosis*, which present a risk to uninfected animals on the operation. The percentage of operations that tested for Johne's disease increased across herd sizes from 1996 to 2002 and for all operations from 1996 to 2007: 13.1 percent of operations tested for Johne's in 1996, 25.7 percent tested in 2002, and 35.3 percent tested in 2007. A higher percentage of medium operations (47.6 percent) tested for Johne's disease in 2007 compared with small operations (30.7 percent). Based on the percentage of operations that participated in a control program (see previous table), a substantial percentage of operations performed testing without being formally enrolled in a Johne's disease control or certification program.

k. Percentage of operations that performed any testing for Johne's disease, by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Study Year	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
1996*	10.5	(1.3)	22.0	(2.4)	19.9	(4.3)	13.1	(1.1)
2002	20.4	(2.5)	39.5	(3.3)	38.3	(4.0)	25.7	(1.9)
2007	30.7	(3.4)	47.6	(4.1)	37.5	(5.7)	35.3	(2.6)

*Question variation: 1996 estimate was operations that tested in the last 24 months, while the 2002 and 2007 estimates are for testing performed in the previous 12 months.

Cows test-positive for Johne's disease can contaminate the calving area and transmit the disease to newborn calves. Test-positive animals should not be allowed in the calving area or other calf areas. There was no herd-size difference in the percentage of operations that allowed Johne's disease test-positive animals into the calving area; 15.5 percent of operations that tested for Johne's disease allowed test-positive cows in the calving area in 2007.

l. For operations with a usual calving area and that tested for Johne's disease, percentage of operations that allowed Johne's test-positive cows in the usual calving area, by herd size

Percent Operations							
Herd Size (Number of Cows)							
Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Pct.	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
12.0	(4.5)	18.0	(5.0)	30.2	(8.3)	15.5	(3.2)

Source: NAHMS Dairy 2007.

4. Newborn calf risks and contact with other cattle

Separating newborn calves from their dams soon after they are born helps prevent disease transmission that can occur through nursing or contact with adult cow feces in maternity areas. Milk from dams infected with *Mycoplasma*, *Salmonella*, *E. coli*, *Mycobacterium avium* subspecies *paratuberculosis*, or BVD can transmit these diseases to calves (Wells, 2000; Nielsen et al., 2008). Feeding preweaned calves pasteurized milk, milk replacer, or milk from known disease-free cows is recommended.

The percentage of operations that separated newborn calves from their dams immediately after they were born doubled from 1991 to 2007 (28.0 to 55.9 percent of operations, respectively). In 2007, 22.2 percent of operations allowed calves to nurse from their dams but removed them from their dams less than 12 hours following birth. In 2007, about two-thirds of calves (65.6 percent) were on operations that removed calves from their dams immediately following birth. Less than 1 of 10 operations (7.3 percent)—representing 2.6 percent of calves—allowed calves to stay with their dams for more than 24 hours.

a. Percentage of operations* by number of hours following birth that calves were separated from their dams

	Percent Operations					Percent Operations			
Number of Hours	NDHEP 1991	Std. Error	Number of Hours	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Removed immediately	28.0	(1.7)	Removed immediately	47.9	(1.3)	52.9	(1.3)	55.9	(1.4)
Less than 12	39.6	(1.7)	After nursing, but less than 12 hours	20.8	(1.0)	22.5	(1.1)	22.2	(1.2)
12 to 24	22.0	(1.4)	12 to 24	17.4	(1.1)	15.9	(1.0)	14.6	(1.0)
More than 24	10.4	(1.0)	More than 24	13.9	(1.0)	8.7	(0.8)	7.3	(0.8)
Total	100.0		Total	100.0		100.0		100.0	

*Operations with any dairy cows.

Keeping preweaned calves separate from older animals is an effective way to reduce their exposure to disease. Preweaned calves are more susceptible to disease than older, healthy animals because their immune system is not yet fully developed (BAMN, 2001b). Physical contact between preweaned calves and cattle from older age groups (including nose-to-nose, sniffing, touching, licking, or contact across fence lines) increases the risk of exposing the calves to diseases such as salmonellosis, Johne's disease, and upper respiratory diseases.

The percentage of operations in which preweaned heifers were not exposed to weaned calves, bred heifers, or adult cattle increased from 1996 to 2007.

b. Percentage of operations[1] in which after separation from the dam preweaned heifers did not have physical contact[2] with the following cattle classes

	Percent Operations							
Cattle Class	NDHEP 1991	Std. Error	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Weaned calves less than approximately 4 months of age	68.5	(2.0)	67.0	(1.3)	77.2	(1.2)	76.0	(1.2)
Calves from approximately 4 months of age to breeding	89.6	(1.3)						
Bred heifers not yet calved	95.4	(0.9)	81.2	(1.1)	86.7	(0.9)	86.8	(1.0)
Adult cattle	89.8	(1.3)	79.8	(1.1)	84.6	(1.0)	84.3	(1.1)

[1] Operations with any dairy cows
[2] Physical contact = possible nose-to-nose contact or sniffing/touching/licking each other, including through a fence.

5. Colostrum feeding

Feeding calves high quality colostrum immediately following birth helps provide calves with the antibodies needed to withstand disease challenges and is recommended to maximize calf health (BAMN, 2001b). The effectiveness of colostral transfer of immunity to calves depends on the antibody mass delivered to calves, the timing of feeding, and the health status of the calves. Antibody mass is a function of antibody concentration and the volume of colostrum delivered to the calves. Administering colostrum to calves rather than allowing calves to obtain colostrum by nursing their dams enables producers to evaluate colostrum quality, determine the timing of the first feeding, and the total amount of colostrum calves receive. Calves that receive colostrum solely through nursing might not receive the proper quantity or quality of colostrum in a timely manner (BAMN, 2001b). Additionally, if the calving area is not properly maintained, calves might ingest manure and pathogens from the environment while searching for teats and suckling colostrum.

"A Guide to Colostrum and Colostrum Management for Dairy Calves", published by The Bovine Alliance on Management and Nutrition, recommends that calves get 3 quarts of high quality colostrum by nipple bottle within 1 hour of birth and an additional 3 quarts in 12 hours, or 4 quarts of high quality colostrum by esophageal feeder within 1 hour of birth (BAMN, 2001b).

On average, calves received hand-fed colostrum 3.3 hours following birth.

a. For operations that immediately removed calves from their dams and hand-fed colostrum, operation* average number of hours following birth that heifer calves received their first colostrum feeding, by herd size

Operation Average Hours							
Herd Size (Number of Cows)							
Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Hours	**Std. Error**	**Hours**	**Std. Error**	**Hours**	**Std. Error**	**Hours**	**Std. Error**
3.4	(0.1)	3.3	(0.1)	2.8	(0.2)	3.3	(0.1)

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

During all study years, about one-third of operations allowed heifers to get colostrum during their first nursing.

b. Percentage of operations* by method normally used for heifers' first feeding of colostrum

	Percent Operations							
Method	NDHEP 1991	Std. Error	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
First nursing	33.7	(1.7)	33.5	(1.2)	30.5	(1.2)	36.3	(1.4)
Hand-fed from bucket or bottle	64.0	(1.7)	62.5	(1.2)	64.8	(1.3)	59.2	(1.4)
Hand-fed using esophageal feeder	2.3	(0.6)	3.6	(0.4)	4.4	(0.5)	4.3	(0.5)
No colostrum	0.0	(0.0)	0.4	(0.2)	0.3	(0.1)	0.2	(0.1)
Total	100.0		100.0		100.0		100.0	

*Operations with any dairy cows.

Photo courtesy of Dr. Jason Lombard.

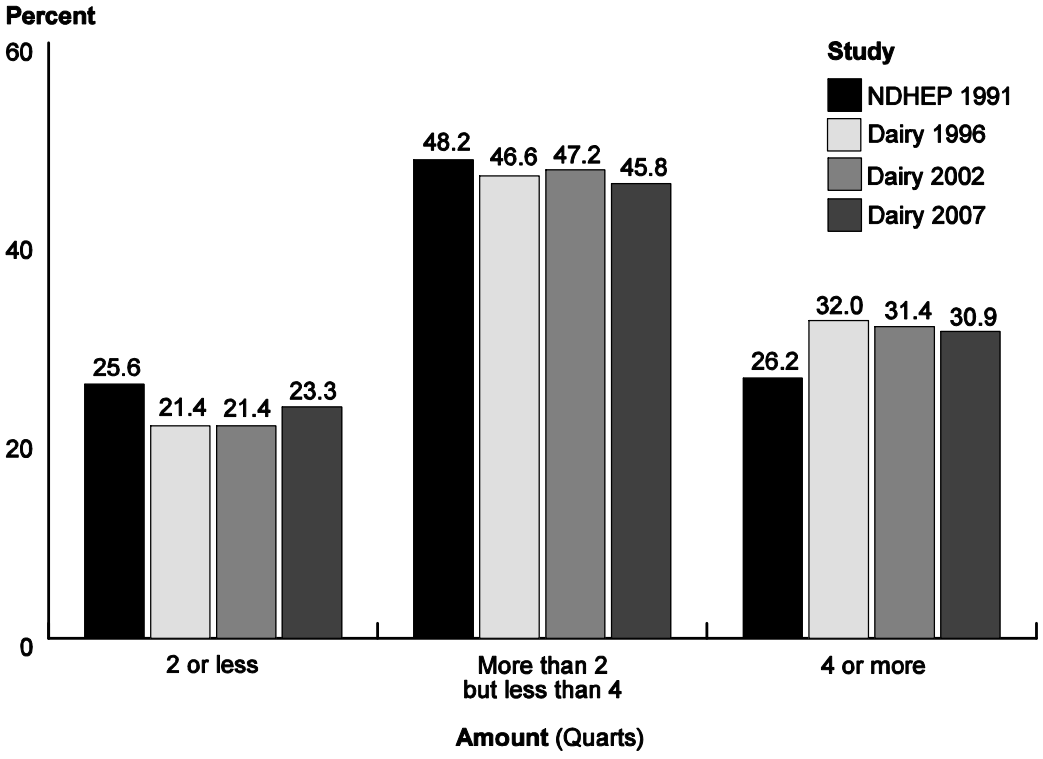
From 1991 to 2007, operations provided calves about the same amount of colostrum during their first 24 hours of life: about one-fourth of operations fed calves 2 quarts or less and about one-third fed calves 4 quarts or more. Nearly one-half of operations (45.8 percent) fed newborn dairy heifers more than 2 quarts but less than 4 quarts of colostrum. An additional 30.9 percent of operations fed 4 or more quarts of colostrum to newborn dairy heifers during their first 24 hours.

c. For operations that normally hand-fed colostrum to heifers, percentage of operations* by amount of colostrum fed during the first 24 hours

	Percent Operations							
Amount (Quarts)	**NDHEP 1991**	**Std. Error**	**Dairy 1996**	**Std. Error**	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
2 or less	25.6	(1.8)	21.4	(1.3)	21.4	(1.4)	23.3	(1.6)
More than 2, but less than 4	48.2	(2.1)	46.6	(1.6)	47.2	(1.7)	45.8	(1.9)
4 or more	26.2	(1.9)	32.0	(1.5)	31.4	(1.5)	30.9	(1.7)
Total	100.0		100.0		100.0		100.0	

*Operations with any dairy cows.

For Operations that Normally Hand-fed Colostrum to Heifers, Percentage of Operations* by Amount of Colostrum Fed During the First 24 Hours



*Operations with any dairy cows.

6. Measuring passive transfer of immunity

Measuring immunoglobulin G (IgG) or serum total protein levels in calves within the first 3 days of life is a relatively simple way to measure passive transfer of immunity and the effectiveness of the colostrum management program. Overall, in 2007 only 2.1 percent of operations routinely measured passive transfer via serum total proteins. Of large operations, 14.5 percent measured serum proteins, while only 2.4 percent of medium operations and 1.1 percent of small operations measured total serum proteins.

a. Percentage of operations* that routinely monitored serum proteins (as a measure of passive transfer) in heifers within the first 3 days of life, by herd size

Percent Operations							
Herd Size (Number of Cows)							
Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Pct.	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
1.1	(0.4)	2.4	(0.6)	14.5	(1.7)	2.1	(0.3)

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

Measuring immunoglobulin levels in colostrum is one way to evaluate its quality. Of operations that hand-fed colostrum in 2007, 13.0 percent either estimated immunoglobulin levels or evaluated colostrum quality before feeding it to newborn calves, compared with 5.2 percent of operations in 2002. The percentage of operations that estimated immunoglobulin levels in colostrum or evaluated its quality increased across herd sizes from 2002 to 2007. A higher percentage of large operations (45.2 percent) evaluated colostrum than medium or small operations (19.8 and 7.6 percent, respectively) in 2007.

b. For operations that hand-fed colostrum, percentage of operations* that estimated immunoglobulin levels of colostrum or evaluated its quality, by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Study Year	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
2002	2.1	(1.6)	10.6	(1.5)	32.2	(2.8)	5.2	(0.5)
2007	7.6	(1.3)	19.8	(2.3)	45.2	(3.2)	13.0	(1.1)

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

The most commonly used methods of evaluating colostrum were a colostrometer and visual appearance (43.7 and 41.6 percent of operations, respectively).

c. For the 13.0 percent of operations that estimated immunoglobulin levels in colostrum or evaluated its quality, percentage of operations* by primary method used for measuring immunoglobulin

Primary Method	Percent	Std. Error
Colostrometer	43.7	(4.2)
Visual appearance	41.6	(4.3)
Volume of first milking colostrum (pounds)	9.7	(2.8)
Other	5.0	(2.7)
Total	100.0	

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

7. Colostrum pooling and storage

Pooling colostrum from several cows to feed calves increases the risk of spreading disease-causing agents (including the agent causing Johne's disease) to more than one calf (BAMN, 2001b). The percentage of large and medium operations that pooled colostrum decreased from 2002 to 2007. Of operations that normally fed colostrum to newborn calves in 2007, 21.0 percent pooled colostrum; 56.9 percent of large operations, and 26.0 and 16.0 percent of medium and small operations, respectively, pooled colostrum in 2007.

a. For operations that normally hand-fed colostrum to newborn calves, percentage of operations* that pooled colostrum from more than one cow, by herd size

	Percent Operations			
Herd Size (Number of Cows)	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
Small (fewer than 100)	22.1	(1.4)	16.0	(1.7)
Medium (100 to 499)	37.4	(2.0)	26.0	(2.4)
Large (500 or more)	70.6	(2.4)	56.9	(3.1)
All operations	27.0	(1.1)	21.0	(1.3)

*Operations with any dairy cows.

The proper handling and storage of excess colostrum is important in protecting its quality. Storing colostrum at warm, ambient temperatures rapidly increases bacterial growth (McGuirk and Collins, 2004). Refrigerating colostrum results in intermediate rates of bacterial proliferation. The use of a preservative and refrigeration to store colostrum results in lower rates of bacterial growth than refrigeration alone. For long-term storage, colostrum should be frozen (McGuirk and Collins, 2004).

The percentages of operations by methods used for storing colostrum remained essentially unchanged from 2002 to 2007, with the highest percentage of operations not storing colostrum. Approximately 6 of 10 operations did not store colostrum in 2002 or 2007.

b. For operations that hand-fed colostrum to newborn calves, percentage of operations* by primary method used for storing colostrum

	Percent Operations			
Method	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Stored without refrigeration	4.4	(0.6)	3.9	(0.7)
Stored in refrigerator	7.8	(0.6)	11.1	(0.9)
Stored in freezer	27.7	(1.1)	28.2	(1.6)
Other	0.5	(0.2)	0.0	(--)
Not stored	59.6	(1.3)	56.8	(1.8)
Total	100.0		100.0	

*Operations with any dairy cows.

8. Pasteurization of colostrum

Pasteurization is a proven method for reducing pathogens in colostrum (Godden et al., 2006). A high-temperature, short-time (HTST) system is one method of pasteurizing colostrum. HTST pasteurizers, however, cause colostrum to gel and reduce the amount of antibodies present, particularly IgG. A batch pasteurizer uses a lower temperature and longer heating time compared with HTST. Batch pasteurizers do not cause colostrum to gel and do not significantly reduce IgG concentrations (Godden et al., 2006). Although pasteurization decreases the pathogens in colostrum, it does not improve the quality of the colostrum in terms of increasing maternal antibodies. Although pasteurization is commonly used for milk and can be used for colostrum, the technical issues inherent in pasteurization may be one reason that dairies have been slow to adopt this management practice.

The percentage of operations that pasteurized colostrum did not change from 2002 to 2007. In 2007, less than 1 percent of operations that hand-fed colostrum (0.8 percent) pasteurized the colostrum before feeding it to newborn calves. Large operations were more likely to pasteurize colostrum (6.4 percent) than medium and small operations (0.9 and 0.2 percent, respectively).

a. For operations that hand-fed colostrum to newborn calves, percentage of operations* that pasteurized colostrum, by herd size

	Percent Operations			
Herd Size (Number of Cows)	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
Small (fewer than 100)	0.4	(0.2)	0.2	(0.2)
Medium (100 to 499)	0.8	(0.3)	0.9	(0.4)
Large (500 or more)	3.6	(0.9)	6.4	(1.6)
All operations	0.6	(0.2)	0.8	(0.2)

*Operations with any dairy cows.

Colostrum from Johne's test-positive cows can transmit the disease to calves. Therefore, producers should feed colostrum from test-negative cows or pasteurize it prior to feeding. In 2007, only 4.9 percent of operations fed newborn calves colostrum from Johne's test-positive cows.

b. For operations that tested for Johne's disease, percentage of operations in which newborn calves were fed colostrum from cows that tested positive for Johne's disease, by herd size

Percent Operations							
Herd Size (Number of Cows)							
Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Pct.	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
6.0	(2.9)	3.8	(2.8)	0.6	(0.4)	4.9	(2.0)

Source: NAHMS Dairy 2007.

9. Calf-feeding equipment

To prevent the spread of disease from one calf to another, calf-feeding equipment (bottles, buckets, and nipples) should be cleaned and disinfected between calves. In 2007, about one-fourth of operations (24.4 percent) cleaned calf-feeding equipment between calves. A higher percentage of large and medium operations (39.1 and 30.9 percent, respectively) cleaned calf-feeding equipment between calves compared with small operations (21.4 percent).

Over one-half of operations across herd sizes cleaned calf-feeding equipment daily. A higher percentage of medium and small operations (5.2 and 7.0 percent, respectively) cleaned calf-feeding equipment weekly compared with large operations (1.3 percent). A high percentage of operations that listed "other" for cleaning frequency indicated that they cleaned calf-feeding equipment twice a day, but not between calves.

Percentage of operations[1] by frequency calf-feeding equipment[2] was cleaned and disinfected, and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Frequency	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Between calves	21.4	(1.5)	30.9	(2.2)	39.1	(2.7)	24.4	(1.2)
Daily	59.8	(1.8)	55.9	(2.3)	51.8	(2.8)	58.5	(1.4)
Weekly	7.0	(1.0)	5.2	(0.9)	1.3	(0.9)	6.4	(0.8)
Monthly	3.8	(0.7)	1.4	(0.6)	2.2	(1.0)	3.2	(0.5)
Other	8.0	(1.0)	6.6	(1.1)	5.6	(1.3)	7.5	(0.8)
Total	100.0		100.0		100.0		100.0	

[1] Operations with any dairy cows.
[2] Bottles, buckets, nipples.
Source: NAHMS Dairy 2007.

10. Physical contact with other animals

Other animals can be the source of many different diseases. These diseases can be spread by direct contact or through ingestion of contaminated feed or water. For example, *Neospora* is a parasitic disease that is shed via the feces of dogs and other canids and can cause abortions in cattle, if ingested. Malignant catarrhal fever is spread to cattle by sheep. In some parts of the country, populations of deer are infected with TB, which can be spread to cattle.

Dogs, cats, and members of the deer family were the three animal types most often reported as having contacts with dairy cattle. The percentage of operations in which pigs, sheep, or beef cattle had physical contact with dairy cattle and/or their feed, minerals, or water was lower in 2007 than in 1991. Dairy cattle contact with the other listed animals remained unchanged from 1991 to 2007.

a. Percentage of operations[1] in which the following animals had physical contact with dairy cattle and/or their feed, minerals, or water

	Percent Operations							
Animal Type	NDHEP 1991	Std. Error	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Chickens/other poultry	10.6	(1.4)	7.5	(0.8)	6.8	(0.7)	8.3	(0.8)
Horses or other equids[2]	15.0	(1.6)	11.6	(0.9)	12.8	(0.9)	13.3	(1.0)
Pigs	5.5	(1.0)	3.9	(0.6)	2.3	(0.4)	2.0	(0.4)
Sheep	3.0	(0.6)	2.3	(0.5)	1.3	(0.3)	0.9	(0.3)
Goats	3.1	(0.7)	3.0	(0.5)	2.8	(0.5)	2.5	(0.4)
Beef cattle	17.3	(1.7)	18.5	(1.1)	10.5	(0.8)	11.3	(1.0)
Exotic species	NA		0.8	(0.2)	0.6	(0.2)	0.7	(0.2)
Deer or other cervidae[3]	56.1	(2.2)	49.3	(1.1)	53.1	(1.3)	49.3	(1.4)
Dogs	NA		77.8	(1.1)	70.6	(1.2)	68.9	(1.3)
Cats	NA		90.2	(0.8)	87.8	(0.8)	85.2	(0.9)

[1] Operations with any dairy cows
[2] In 1991, “horses” was the animal type; “other equids” was not listed.
[3] In 1991, “deer” was the animal type; “other cervidae” was not listed.

TB is transmitted most commonly by the respiratory route, whereby invisible droplets (aerosols) containing TB bacteria are exhaled or coughed by infected animals and then inhaled by susceptible animals or humans. The risk of exposure is greatest in enclosed areas; however, livestock can become infected if they share a common eating or watering place contaminated with the saliva and other discharges from infected deer or other animals. Direct contact between cattle and deer infected with TB increases the risk cattle contracting TB.

On operations in which deer or other members of the deer family had contact with cattle and/or their feed or water in 2007, 90.8 percent of operations reported that cattle could possibly or sometimes have face-to-face contact with deer. There were no differences by region in the percentages of operations that reported face-to-face contact between cattle and deer.

b. For operations in which deer had physical contact with cattle and/or their feed, minerals, or water, percentage of operations* by frequency that members of the deer family had face-to-face contact with cattle, and by region

	Percent Operations					
	Region					
	West		East		All Operations	
Frequency	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Never	4.8	(2.1)	9.4	(1.2)	9.2	(1.2)
Possibly	56.3	(8.0)	64.3	(2.1)	64.1	(2.0)
Sometimes	38.9	(7.9)	26.3	(1.9)	26.7	(1.9)
Total	100.0		100.0		100.0	

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

11. Equipment handling for manure and feed

Using the same equipment for both manure removal and feed handling increases the risk of contaminating feed with disease-causing organisms, especially *Salmonella* and *Mycobacterium avium* subspecies *paratuberculosis*. On some operations it may not be feasible to have equipment dedicated solely to feed handling or manure removal. In those cases, implementing procedures for cleaning and disinfecting equipment between uses and training employees to use those procedures will reduce the likelihood of feed contamination with feces and pathogens.

About one-third of operations (32.2 percent) routinely used the same equipment to handle manure and to feed cattle in 2007; another one-third (35.6 percent) rarely used the same equipment, and another one-third (32.2 percent) never used the same equipment to handle both manure and feed. No differences were observed across herd sizes.

a. Percentage of operations by frequency that the same equipment was used to handle manure and feed cattle during the previous 12 months, and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Frequency	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Routinely	34.1	(3.6)	29.8	(3.9)	20.3	(4.7)	32.2	(2.7)
Rarely	34.4	(3.6)	36.4	(4.0)	46.0	(5.6)	35.6	(2.7)
Never	31.5	(3.6)	33.8	(3.9)	33.7	(5.5)	32.2	(2.7)
Total	100.0		100.0		100.0		100.0	

Source: NAHMS Dairy 2007.

For operations that used the same equipment to handle manure and feed cattle, about 5 percent washed and chemically disinfected the equipment between uses in 2002 and 2007. The majority of operations washed equipment with water or steam, and less than 1 percent of operations used chemical disinfectants only. The majority of the 23.2 percent of operations that used "other" procedures in 2007 used separate loader buckets. More than 1 of 10 operations that used the same equipment to handle manure and feed cattle performed no procedures on the equipment between uses in 2002 or 2007.

b. For operations that used the same equipment to handle manure and feed cattle, percentage of operations by procedure that best describes what was usually done with equipment after handling manure

	Percent Operations			
Procedure	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
Wash equipment with water or steam only	54.2	(2.9)	61.0	(3.4)
Chemically disinfect only	0.0	(--)	0.1	(0.1)
Wash equipment and chemically disinfect	5.7	(1.5)	4.6	(1.5)
Other	24.9	(2.5)	23.2	(3.1)
No procedures done	15.2	(2.2)	11.1	(2.3)
Total	100.0		100.0	

12. Equipment sharing with other livestock operations

Sharing equipment between operations can spread disease from one operation to another. Sanitation and disinfection procedures should be used to ensure that all shared equipment is cleaned prior to use. In 2002 and 2007, about one of three operations shared equipment with other livestock operations.

a. Percentage of operations that shared any heavy equipment (tractors, feeding equipment, manure spreaders, trailers, etc.) with other livestock operations, by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Study Year	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
2002	40.0	(2.7)	33.4	(2.8)	28.0	(3.7)	38.0	(2.1)
2007	35.9	(3.7)	41.0	(4.1)	21.3	(4.3)	36.2	(2.8)

Photo courtesy of Dr. Jason Lombard.

The majority of all operations (63.8 percent) had not shared any heavy equipment with other livestock operations during the previous 12 months. More than 12 percent of operations across all herd sizes shared equipment at least six times during the previous 12 months.

b. Percentage of operations by number of times heavy equipment was shared during the previous 12 months, and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Number of Times	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
0	64.1	(3.7)	59.0	(4.1)	78.7	(4.3)	63.8	(2.8)
1 to 2	11.1	(2.6)	15.5	(3.1)	5.3	(2.3)	11.8	(2.0)
3 to 5	12.6	(2.5)	7.0	(2.4)	3.1	(1.1)	10.6	(1.8)
6 or more	12.2	(2.3)	18.5	(3.4)	12.9	(3.8)	13.8	(1.8)
Total	100.0		100.0		100.0		100.0	

Source: NAHMS Dairy 2007.

For the 36.2 percent of operations that shared equipment with other operations in 2007, the majority of operations performed no cleaning procedures prior to using the equipment on their own operations (63.0 percent), while 26.6 percent washed equipment with water or steam.

c. For operations that shared equipment with other livestock operations, percentage of operations by cleaning procedure usually performed on equipment shared with other operations prior to use on the operation

Procedure	**Percent Operations**	**Standard Error**
Wash equipment with water or steam only	26.6	(3.9)
Chemically disinfect only	0.0	(--)
Wash equipment and chemically disinfect	0.5	(0.3)
Other	9.9	(3.2)
No procedures done	63.0	(4.6)
Total	100.0	

Source: NAHMS Dairy 2007.

13. Water sources for cows

Water sources for cows have changed since 1996. For example, the use of a single cup/bowl by only one cow decreased from 52.5 percent of operations in 1996 to 11.4 percent in 2007. The percentage of operations that used a single cup/bowl for multiple cows increased from 50.0 percent of operations in 1996 to 64.1 percent in 2007. The percentage of operations that used a water tank or trough increased from 77.9 percent in 1996 to 93.2 percent in 2007. The changes in water sources mirror the changes in housing, in which cows are in loose housing rather than restricted to a single stall and water source.

a. Percentage of operations by source of drinking water for cows

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

Source: NAHMS Dairy 2007.

For operations that used a water tank or trough, the percentage of operations that cleaned water tanks/troughs 13 or more times a year increased from 13.6 percent of operations in 1996 to 34.2 percent of operations in 2007.

b. For operations that used a water tank or trough, percentage of operations by average number of times per year water tank or trough was drained *and* cleaned

	Percent Operations					
Number of Times	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
0	8.4	(1.2)	6.2	(1.1)	4.6	(1.4)
1 to 4	51.8	(2.1)	46.5	(2.3)	37.1	(3.2)
5 to 12	26.2	(1.9)	22.3	(1.9)	24.1	(2.8)
13 or more	13.6	(1.4)	25.0	(1.9)	34.2	(2.8)
Total	100.0		100.0		100.0	

From 1996 to 2007, about 9 percent of operations chlorinated drinking water for cows.

c. Percentage of operations that usually chlorinated drinking water for cows

Percent Operations					
Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
10.7	(1.0)	9.8	(1.0)	8.7	(1.2)

14. Milking personnel and training

Owners of large operations were usually more involved in overall management of the operation rather than in specific labor-intensive procedures such as milking cows. In 2007, the percentage of operations in which owners/operators milked the majority of cows decreased from 74.8 percent of small operations to 0.0 percent of large operations. Family members milked the majority of cows on 17.4 percent of small operations and 14.3 percent of medium operations. No large operations reported family members performing the majority of milking.

The number of employees increased as herd size increased. Large operations averaged almost 13 full-time employees (including owners and family members), while small operations averaged 2 (see table b. p 40). The percentage of operations in which hired workers milked the majority of cows increased as herd size increased. Hired workers milked the majority of cows on 100.0 percent of large operations.

a. Percentage of operations by personnel who milked the majority of cows, and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Personnel	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Owner/operator	74.8	(3.3)	33.7	(3.9)	0.0	(--)	59.8	(2.5)
Family member(s) of operator	17.4	(3.0)	14.3	(3.1)	0.0	(--)	15.6	(2.2)
Hired worker(s)	7.8	(1.8)	52.0	(3.9)	100.0	(0.0)	24.6	(1.7)
Total	100.0		100.0		100.0		100.0	

Source: NAHMS Dairy 2007.

Good milking practices include training milkers in proper procedures such as hygiene, the correct attachment of milking units, and how to recognize the signs of mastitis. Training is usually an ongoing processes, as milking protocols are often modified or updated.

In 2007, milker training increased as herd size increased, with 50.3 percent of small operations training milking personnel compared with 79.0 percent of medium operations and 97.8 percent of large operations. About one of four operations (42.5 percent) trained new employees only, while about one-third (37.3 percent) provided no milker training. A lower percentage of small operations (3.2 percent) performed training one to two times per year for all milkers compared with medium and large operations (14.9 and 25.5 percent, respectively).

b. For the 75.7 percent of operations with employees, percentage of operations by how frequently milking personnel were trained, and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Frequency	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
As new employees only	39.6	(4.4)	48.4	(4.2)	42.3	(5.7)	42.5	(3.1)
1 to 2 times/year for all milkers	3.2	(1.2)	14.9	(3.0)	25.5	(5.4)	8.5	(1.3)
3 to 4 times/year for all milkers	2.8	(1.7)	4.3	(1.4)	14.0	(3.8)	4.2	(1.2)
5 times/year or more for all milkers	1.4	(1.2)	7.0	(2.5)	10.8	(3.5)	3.8	(1.1)
Other	3.3	(1.6)	4.4	(1.9)	5.2	(2.6)	3.7	(1.2)
No milker training	49.7	(4.5)	21.0	(3.7)	2.2	(2.2)	37.3	(3.1)
Total	100.0		100.0		100.0		100.0	

Source: NAHMS Dairy 2007.

A higher percentage of operations in the West region than in the East region provided milker training (89.0 and 59.6 percent, respectively). A higher percentage of operations in the West region than in the East region provided milker training one or two times per year for all milkers (20.8 and 7.1 percent, respectively).

c. For the 75.7 percent of operations with employees, percentage of operations by how frequently milking personnel were trained, and by region

	Percent Operations			
	Region			
	West		East	
Frequency	**Percent**	**Std. Error**	**Percent**	**Std. Error**
As new employees only	57.1	(5.6)	40.7	(3.4)
1 to 2 times/year for all milkers	20.8	(4.2)	7.1	(1.3)
3 to 4 times/year for all milkers	7.2	(3.1)	3.8	(1.3)
5 times/year or more for all milkers	1.7	(1.0)	4.1	(1.2)
Other	2.2	(1.5)	3.9	(1.3)
No milker training	11.0	(3.4)	40.4	(3.4)
Total	100.0		100.0	

Source: NAHMS Dairy 2007.

Almost all operations that trained milkers (97.1 percent) used on-the-job training. Almost one-third of operations (31.9 percent) used discussion/lecture to train milkers, while less than 1 of 10 (6.9 percent) used video training.

d. For the 62.7 percent of operations that trained milking personnel, percentage of operations by training method used

Method	Percent Operations	Standard Error
Video training	6.9	(1.1)
Discussion/lecture	31.9	(3.2)
On-the-job training	97.1	(0.9)
Other	3.9	(1.0)

Source: NAHMS Dairy 2007.

15. Milking biosecurity practices

The percentage of operations in which milkers wore gloves to milk all cows increased from 32.9 percent in 2002 to 55.2 percent in 2007. The percentage of cows on operations in which milkers wore gloves increased from 48.7 in 2002 to 76.8 percent in 2007.

a. Percentage of operations (and percentage of cows on these operations) in which milkers wore gloves to milk all cows

Percent Operations				Percent Cows			
Dairy 2002		Dairy 2007		Dairy 2002		Dairy 2007	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
32.9	(1.9)	55.2	(2.8)	48.7	(1.9)	76.8	(2.5)

To reduce the exposure of noninfected cows to mastitis organisms, cows with clinical mastitis should be milked at the end of milking, with a separate milking unit, or in a separate string. Across herd sizes, about one of three operations used a separate milking unit to milk cows with mastitis. A higher percentage of large operations (83.4 percent) milked cows with mastitis in a separate string from healthy cows compared with medium and small operations (33.4 and 29.8 percent, respectively).

b. Percentage of operations by method used for milking cows with clinical mastitis, and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Method	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Separate milking unit from healthy cows	38.5	(3.7)	25.7	(3.6)	31.5	(5.3)	34.9	(2.7)
Separate string from healthy cows	29.8	(3.5)	33.4	(3.8)	83.4	(4.7)	34.1	(2.6)

Source: NAHMS Dairy 2007.

About 6 of 10 operations in the West region (59.9 percent) milked cows with clinical mastitis in a separate string from healthy cows compared with approximately 3 of 10 operations in the East region (31.6 percent) in 2007.

c. Percentage of operations by method used to milk cows with clinical mastitis, and by region

	Percent Operations			
	Region			
	West		**East**	
Method	**Percent**	**Std. Error**	**Percent**	**Std. Error**
Separate milking unit from healthy cows	27.5	(4.9)	35.6	(2.9)
Separate string from healthy cows	59.9	(5.0)	31.6	(2.8)

Source: NAHMS Dairy 2007.

D. Vaccination and Prevention Practices

1. Heifer vaccination

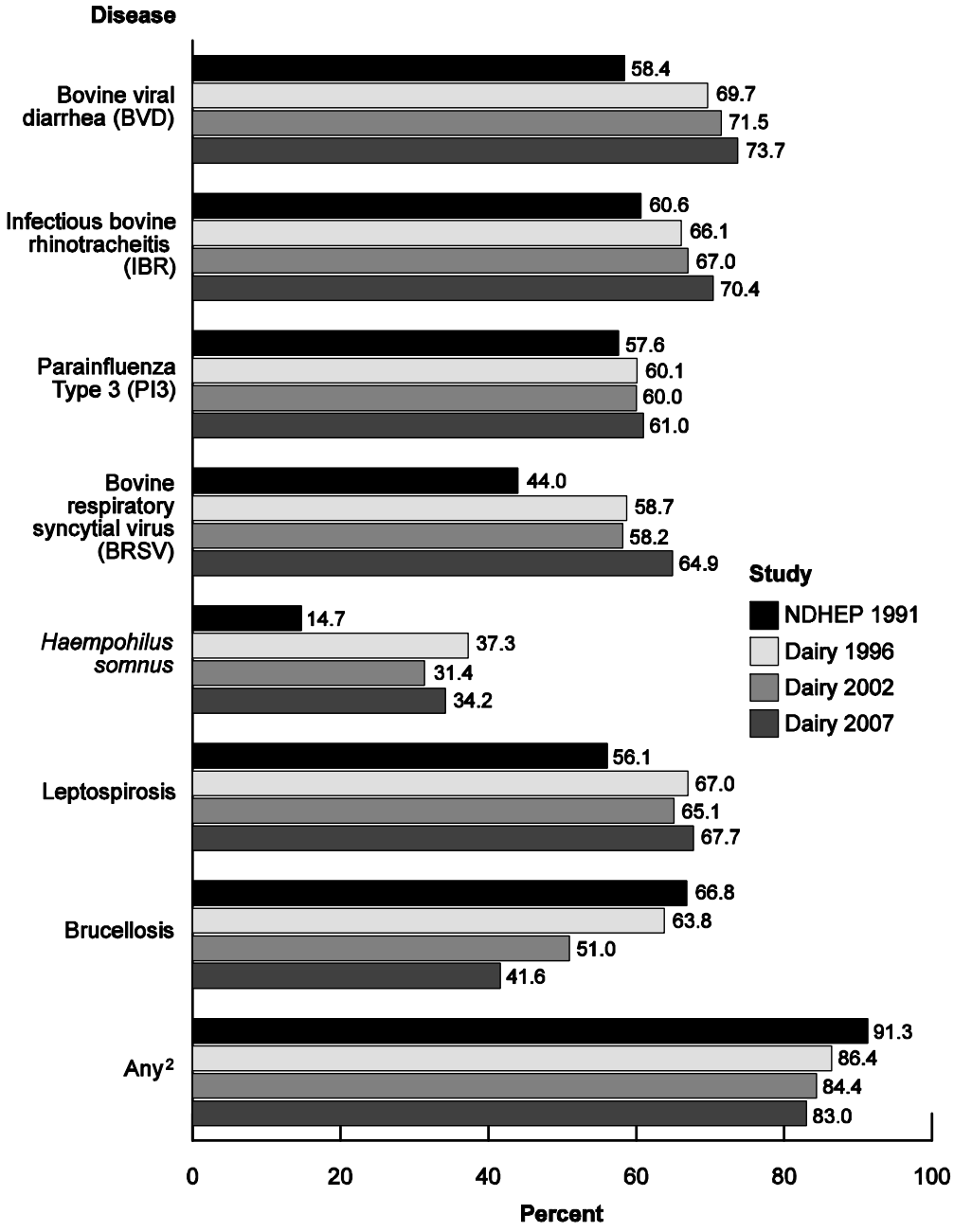
The percentage of operations that administered any vaccine to heifers decreased from 91.3 percent in 1991 to 83.0 percent in 2007. With the exceptions of parainfluenza (PI3), brucellosis, and Johne's disease vaccines, use of vaccines for other diseases increased or remained the same. Interestingly, only the use of brucellosis vaccine has decreased since 1991. The percentage of operations that vaccinated heifers against brucellosis decreased from 66.8 percent in 1991 to 41.6 percent in 2007. This decrease may be due to the fact that many States switched from a mandatory to a voluntary brucellosis program from 1991 to 2007. In addition, the number of States that were certified brucellosis-free increased from 34 in 1996 to 49 in 2007, which may have impacted how many operations vaccinated against brucellosis.

Percentage of operations* that normally vaccinated heifers against the following diseases

	Percent Operations							
Disease	NDHEP 1991	Std. Error	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Bovine viral diarrhea (BVD)	58.4	(2.1)	69.7	(1.3)	71.5	(1.2)	73.7	(1.3)
Infectious bovine rhinotracheitis (IBR)	60.6	(2.1)	66.1	(1.3)	67.0	(1.3)	70.4	(1.3)
Parainfluenza Type 3 (PI3)	57.6	(2.1)	60.1	(1.3)	60.0	(1.3)	61.0	(1.4)
Bovine respiratory syncytial virus (BRSV)	44.0	(2.1)	58.7	(1.3)	58.2	(1.3)	64.9	(1.4)
Haemophilus somnus	14.7	(1.4)	37.3	(1.3)	31.4	(1.2)	34.2	(1.3)
Leptospirosis	56.1	(2.2)	67.0	(1.3)	65.1	(1.3)	67.7	(1.3)
Salmonella	NA		18.9	(1.0)	16.8	(1.0)	21.5	(1.1)
E. coli mastitis	NA		18.1	(0.9)	21.3	(1.0)	24.1	(1.1)
Clostridia (blackleg/ malignant edema)	20.7	(1.4)	32.3	(1.1)	32.8	(1.1)	34.6	(1.3)
Brucellosis	66.8	(1.9)	63.8	(1.3)	51.0	(1.3)	41.6	(1.3)
Mycobacterium avium subspecies *paratuberculosis* (Johne's disease)	NA		5.4	(0.6)	4.6	(0.5)	5.0	(0.6)
Neospora	NA		NA		3.6	(0.4)	6.3	(0.6)
Other	NA		7.3	(0.6)	6.9	(0.6)	6.8	(0.7)
Any	91.3	(1.3)	86.4	(1.0)	84.4	(1.1)	83.0	(1.1)

*Operations with any dairy cows.

Percentage of Operations[1] that Normally Vaccinated Heifers Against the Following Diseases



[1] Operations with any dairy cows.
[2] Includes vaccines for the diseases listed above plus *Salmonella*, *E. coli* mastitis, clostridia, Johne's disease, *Neospora,* and "Other."

2. Cow vaccination

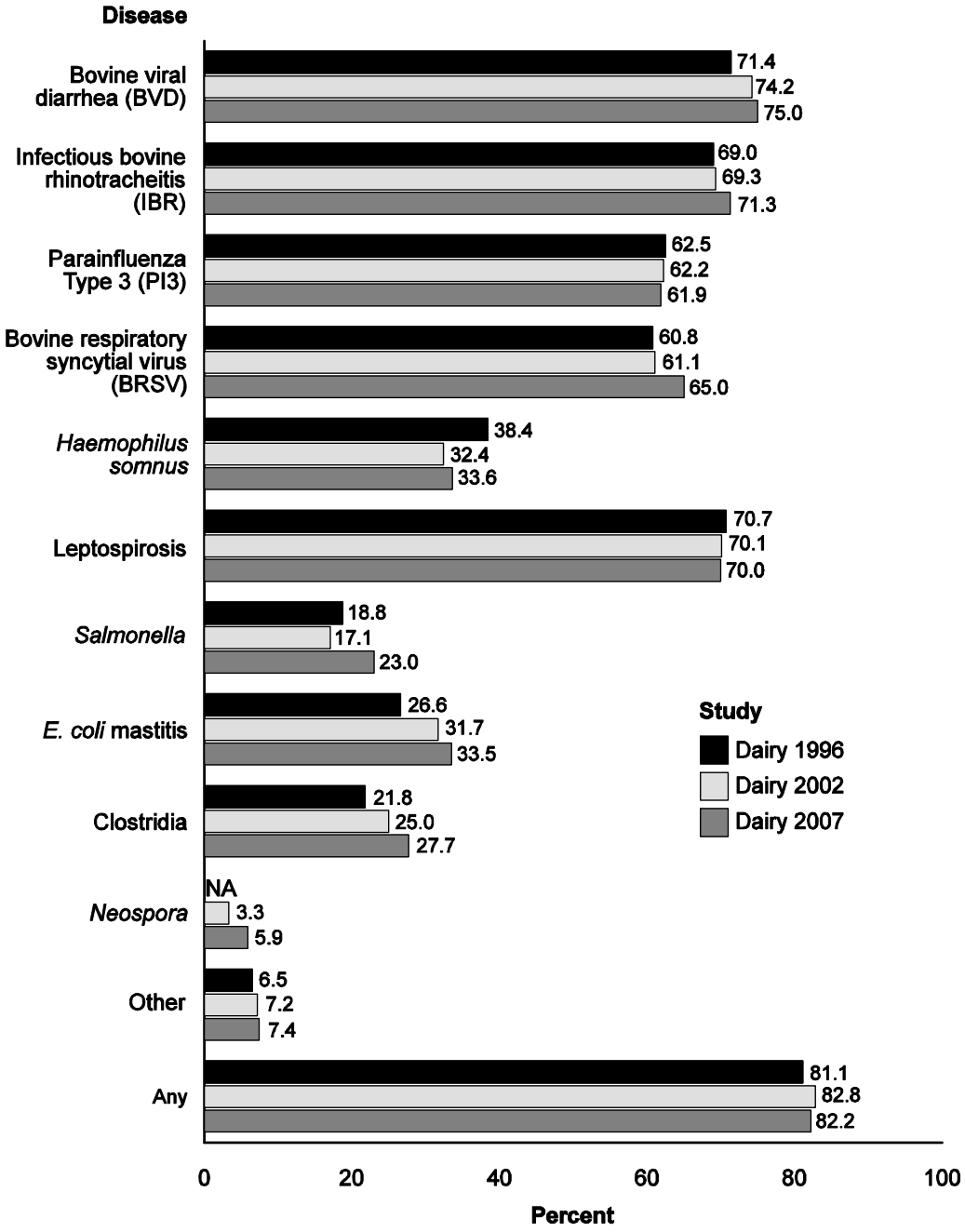
About four of five operations (82.2 percent) vaccinated cows in 2007. The use of *Salmonella*, *E. coli*, and clostridia vaccines has increased since 1996. The use of the most common vaccines (BVD, IBR, PI3, BRSV, and leptospirosis) has remained steady since 1996.

Percentage of operations* that normally vaccinated cows against the following diseases

	Percent Operations					
Disease	**Dairy 1996**	**Std. Error**	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
Bovine viral diarrhea (BVD)	71.4	(1.3)	74.2	(1.2)	75.0	(1.3)
Infectious bovine rhinotracheitis (IBR)	69.0	(1.3)	69.3	(1.3)	71.3	(1.3)
Parainfluenza Type 3 (PI3)	62.5	(1.3)	62.2	(1.3)	61.9	(1.4)
Bovine respiratory syncytial virus (BRSV)	60.8	(1.3)	61.1	(1.3)	65.0	(1.4)
Haemophilus somnus	38.4	(1.3)	32.4	(1.2)	33.6	(1.3)
Leptospirosis	70.7	(1.3)	70.1	(1.3)	70.0	(1.3)
Salmonella	18.8	(1.0)	17.1	(1.0)	23.0	(1.1)
E. coli mastitis	26.6	(1.1)	31.7	(1.2)	33.5	(1.2)
Clostridia	21.8	(1.0)	25.0	(1.1)	27.7	(1.2)
Neospora	NA		3.3	(0.4)	5.9	(0.6)
Other	6.5	(0.6)	7.2	(0.6)	7.4	(0.7)
Any	81.1	(1.1)	82.8	(1.1)	82.2	(1.1)

*Operations with any dairy cows.

Percentage of Operations* that Normally Vaccinated Cows Against the Following Diseases



*Operations with any dairy cows.

3. BVD vaccinations

In 1996, the majority of operations that administered BVD vaccines to heifers gave killed vaccines (58.4 percent of operations). In 2007, the majority gave modified live vaccines (62.2 percent of operations).

a. For operations that gave BVD vaccinations to heifers, percentage of operations* by type of BVD vaccine given

	Percent Operations					
Type of BVD Vaccine	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Killed	58.4	(1.5)	50.6	(1.6)	43.1	(1.6)
Modified live	40.7	(1.5)	49.2	(1.6)	62.2	(1.5)

*Operations with any dairy cows.

Although the majority of operations administered killed BVD vaccines to cows in 1996, 2002, and 2007, the percentage of operations that used modified live vaccines increased from 29.3 percent in 1996 to 48.9 percent in 2007. The use of killed BVD vaccines decreased slightly during the same period.

b. For operations that gave BVD vaccinations to cows, percentage of operations* by type of BVD vaccine given

	Percent Operations					
Type of BVD Vaccine	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Killed	65.4	(1.4)	61.9	(1.5)	56.3	(1.6)
Modified live	29.3	(1.3)	36.7	(1.5)	48.9	(1.6)

*Operations with any dairy cows.

A higher percentage of operations used a combination of Type I and Type II BVD vaccines in 2007 compared with 2002 (60.8 and 39.4 percent, respectively). Producers are becoming more aware of the type of BVD vaccine they use, as the percentage of operations that did not know which vaccine was used decreased from 47.6 percent in 2002 to 27.2 percent in 2007. Interestingly, a Type II only vaccine is not currently available, suggesting that these producers did not know which strain they were administering, or gave a combination and were primarily concerned with the Type II strain.

c. For operations that gave any BVD vaccinations, percentage of operations* by strain of BVD contained in vaccine administered

	Percent Operations			
BVD Strain	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
Type I only	5.4	(0.6)	4.3	(0.6)
Type II only	7.6	(0.9)	7.7	(0.8)
Combination (Type I and Type II)	39.4	(1.4)	60.8	(1.5)
Did not know	47.6	(1.5)	27.2	(1.4)
Total	100.0		100.0	

*Operations with any dairy cows.

The percentage of operations that gave annual BVD booster injections was similar in 1996, 2002, and 2007, with about 80 percent of operations giving booster injections.

d. For operations that gave BVD vaccinations to cows, percentage of operations* that gave annual BVD booster injections

Percent Operations					
Dairy 1996	**Std. Error**	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
77.4	(1.3)	82.9	(1.2)	80.2	(1.3)

*Operations with any dairy cows.

4. BVD testing

Animals persistently infected with BVD virus (BVDV) become infected while in utero and shed large quantities of BVDV following birth. This shedding can infect susceptible animals and create the next generation of persistently infected animals. The most efficient method of determining if the dam and her calf are persistently infected with BVDV is to test the calf. Since a persistently infected cow will always produce a persistently infected calf, the dam is negative if the calf tests negative. In 2007, few operations (4.0 percent) routinely tested dairy heifer replacements for persistent infection with BVDV. The percentage of operations that did test increased as herd size increased.

a. Percentage of operations* that routinely tested heifer replacements to determine if animals were persistently infected with BVDV, by herd size

Percent Operations							
Herd Size (Number of Cows)							
Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Pct.	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
1.9	(0.5)	6.7	(1.1)	21.2	(2.4)	4.0	(0.4)

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

Of operations that tested dairy heifer replacements for persistent infection with BVDV, the majority (66.8 percent) used individual ear-notch tests, while 21.1 percent tested individual serum samples.

b. For operations that routinely tested heifer replacements to determine if animals were persistently infected with BVDV, percentage of operations* by testing method used

Testing Method	Percent Operations	Standard Error
Individual ear notch	66.8	(5.7)
Pooled ear notch	11.4	(4.0)
Individual serum sample	21.1	(5.4)
Pooled serum sample	6.0	(3.0)
Other	6.5	(2.4)

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

Photo courtesy of Dr. Jason Lombard

5. Mastitis vaccinations

Although the efficacy of certain mastitis vaccines has been questioned, coliform vaccines have generally provided good protection. Coliform vaccines were used on at least some cows on 37.6 percent of operations in 2007, compared with vaccines for *Salmonella* (13.4 percent), siderophore receptors and porins (4.1 percent), *Mycoplasma* (1.8 percent), and *Staphylococcus aureus* (7.3 percent). *Salmonella* vaccine might also help prevent coliform mastitis.

a. Percentage of operations by type of vaccine used and by proportion of cows vaccinated

	Percent Operations						
	Proportion of Cows						
	All		Some		None		
Vaccine Type	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Total
Coliform mastitis	32.6	(2.4)	5.0	(1.1)	62.4	(2.6)	100.0
Salmonella	11.1	(1.5)	2.3	(0.7)	86.6	(1.6)	100.0
Siderophore receptors and porins (SRPs) vaccine	3.3	(0.7)	0.8	(0.4)	95.9	(0.8)	100.0
Mycoplasma	1.4	(0.5)	0.4	(0.2)	98.2	(0.6)	100.0
Staphylococcus aureus	5.7	(1.1)	1.6	(0.6)	92.7	(1.2)	100.0

Source: NAHMS Dairy 2007.

Regional differences in vaccine use were observed for coliform mastitis and *Salmonella* vaccines. More operations in the West region vaccinated their cows against coliforms and *Salmonella* in 2007 than operations in the East region.

b. Percentage of operations that vaccinated at least some cows, by vaccine type and by region

	Percent Operations			
	Region			
	West		East	
Vaccine Type	Percent	Std. Error	Percent	Std. Error
Coliform mastitis	65.1	(4.7)	35.0	(2.8)
Salmonella	36.4	(4.8)	11.1	(1.7)
Siderophore receptors and porins (SRPs) vaccine	9.2	(2.9)	3.6	(0.8)
Mycoplasma	4.1	(2.5)	1.6	(0.6)
Staphylococcus aureus	13.2	(3.5)	6.7	(1.3)

Source: NAHMS Dairy 2007.

There were no changes from 2002 to 2007 in the percentages of operations that administered coliform mastitis and *Salmonella* vaccines. As reported in 2002 and 2007, about 4 of 10 operations vaccinated for coliform mastitis and about 1 of 10 vaccinated for *Salmonella*.

c. Percentage of operations by type of vaccination used

	Percent Operations			
Vaccine Type	Dairy 2002*	Std. Error	Dairy 2007	Std. Error
Coliform mastitis	35.8	(2.0)	37.6	(2.6)
Salmonella	10.4	(1.3)	13.4	(1.6)

*Question variation: majority of cows.

6. Preventive practices

Preventive practices such as deworming and the use of coccidiostats, vitamin and mineral supplements, and ionophores can help ensure that cattle are not parasitized and can more efficiently utilize nutrients. In addition, these practices can help cattle withstand the stresses associated with transport and arrival at a new facility.

The use of specific preventive practices for heifers has remained stable or increased since 1991; over 90 percent of all operations used at least one preventive practice on heifers in all four studies. In 2007, the most commonly used preventive practices were the use of vitamin A-D-E supplements in feed (74.4 percent of operations), selenium supplementation in feed (69.3 percent of operations), and dewormers (69.4 percent of operations). The largest increases in the use of preventive practices since 1991 were observed for coccidiostats in feed, vitamins A-D-E in feed, and selenium in feed.

a. Percentage of operations* by preventive practices normally used for heifers

	Percent Operations							
Preventive Practice	NDHEP 1991	Std. Error	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Dewormers	62.2	(2.2)	67.3	(1.3)	69.0	(1.2)	69.4	(1.3)
Coccidiostats in feed	37.8	(2.0)	46.5	(1.2)	44.4	(1.3)	46.5	(1.4)
Vitamins A-D-E injection	11.8	(1.3)	16.3	(1.0)	15.3	(1.0)	10.4	(0.7)
Vitamins A-D-E in feed	57.4	(2.2)	76.9	(1.1)	72.7	(1.2)	74.4	(1.2)
Selenium injection	16.2	(1.8)	12.7	(0.8)	13.3	(0.9)	13.2	(0.9)
Selenium in feed	50.3	(2.2)	70.8	(1.2)	67.6	(1.3)	69.3	(1.3)
Ionophores in feed (e.g., Rumensin®, Bovatec®)	40.0	(2.2)	42.2	(1.2)	44.2	(1.3)	45.2	(1.4)
Probiotics	NA		13.1	(0.9)	14.2	(0.9)	20.0	(1.1)
Anionic salts in feed	NA		NA		20.6	(1.1)	20.9	(1.1)
Other	NA		4.8	(0.6)	3.8	(0.5)	4.6	(0.7)
Any	91.7	(1.1)	93.6	(0.7)	94.9	(0.6)	94.6	(0.7)

*Operations with any dairy cows.

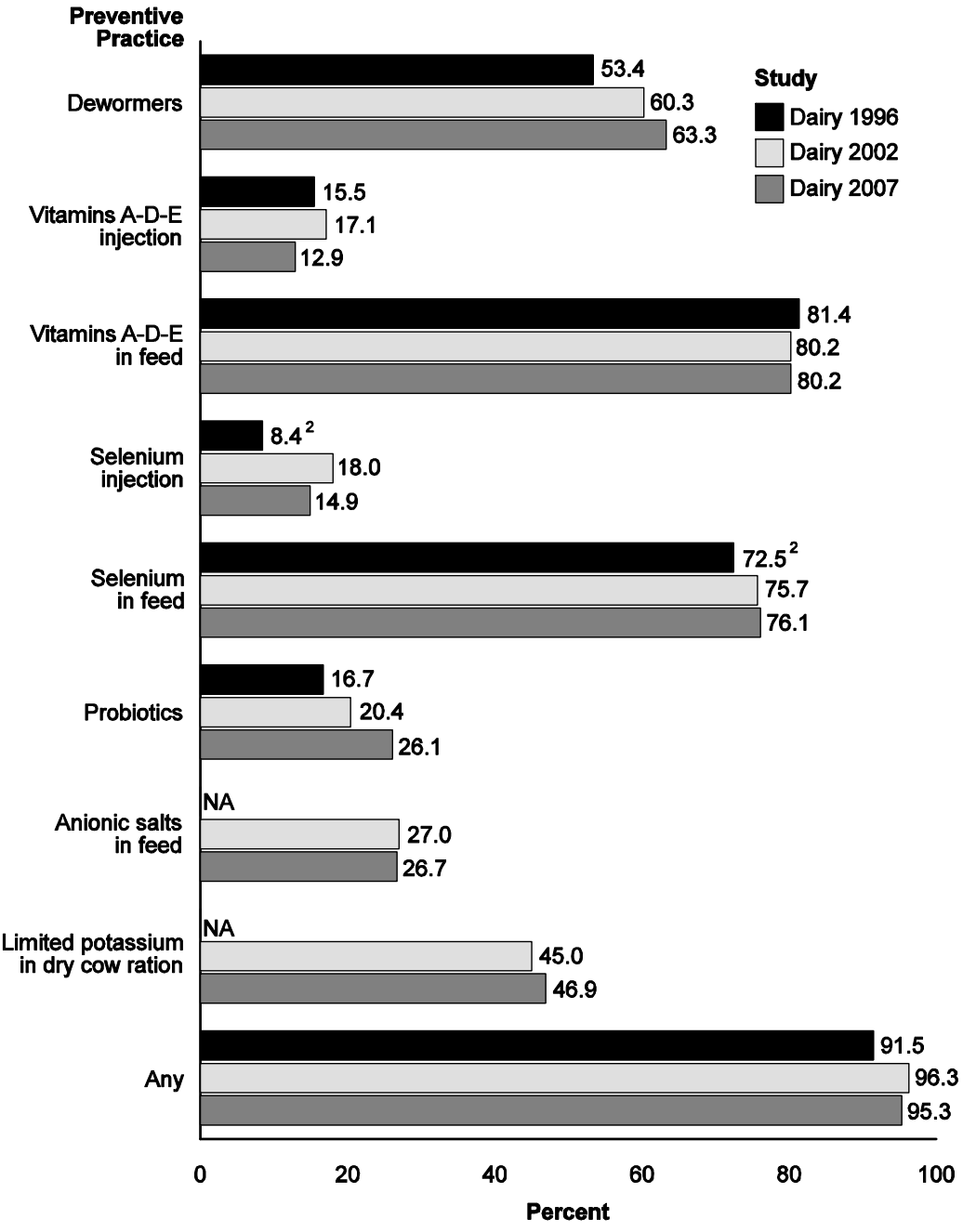
Nearly all operations (95.3 percent) used some preventive practice on their cows in 2007. The most frequent practices used included supplementing feed with vitamins A-D-E or selenium and dewormers. Since 1996, the use of dewormers, selenium injections, and probiotics has increased.

b. Percentage of operations[1] by preventive practices normally used for cows

	Percent Operations					
Preventive Practice	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Dewormers	53.4	(1.3)	60.3	(1.3)	63.3	(1.4)
Vitamins A-D-E injection	15.5	(0.9)	17.1	(1.0)	12.9	(0.8)
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)
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)
Anionic salts in feed	NA		27.0	(1.2)	26.7	(1.2)
Limited potassium in dry cow ration	NA		45.0	(1.3)	46.9	(1.4)
Ionophores in feed	NA		NA		26.8	(1.1)
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)

[1] Operations with any dairy cows.
[2] Lactating cows only.

Percentage of Operations[1] by Preventive Practices Normally Used for Cows



[1]Operations with any dairy cows.

[2]Lactating cows only.

E. Incidence of Disease or Illness

1. Cow morbidity

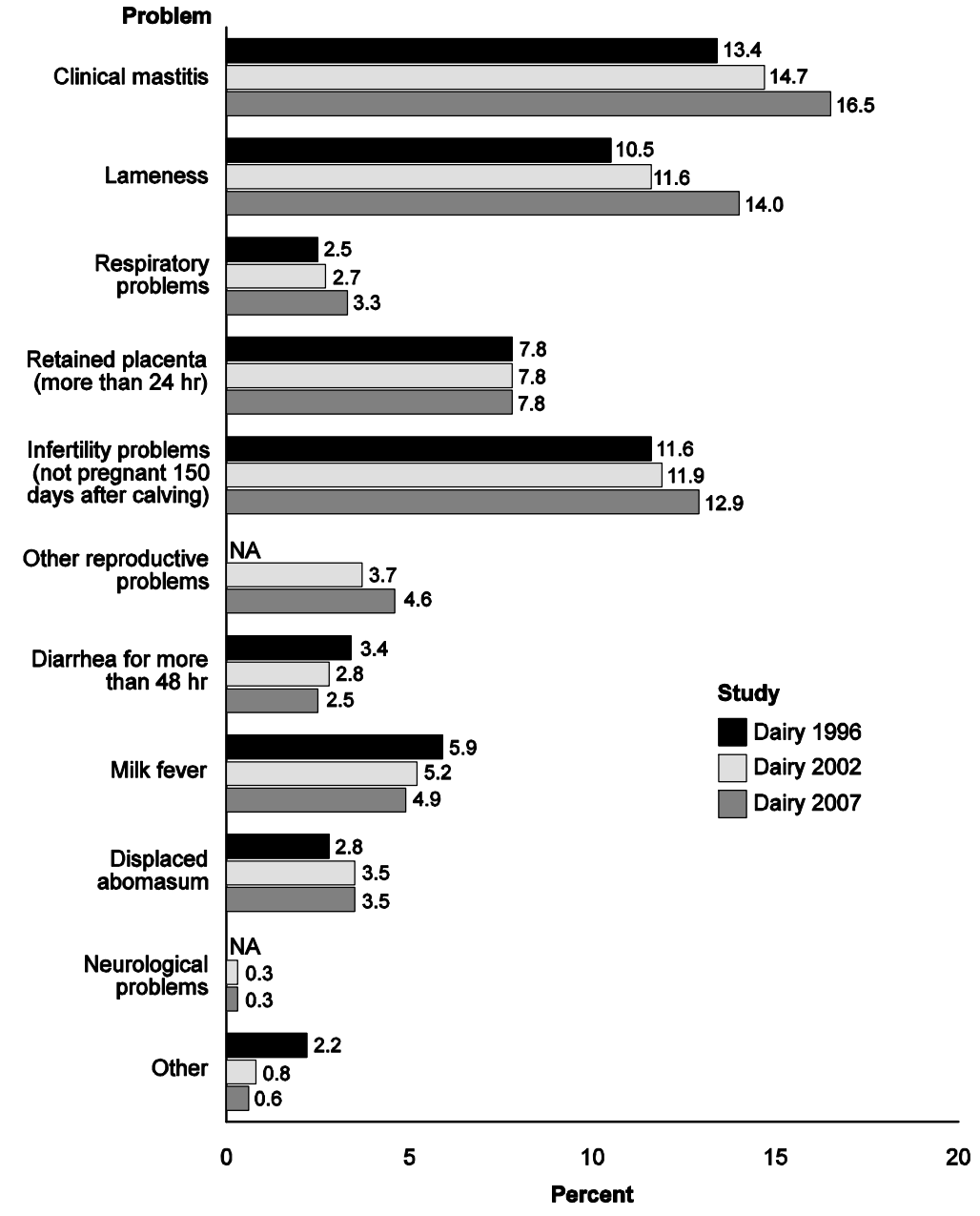
The percentage of cows with clinical mastitis, lameness, respiratory problems, infertility problems, or displaced abomasum increased from 1996 to 2007. The percentage of cows with diarrhea for more than 48 hours or milk fever decreased from 1996 to 2007. The three most common conditions identified by producers in 2007 were clinical mastitis, lameness, and infertility problems (16.5, 14.0, and 12.9 percent of cows, respectively).

Percentage of cows by health problem

	Percent Cows*					
Problem	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Clinical mastitis	13.4	(0.3)	14.7	(0.3)	16.5	(0.5)
Lameness	10.5	(0.3)	11.6	(0.3)	14.0	(0.4)
Respiratory problems	2.5	(0.1)	2.7	(0.1)	3.3	(0.1)
Retained placenta (more than 24 hours)	7.8	(0.2)	7.8	(0.2)	7.8	(0.2)
Infertility problems (not pregnant 150 days after calving)	11.6	(0.3)	11.9	(0.3)	12.9	(0.3)
Other reproductive problems (e.g., dystocia, metritis)	NA		3.7	(0.2)	4.6	(0.3)
Diarrhea for more than 48 hours	3.4	(0.2)	2.8	(0.2)	2.5	(0.2)
Milk fever	5.9	(0.1)	5.2	(0.1)	4.9	(0.1)
Displaced abomasum	2.8	(0.1)	3.5	(0.1)	3.5	(0.1)
Neurological problems	NA		0.3	(0.0)	0.3	(0.0)
Other health-related problems	2.2	(0.2)	0.8	(0.1)	0.6	(0.1)

*As a percentage of January 1 respective-year cow inventory on operations with any dairy cows.

Percentage of Cows* by Health Problem



*As a percentage of January 1 respective-year cow inventory on operations with any dairy cows.

2. Disease confirmation

The timely recognition of signs of illness among cattle and the timely diagnosis and treatment of disease are significant in limiting the spread of disease. Decreased milk production, cows with fever, deaths, and/or abortions could indicate that a new disease has been introduced into the herd. On average in 2007, an operation would have to have a 20.6 percent decrease in milk production before a veterinarian would be contacted for assistance or consultation. Large operations had a lower threshold (12.9 percent reduction) compared with small operations (22.3 percent reduction). Operations reported that a veterinarian would be contacted if 9.6 percent of cows exhibited a fever, 5.8 percent of cows died within a short period, or 6.8 percent of cows aborted.

a. Operation average percentage change at which a veterinarian would be contacted for assistance, by potential problem sign and by herd size

	Operation Average Percent Change **Herd Size** (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Potential Problem Sign	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
Decline in total daily milk production	22.3	(1.2)	18.0	(1.1)	12.9	(1.2)	20.6	(0.9)
Milk cows exhibiting fever within a short time period	10.7	(1.2)	7.3	(0.9)	6.0	(1.8)	9.6	(0.9)
Milk cows dying within a short time period	6.8	(1.1)	3.2	(0.7)	4.2	(1.9)	5.8	(0.8)
Milk cows aborting within a short time period	8.1	(1.1)	3.9	(0.7)	4.6	(1.8)	6.8	(0.8)

Source: NAHMS Dairy 2007.

Operations in the West region would seek veterinary assistance if daily milk production declined by 14.1 percent, while operations in the East region would do so at a 21.3 percent decline. For the other three potential problem signs, there were no regional differences in the average percentage change at which operations would seek assistance from a veterinarian.

b. Operation average percentage change at which a veterinarian would be contacted for assistance, by potential problem sign and by region

	Operation Average Percent Change			
	Region			
	West		East	
Potential Problem Sign	Average	Std. Error	Average	Std. Error
Decline in total daily milk production	14.1	(1.1)	21.3	(1.0)
Milk cows exhibiting fever within a short time period	5.7	(1.3)	10.0	(0.9)
Milk cows dying within a short time period	3.8	(1.3)	5.9	(0.9)
Milk cows aborting within a short time period	4.5	(1.3)	7.0	(0.9)

Source: NAHMS Dairy 2007.

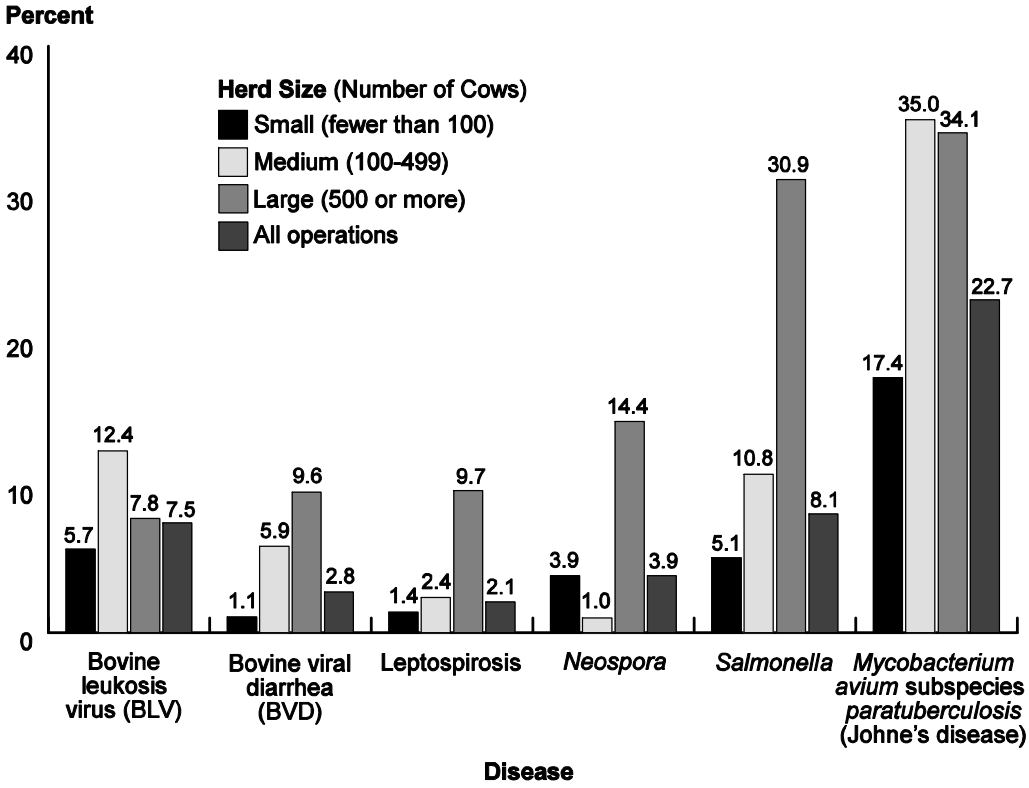
Laboratory testing is essential in determining the cause of many diseases and allows for the implementation of appropriate preventive or control measures. More than one of five operations in 2007 (22.7 percent) reported that Johne's disease was confirmed via laboratory testing. A lower percentage of small operations (17.4 percent) received a laboratory diagnosis for Johne's disease compared with medium and large operations (35.0 and 34.1 percent, respectively). Less than 10 percent of all operations reported a laboratory confirmation for the other listed diseases. *Salmonella* was more frequently diagnosed via laboratory testing on large operations than on medium and small operations.

c. Percentage of operations in which the following diseases in cattle on the operation were confirmed via laboratory testing during the previous 12 months, by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Disease	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Bovine leukosis virus (BLV)	5.7	(1.9)	12.4	(2.9)	7.8	(2.9)	7.5	(1.5)
Bovine viral diarrhea (BVD)	1.1	(0.7)	5.9	(2.0)	9.6	(3.3)	2.8	(0.7)
Leptospirosis	1.4	(0.8)	2.4	(1.1)	9.7	(3.8)	2.1	(0.7)
Neospora	3.9	(1.6)	1.0	(0.6)	14.4	(4.4)	3.9	(1.1)
Salmonella	5.1	(1.8)	10.8	(2.3)	30.9	(5.9)	8.1	(1.4)
Mycobacterium avium subspecies *paratuberculosis* (Johne's disease)	17.4	(3.0)	35.0	(3.9)	34.1	(4.8)	22.7	(2.3)

Source: NAHMS Dairy 2007.

Percentage of Operations in which the Following Diseases in Cattle on the Operation were Confirmed via Laboratory Testing, by Herd Size



During the previous 12 months, there were no differences by region in the percentages of operations reporting laboratory confirmation for the listed diseases.

d. Percentage of operations in which the following diseases in cattle on the operation were confirmed via laboratory testing during the previous 12 months, by region

	Percent Operations			
	Region			
	West		East	
Disease	**Percent**	**Std. Error**	**Percent**	**Std. Error**
Bovine leukosis virus (BLV)	4.3	(2.0)	7.8	(1.7)
Bovine viral diarrhea (BVD)	5.3	(2.3)	2.5	(0.7)
Leptospirosis	5.2	(2.4)	1.9	(0.7)
Neospora	10.8	(3.5)	3.2	(1.2)
Salmonella	17.2	(4.2)	7.3	(1.5)
Mycobacterium avium subspecies *paratuberculosis* (Johne's disease)	12.8	(3.2)	23.6	(2.5)

Source: NAHMS Dairy 2007.

Bovine leukosis virus (BLV) was most frequently diagnosed via blood samples (88.5 percent of operations) in 2007. Blood, ear notches, tissues at necropsy, and aborted fetuses were the most frequently used samples for diagnosing BVD. Leptospirosis and Johne's disease were most frequently diagnosed via blood samples (69.6 and 70.3 percent of operations, respectively). *Neospora* was confirmed using aborted fetuses, blood, and tissues at necropsy. *Salmonella* was most frequently confirmed using fecal samples (49.3 percent of operations).

e. For operations in which disease was confirmed via laboratory testing, percentage of operations by diagnostic samples used to confirm disease, and by confirmed disease

	Percent Operations											
	Confirmed Disease											
	Bovine Leukosis Virus (BLV)		Bovine Viral Diarrhea (BVD)		Lepto-spirosis		*Neospora*		*Salmonella*		Johne's Disease	
Diagnostic Sample	Pct.	Std. Err.	Pct.	Std. Err.	Pct.	Std. Err.	Pct.	Std. Err.	Pct.	Std. Err.	Pct.	Std. Err.
Aborted fetus	NA		13.9	(6.7)	22.8	(11.2)	59.0	(14.2)	7.9	(4.9)	NA	
Blood	88.5	(4.8)	47.5	(12.9)	69.6	(12.5)	40.6	(14.2)	16.9	(5.5)	70.3	(5.3)
Ear notch	NA		41.3	(12.5)	NA		NA		NA		NA	
Feces	NA		7.5	(4.4)	NA		NA		49.3	(9.1)	36.4	(5.5)
Milk	NA		0.6	(0.4)	NA		NA		20.0	(9.9)	12.4	(3.5)
Tissues at necropsy	6.3	(3.5)	15.7	(7.9)	10.3	(7.4)	18.5	(10.1)	15.4	(4.7)	0.1	(0.1)
Urine	NA		NA		8.8	(5.4)	NA		NA		NA	
Other	15.5	(6.3)	3.0	(2.9)	0.0	(--)	9.0	(8.5)	5.0	(4.2)	1.7	(1.6)

Source: NAHMS Dairy 2007.

3. Milk cultures

Milk cultures can identify the most prevalent cause of clinical mastitis, help direct mastitis therapy, and screen purchased animals or milking strings for contagious mastitis pathogens.

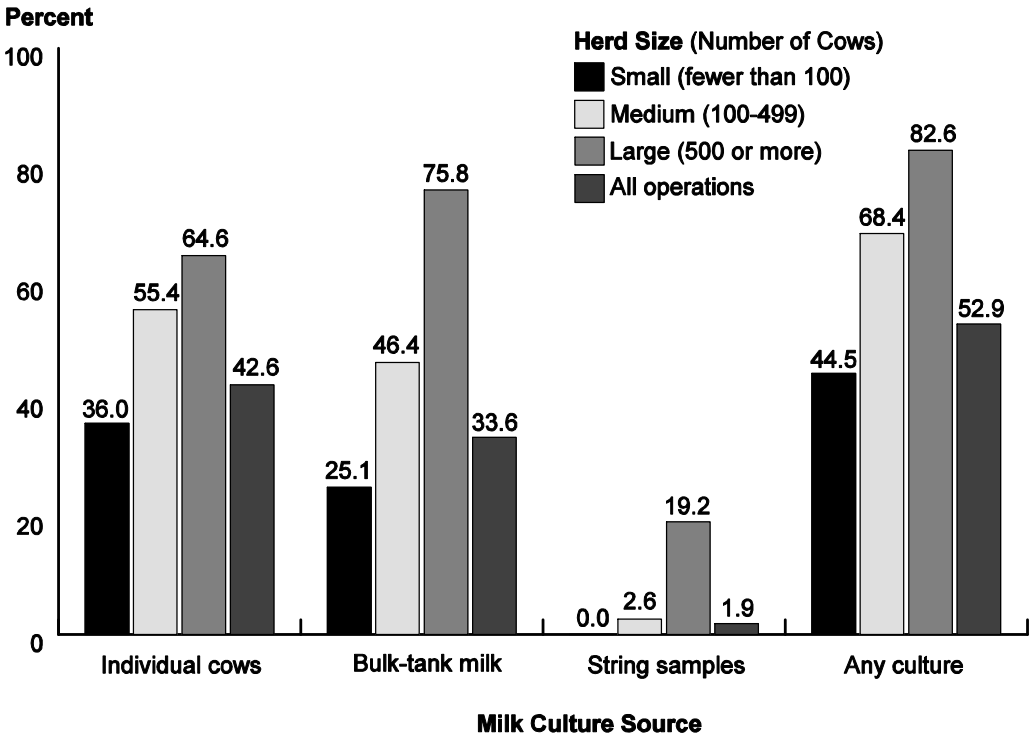
A lower percentage of small operations performed individual cow, bulk-tank milk, string sample, or any cultures compared with medium and large operations. A higher percentage of large operations performed bulk-tank milk or string-sample cultures compared with medium and small operations. More than one-half of operations (52.9 percent) had performed milk cultures during the previous 12 months. More than 8 of 10 large operations (82.6 percent) had performed any culture, compared with about 7 of 10 medium operations (68.4 percent) and 4 of 10 small operations (44.5 percent).

a. Percentage of operations by source of milk cultures performed during the previous 12 months, and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Milk Culture Source	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Individual cows	36.0	(3.6)	55.4	(4.2)	64.6	(5.3)	42.6	(2.7)
Bulk-tank milk	25.1	(3.3)	46.4	(4.1)	75.8	(5.1)	33.6	(2.5)
String samples	0.0	(--)	2.6	(0.8)	19.2	(3.9)	1.9	(0.3)
Any culture	44.5	(3.8)	68.4	(3.9)	82.6	(4.6)	52.9	(2.8)

Source: NAHMS Dairy 2007.

Percentage of Operations by Source of Milk Cultures Performed During the Previous 12 Months, and by Herd Size



Source: NAHMS Dairy 2007.

A higher percentage of operations in the West region performed bulk-tank milk or string-sample cultures compared with operations in the East region.

b. Percentage of operations by source of milk cultures performed during the previous 12 months, and by region

	Percent Operations			
	Region			
	West		East	
Milk Culture Source	Percent	Std. Error	Percent	Std. Error
Individual cows	43.4	(5.3)	42.6	(2.9)
Bulk-tank milk	60.6	(5.1)	31.0	(2.7)
String samples	11.0	(3.0)	1.0	(0.2)
Any culture	65.1	(5.0)	51.7	(3.1)

Source: NAHMS Dairy 2007.

For operations that performed milk cultures during the previous 12 months, a higher percentage of large operations than small operations performed on-farm cultures (20.8 and 4.2 percent, respectively). A higher percentage of medium operations (45.5 percent) had cultures performed at a State or university diagnostic laboratory compared with small operations (24.1 percent). There were no herd-size differences in the percentage of operations that used a commercial laboratory; about 4 of 10 operations (41.5 percent) used a commercial laboratory to culture milk. Almost 50 percent of operations that performed milk cultures (49.2 percent) used a private veterinary laboratory or clinic, with no differences across herd sizes.

c. For the 52.9 percent of operations that performed milk cultures during the previous 12 months, percentage of operations by facility used to perform cultures and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Facility	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
On-farm, by farm personnel	4.2	(2.0)	14.0	(3.8)	20.8	(4.8)	9.0	(1.8)
State or university diagnostic laboratory	24.1	(4.9)	45.5	(5.0)	31.2	(4.4)	31.8	(3.3)
Commercial laboratory	38.9	(5.6)	45.3	(5.0)	43.8	(6.0)	41.5	(3.6)
Private veterinary laboratory (veterinary clinic)	50.5	(5.7)	43.2	(5.1)	60.8	(6.3)	49.2	(3.7)

Source: NAHMS Dairy 2007.

The only regional difference in the percentage of operations that used a specific facility to perform milk cultures was observed for State or university diagnostic laboratory, which was used by 13.0 percent of operations in the West region compared with 34.0 percent in the East region.

d. For the 52.9 percent of operations that performed milk cultures during the previous 12 months, percentage of operations by facility used to perform cultures and by region

	Percent Operations			
	Region			
	West		East	
Facility	Percent	Std. Error	Percent	Std. Error
On-farm, by farm personnel	13.0	(4.6)	8.5	(1.9)
State or university diagnostic laboratory	13.0	(4.2)	34.0	(3.7)
Commercial laboratory	59.2	(6.4)	39.4	(4.0)
Private veterinary laboratory (veterinary clinic)	52.5	(6.6)	48.8	(4.1)

Source: NAHMS Dairy 2007.

Milk was cultured most often from cows with chronic clinical disease and from clinical cases that did not respond to treatment (59.1 and 54.0 percent of operations, respectively). A higher percentage of large operations performed cultures on milk from individual fresh cows and from all clinical cases compared with medium and small operations.

e. For the 42.6 percent of operations that performed cultures on milk from individual cows during the previous 12 months, percentage of operations by cow type and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Cow Type	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Fresh cows	8.0	(3.5)	14.9	(3.8)	47.2	(6.6)	13.9	(2.5)
All clinical cases	22.2	(5.4)	35.4	(5.5)	65.4	(6.4)	30.5	(3.7)
Chronic clinical cases	54.8	(6.4)	64.5	(5.3)	67.0	(7.6)	59.1	(4.2)
Clinical cases that did not respond to treatment	50.1	(6.5)	61.1	(5.6)	53.5	(7.9)	54.0	(4.3)
High somatic cell count cows	37.9	(5.7)	49.6	(5.8)	31.5	(6.2)	41.1	(3.9)
Other	11.0	(4.8)	7.0	(2.5)	8.6	(4.4)	9.5	(3.0)

Source: NAHMS Dairy 2007.

A higher percentage of operations in the West region performed cultures on milk from individual fresh cows and all clinical cases (49.8 and 60.7 percent, respectively) compared with operations in the East region (10.5 and 27.7 percent, respectively).

f. For the 42.6 percent of operations that performed cultures on milk from individual cows during the previous 12 months, percentage of operations by cow type and by region

	Percent Operations			
	Region			
	West		East	
Cow Type	**Percent**	**Std. Error**	**Percent**	**Std. Error**
Fresh cows	49.8	(7.9)	10.5	(2.6)
All clinical cases	60.7	(8.3)	27.7	(4.0)
Chronic clinical cases	55.4	(8.5)	59.4	(4.5)
Clinical cases that did not respond to treatment	43.9	(8.1)	54.9	(4.7)
High somatic cell count cows	46.6	(8.2)	40.6	(4.1)
Other	4.8	(2.6)	9.9	(3.2)

Source: NAHMS Dairy 2007.

Similar percentages of all operations that performed milk cultures during the previous 12 months detected *Staphylococcus aureus, E. coli/Klebsiella/*other gram-negative, or environmental strep (*Strep.* spp.). A higher percentage of large operations (21.4 percent) identified *Mycoplasma* compared with medium and small operations (3.8 and 4.0 percent, respectively). A lower percentage of small operations identified *E. coli/Klebsiella/*other gram-negative or coagulase-negative staph (*Staph.* spp. non-*aureus*) organisms compared with large operations.

g. For the 52.9 percent of operations that performed milk cultures during the previous 12 months, percentage of operations by organism identified and by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Organism	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Strep. agalactiae	29.4	(5.4)	42.2	(5.0)	35.6	(5.7)	34.4	(3.6)
Staph. aureus	50.5	(6.1)	51.4	(5.1)	64.4	(6.1)	52.3	(3.9)
Mycoplasma	4.0	(3.2)	3.8	(1.9)	21.4	(4.7)	5.7	(1.9)
E. coli/Klebsiella/ other gram-negative	41.8	(5.9)	64.3	(4.8)	78.9	(5.4)	53.3	(3.8)
Coagulase-negative staph (*Staph.* spp. non-*aureus*)	25.3	(5.5)	37.6	(4.8)	63.4	(6.0)	33.5	(3.5)
Environmental strep (*Strep.* spp. non-*agalactiae*)	52.4	(6.1)	67.0	(4.8)	78.3	(5.1)	60.1	(3.8)

Source: NAHMS Dairy 2007.

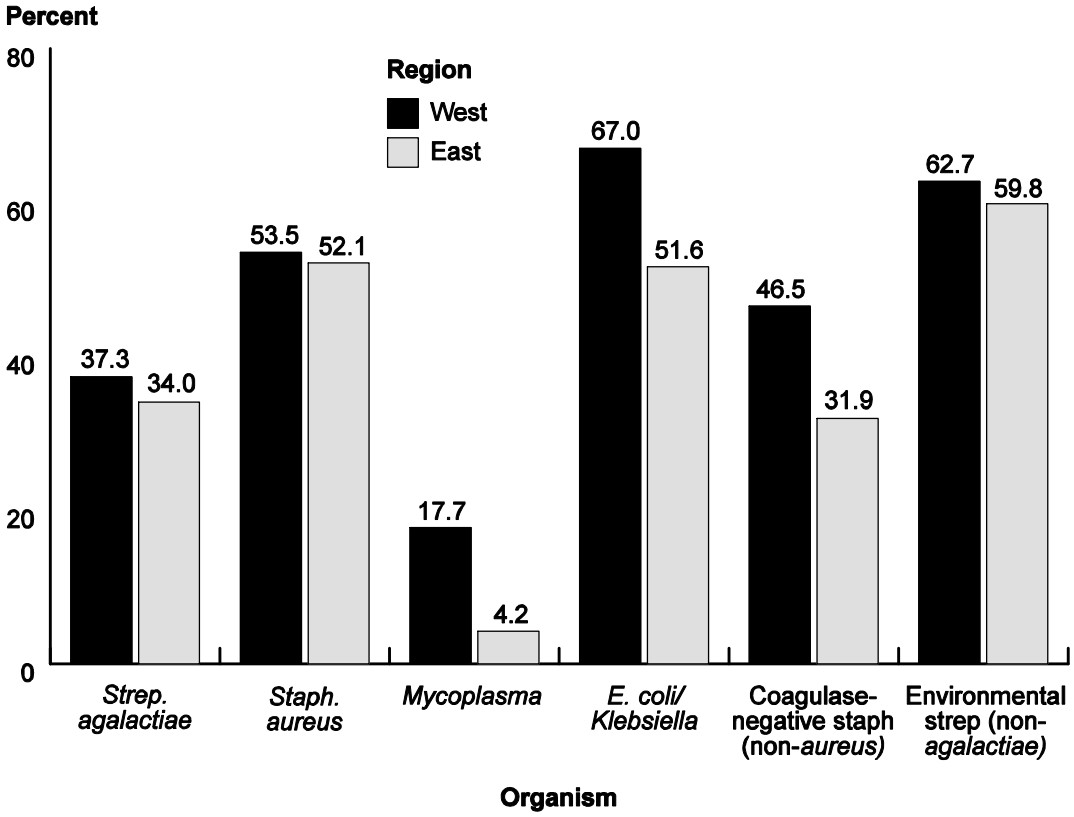
Mycoplasma was isolated from a higher percentage of operations in the West region (17.7 percent) than in the East region (4.2 percent).

h. For the 52.9 percent of operations that performed milk cultures during the previous 12 months, percentage of operations by organism identified and by region

	Percent Operations			
	Region			
	West		East	
Organism	**Percent**	**Std. Error**	**Percent**	**Std. Error**
Strep. agalactiae	37.3	(6.2)	34.0	(3.9)
Staph. aureus	53.5	(6.4)	52.1	(4.3)
Mycoplasma	17.7	(4.5)	4.2	(2.1)
*E. coli/Klebsiella/*other gram-negative	67.0	(6.3)	51.6	(4.2)
Coagulase-negative staph (*Staph.* spp. non-*aureus*)	46.5	(6.5)	31.9	(3.9)
Environmental strep (*Strep.* spp. non-*agalactiae*)	62.7	(6.5)	59.8	(4.2)

Source: NAHMS Dairy 2007.

For the 52.9 Percent of Operations that Performed Milk Cultures During the Previous 12 Months, Percentage of Operations by Organism Identified and by Region



Source: NAHMS Dairy 2007.

4. Abortions

Abortion is a term generally used to describe the expulsion of a dead fetus at 45 to 265 days of gestation (Virginia Cooperative Extension, 2009). Abortions in cattle can be due to a variety of conditions: congenital problems with the calf that cause spontaneous abortions; disease processes that cause sporadic abortions; and infectious diseases such as *Campylobacter* or brucellosis, which can cause economically damaging abortion "storms." Determining the cause of abortions can help diagnose health problems in the herd, lead to the reduction or prevention of additional abortions, and result in the birth of more healthy calves.

The percentage of operations in which at least one abortion occurred increased from 1996 to 2007.

a. Percentage of operations that had at least one cow or heifer abort

Percent Operations					
Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
66.3	(1.2)	72.9	(1.3)	86.6	(2.2)

Optimally, no more than 2 percent of cows and heifers should abort each year, although up to 5 percent is considered acceptable. The abortion percentage for cows and heifers combined increased from 3.5 percent in 1996 to 4.5 percent in 2007.

b. Percentage of heifers and cows* that aborted, by herd size

	Percent Heifers/Cows							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Study Year	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
1996	3.2	(0.1)	3.3	(0.1)	4.3	(0.3)	3.5	(0.1)
2002	3.6	(0.1)	3.4	(0.1)	4.9	(0.3)	4.0	(0.1)
2007	3.7	(0.1)	3.7	(0.1)	5.3	(0.3)	4.5	(0.2)

*As a percentage of cow inventory on January 1 of each respective year on operations with any dairy cows.

The percentages of operations by abortion percentages were similar across study years.

c. Percentage of operations[1] by abortion percentage

	Percent Operations					
Percent Abortions[2]	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Less than 2.0	42.7	(1.3)	39.3	(1.3)	38.2	(1.4)
2.0 to 4.9	36.2	(1.2)	34.6	(1.2)	34.3	(1.3)
5.0 to 9.9	16.2	(0.9)	20.3	(1.1)	20.6	(1.1)
10.0 to 14.9	3.2	(0.5)	4.7	(0.7)	4.9	(0.6)
15.0 or more	1.7	(0.4)	1.1	(0.3)	2.0	(0.4)
Total	100.0		100.0		100.0	

[1]Operations with any dairy cows
[2]As a percentage of cow inventory at time of interview.

Determining the cause of abortion can be difficult. In many cases, the event that caused the fetus to die occurred days to weeks before the actual abortion. Frequently, the cause of an abortion is not detectable, or the fetus is too decomposed to evaluate or is never found at all. A diagnosis is determined in 50 percent or less of abortion samples submitted to diagnostic laboratories. To improve the chances of diagnosing the cause of an abortion, a detailed history and the proper diagnostic specimens should be submitted to the laboratory. Specific samples recommended for submission include sera from the dam, the entire fetus, or specific tissues and placenta.

About one of eight operations (12.4 percent) submitted samples to determine the cause of abortion in 2007.

d. For the 86.6 percent of operations that had any cows or heifers abort, percentage of operations that submitted any samples for diagnosis

Percent Operations	Standard Error
12.4	(1.7)

Source: NAHMS Dairy 2007.

For operations that submitted samples, 70.2 percent submitted serum from the dam and 32.7 percent submitted the placenta.

e. For operations that submitted samples to determine cause of abortion, percentage of operations by type of sample submitted

Sample Type	Percent Operations	Standard Error
Placenta	32.7	(6.9)
Entire fetus	53.8	(7.6)
Serum of dam	70.2	(6.6)
Other	4.0	(3.2)

Source: NAHMS Dairy 2007.

The majority of operations that reported any abortions but did not submit samples for diagnosis (69.6 percent) did not perceive abortion as a problem on their operation.

f. For any aborted fetuses that were not submitted for diagnosis, percentage of operations by reason for not submitting fetus

Reason	Percent Operations	Standard Error
Cost	2.5	(1.0)
Lack of information obtained from previous abortion submissions	6.6	(1.3)
Inconvenience	7.0	(1.7)
Abortion not perceived as a problem on the operation	69.6	(2.7)
Other	14.3	(2.0)
Total	100.0	

Source: NAHMS Dairy 2007.

Although only 12.4 percent of operations that reported any abortions submitted samples for diagnosis, more than 8 of 10 operations (82.0 percent) would submit aborted fetuses for diagnosis if testing was performed at no cost, and 48.5 percent of aborted fetuses would be submitted for diagnosis.

g. Percentage of operations that would submit aborted fetuses to a veterinary diagnostic laboratory if testing was performed at no cost, and percentage of aborted fetuses that would be submitted

Percent Operations	Standard Error	Operation Average Percent Aborted Fetuses	Standard Error
82.0	(2.3)	48.5	(4.9)

Source: NAHMS Dairy 2007.

Photo courtesy of Keith Weller, ARS.

F. Mortality, Necropsy, and Carcass Disposal

1. Mortality

A lower percentage of small operations had any deaths in each of the cattle classes compared with medium and larger operations. All large herds had at least one death in each cattle class, which was expected since these operations have more animals at risk.

a. Percentage of operations that had at least one death* in the following cattle classes, by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Cattle Class	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Preweaned heifers	59.8	(1.8)	100.0	(0.0)	100.0	(0.0)	69.9	(1.4)
Weaned heifers	29.9	(1.6)	73.1	(2.3)	100.0	(0.0)	41.6	(1.3)
Cows	76.5	(1.5)	99.1	(0.4)	100.0	(0.0)	82.6	(1.1)

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

The percentages of preweaned and weaned heifer calves that died decreased from 1996 to 2007. The percentage of preweaned heifer calves that died decreased from 10.8 percent in 1996 to 7.8 percent in 2007. Weaned heifer calf deaths increased from 2.2 percent in 1991 to 2.8 percent in 2002 and then decreased to 1.8 percent in 2007.

b. Number of preweaned and weaned heifer deaths*, as a percentage of heifers born alive…

	…or moved onto the operation NDHEP 1991		Dairy 1996		Dairy 2002		Dairy 2007	
Heifer Class	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Preweaned	8.4	(0.4)	10.8	(0.4)	10.5	(0.3)	7.8	(0.2)
Weaned	2.2	(0.1)	2.4	(0.1)	2.8	(0.1)	1.8	(0.1)

*Operations with any dairy cows.

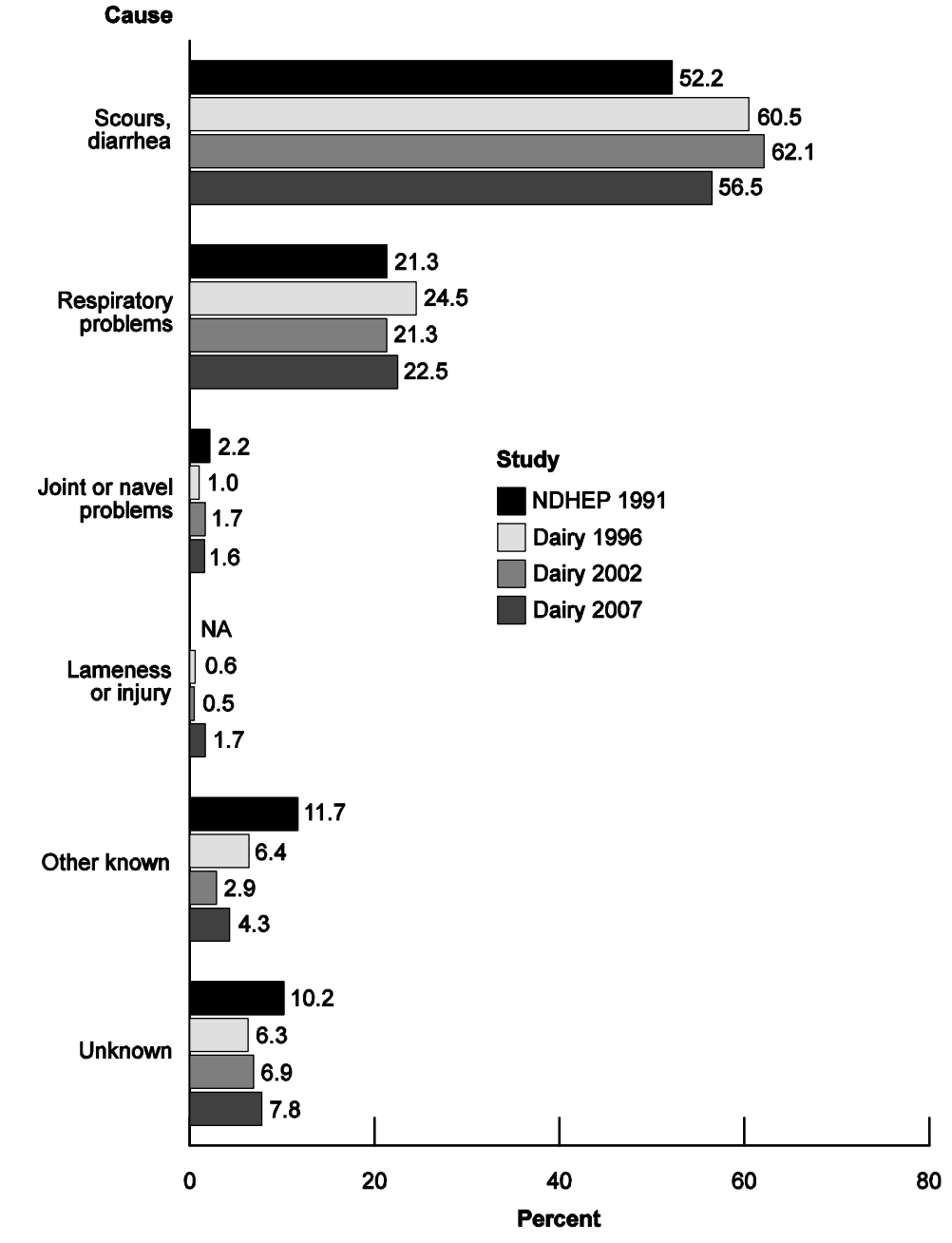
Scours/diarrhea accounted for more than 50 percent of preweaned heifer deaths in each study year since 1991, while respiratory problems accounted for 21 to 25 percent of deaths during the same period.

c. Percentage of preweaned heifer deaths*, by cause

	Percent Deaths							
Cause	NDHEP 1991	Std. Error	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Scours/ diarrhea	52.2	(2.6)	60.5	(1.2)	62.1	(1.1)	56.5	(1.3)
Respiratory problems	21.3	(1.6)	24.5	(1.0)	21.3	(0.9)	22.5	(0.9)
Joint or navel problems	2.2	(0.7)	1.0	(0.1)	1.7	(0.2)	1.6	(0.3)
Lameness or injury	NA		0.6	(0.1)	0.5	(0.1)	1.7	(0.3)
Lack of coordination/ severe depression	NA		0.4	(0.1)	0.4	(0.1)	0.3	(0.1)
Poison	NA		0.3	(0.1)	0.1	(0.0)	0.0	(0.0)
Calving problems	NA		NA		4.1	(0.6)	5.3	(0.7)
Trauma	2.4	(0.8)	NA		NA		NA	
Other known	11.7	(1.8)	6.4	(1.1)	2.9	(0.4)	4.3	(0.7)
Unknown	10.2	(1.4)	6.3	(0.9)	6.9	(0.8)	7.8	(0.9)
Total	100.0		100.0		100.0		100.0	

*Operations with any dairy cows

Percentage of Preweaned Heifer Deaths*, by Cause



*Operations with any dairy cows.

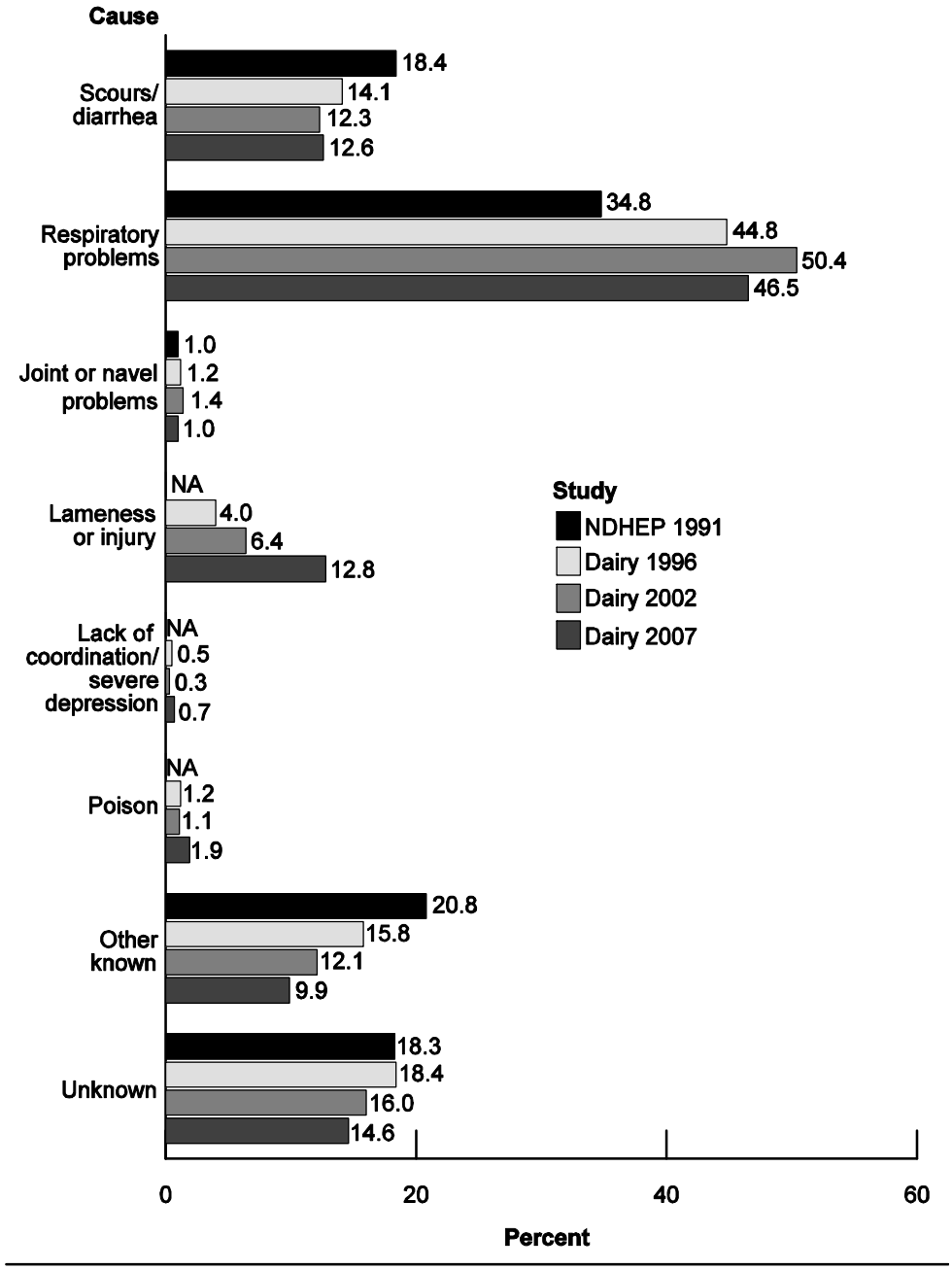
The percentage of weaned heifer deaths caused by respiratory problems increased from 34.8 percent of deaths in 1991 to 46.5 percent in 2007. Weaned heifer deaths caused by lameness or injury increased from 4.0 percent of deaths in 1996 to 12.8 percent in 2007.

d. Percentage of weaned heifer deaths*, by cause

	Percent Deaths							
Cause	NDHEP 1991	Std. Error	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Scours/ diarrhea	18.4	(2.6)	14.1	(1.6)	12.3	(1.0)	12.6	(1.0)
Respiratory problems	34.8	(3.5)	44.8	(2.1)	50.4	(1.6)	46.5	(1.7)
Joint or navel problems	1.0	(0.4)	1.2	(0.5)	1.4	(0.3)	1.0	(0.3)
Lameness or injury	NA		4.0	(0.5)	6.4	(0.6)	12.8	(1.0)
Lack of coordination/ severe depression	NA		0.5	(0.1)	0.3	(0.1)	0.7	(0.2)
Poison	NA		1.2	(0.3)	1.1	(0.4)	1.9	(0.9)
Trauma	6.7	(0.9)	NA		NA		NA	
Other known	20.8	(2.0)	15.8	(2.4)	12.1	(1.2)	9.9	(1.0)
Unknown	18.3	(2.1)	18.4	(1.4)	16.0	(1.1)	14.6	(1.2)
Total	100.0		100.0		100.0		100.0	

*Operations with any dairy cows.

Percentage of Weaned Heifer Deaths*, by Cause



*Operations with any diary cows.

The percentage of cows that died increased across herd sizes from 1996 to 2007. The overall percentage of cows that died increased from 3.8 percent in 1996 to 5.7 percent in 2007.

e. Percentage of cows deaths*, as a percentage of January 1 inventory, by herd size

	Percent Cows					
Herd Size (Number of Cows)	**Dairy 1996**	**Std. Error**	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
Small (fewer than 100)	3.6	(0.1)	4.4	(0.1)	4.8	(0.1)
Medium (100 to 499)	3.9	(0.1)	5.0	(0.1)	5.8	(0.2)
Large (500 or more)	4.0	(0.2)	4.9	(0.1)	6.1	(0.2)
All operations	3.8	(0.1)	4.8	(0.1)	5.7	(0.1)

*Operations with any dairy cows.

The percentage of cow deaths due to lameness or injury increased from 12.7 percent in 1996 to 20.0 percent in 2007. Conversely, the percentage of cow deaths due to calving problems and other known reasons decreased from 1996 to 2007.

f. Percentage of cow deaths*, by cause

	Percent Deaths					
Cause	Dairy 1996	Std. Error	Dairy 2002	Std. Error	Dairy 2007	Std. Error
Scours, diarrhea, or other digestive problems	9.0	(1.0)	8.6	(0.5)	10.4	(0.5)
Respiratory problems	9.6	(0.7)	10.3	(0.5)	11.3	(0.7)
Poison	0.9	(0.2)	0.4	(0.1)	0.4	(0.1)
Put down due to lameness or injury	12.7	(0.7)	13.9	(0.6)	20.0	(0.8)
Lack of coordination or severe depression	1.4	(0.2)	1.4	(0.2)	1.0	(0.1)
Mastitis	16.3	(0.8)	17.1	(0.6)	16.5	(0.7)
Calving problems	18.3	(0.7)	17.4	(0.7)	15.2	(0.7)
Other known reasons	17.0	(0.9)	11.1	(0.6)	10.2	(0.8)
Unknown reasons	14.8	(0.8)	19.8	(0.9)	15.0	(1.1)
Total	100.0		100.0		100.0	

*Operations with any dairy cows.

2. Necropsy

Determining the cause of death is important in preventing future deaths and improving the health of the herd. A relatively low percentage of operations performed necropsies on dead preweaned heifers, weaned heifers, or cows (8.0, 7.1, and 13.0 percent, respectively) to determine cause of death. With the exception of weaned heifers, the percentage of operations that performed any necropsy for a particular cattle class increased as herd size increased. Less than 1 of 10 small operations (8.4 percent) performed necropsies on cows, while 3 of 10 large operations (33.3 percent) performed necropsies.

a. For operations* that had at least one death in the following cattle classes, percentage of operations that performed necropsies to determine the cause of death, by herd size

	Percent Operations							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		**Medium** (100-499)		**Large** (500 or More)		**All Operations**	
Cattle Class	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Preweaned heifers	4.4	(0.9)	11.9	(1.4)	22.6	(2.5)	8.0	(0.7)
Weaned heifers	5.8	(1.4)	6.9	(1.2)	13.5	(2.1)	7.1	(0.9)
Cows	8.4	(1.0)	20.2	(1.8)	33.3	(2.7)	13.0	(0.9)

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

About 4 percent of animals that died within any cattle class were necropsied to determine the cause of death. There were no substantial differences in the percentages of deaths necropsied among cattle classes or herd sizes.

b. For operations* that had at least one death in the following cattle classes, percentage of preweaned heifer deaths, weaned heifer deaths, and cow deaths in which necropsies were performed to determine cause of death, by herd size

	Percent Deaths Necropsied							
	Herd Size (Number of Cows)							
	Small (Fewer than 100)		Medium (100-499)		Large (500 or More)		All Operations	
Cattle Class	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Preweaned heifers	1.8	(0.4)	4.7	(1.1)	3.8	(0.5)	3.5	(0.4)
Weaned heifers	3.9	(1.0)	4.8	(1.5)	3.7	(0.7)	4.1	(0.6)
Cows	4.4	(0.7)	6.0	(0.9)	3.5	(0.4)	4.4	(0.4)

*Operations with any dairy cows.
Source: NAHMS Dairy 2007.

3. Carcass disposal

Prompt removal and disposal of dead animals from pens before other animals, rodents, or birds have contact with them reduces the risk that disease agents from the carcasses will be spread to other animals.

The percentage of operations that used rendering to dispose of dead calves decreased from 43.8 percent in 2002 to 36.5 percent in 2007, while the percentage of operations that composted dead calves increased from 10.1 to 24.2 percent during the same period.

a. Percentage of operations* by primary method used to dispose of dead calves

	Percent Operations			
Disposal Method	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
Buried	35.3	(1.3)	32.6	(1.3)
Burned/incinerated	2.8	(0.4)	2.0	(0.4)
Rendered	43.8	(1.3)	36.5	(1.3)
Composted	10.1	(0.8)	24.2	(1.2)
Landfill	2.4	(0.4)	1.7	(0.3)
Other	5.6	(0.6)	3.0	(0.5)
Total	100.0		100.0	

*Operations with any dairy cows.

Although rendering remained the primary method of dead-cow disposal, the percentage of operations that used this method decreased from 62.4 percent in 2002 to 56.9 percent in 2007. Conversely, the use of composting increased from 6.9 percent of operations in 2002 to 16.8 percent in 2007. These changes in dead-cow disposal are similar to those observed in disposing of dead calves.

b. Percentage of operations* by primary method used to dispose of dead cows

	Percent Operations			
Disposal Method	**Dairy 2002**	**Std. Error**	**Dairy 2007**	**Std. Error**
Buried	22.7	(1.1)	20.3	(1.1)
Burned/incinerated	2.2	(0.4)	1.8	(0.4)
Rendered	62.4	(1.2)	56.9	(1.3)
Composted	6.9	(0.7)	16.8	(1.0)
Landfill	1.9	(0.3)	1.7	(0.3)
Other	3.9	(0.5)	2.5	(0.4)
Total	100.0		100.0	

*Operations with any dairy cows.

Section II: Methodology Dairy 2007

Note: For methodology documentation for studies in 1991, 1996, and 2002, see previous study reports. Also see Appendices III and IV for an overview.

A. Needs Assessment

NAHMS develops study objectives by exploring existing literature and contacting industry members about their informational needs and priorities during a needs-assessment phase. The objective of the needs assessment for the NAHMS Dairy 2007 study was to collect information from U.S. dairy producers and other dairy specialists about what they perceived to be the most important dairy health and productivity issues. A driving force of the needs assessment was the desire of NAHMS researchers to receive as much input as possible from a variety of producers, industry experts and representatives, veterinarians, extension specialists, universities, and dairy organizations. Information was collected via focus groups and through a Needs Assessment Survey.

Focus group teleconferences and meetings were held to help determine the focus of the study:

Teleconference, March 30, 2006
National Johne's Working Group

Meeting, Louisville, KY, April 2, 2006
National Johne's Working Group
National Institute for Animal Agriculture

Meeting, Louisville, KY, April 3, 2006
National Milk Producers Federation
Animal Health Committee

Teleconference, December 15, 2006
Bovine Alliance on Management and Nutrition

In addition, a Needs Assessment Survey was designed to ascertain the top three management issues, diseases/disorders, and producer incentives from producers, veterinarians, extension personnel, university researchers, and allied industry groups. The survey, created in SurveyMonkey, was available online from early February through late April 2006 and was promoted via electronic newsletters, magazines, and Web sites. Organizations and magazines promoting the study included Vance Publishing's "Dairy Herd Management–Dairy Alert," "Dairy Today," "Hoard's Dairyman," NMC, "Journal of the American Veterinary Medical Association," and the American Association of Bovine Practitioners. E-mail messages requesting input were also sent to cooperative members of the National Milk Producers Federation as well as State and Federal personnel. A total of 313 people completed the survey questionnaire.

Respondents to the Needs Assessment Survey represented

- University/extension personnel—23 percent,
- Producers—22 percent,
- Veterinarians/consultants—20 percent,
- Federal or State government personnel—15 percent,
- Nutritionists—8 percent,
- Allied industry personnel—8 percent, and
- Other—4 percent.

CEAH Focus Group meeting
Fort Collins, CO, May 18, 2006

Draft objectives for the Dairy 2007 study were based on input from teleconferences, face-to-face meetings, and the online survey, and were developed prior to the focus group meeting. Attendees included producers, university/extension personnel, veterinarians, and government personnel. The day-long meeting culminated in the formulation of eight objectives for the study:

1. Describe trends in dairy cattle health and management practices.
2. Evaluate management factors related to cow comfort and removal rates.
3. Describe dairy calf health and nutrition from birth to weaning and evaluate heifer disease-prevention practices.
4. Estimate the prevalence of herds infected with bovine viral diarrhea virus (BVD).
5. Describe current milking procedures and estimate the prevalence of contagious mastitis pathogens.
6. Estimate the herd-level prevalence and associated costs of *Mycobacterium avium* subspecies *paratuberculosis* (Johne's disease).
7. Describe current biosecurity practices and determine producer motivation for implementing or not implementing biosecurity practices.
8. Determine the prevalence of specific food-safety pathogens and describe antimicrobial resistance patterns.

B. Sampling and Estimation

1. State selection

The preliminary selection of States to be included in the study was done in February 2006 using the National Agricultural Statistics Service (NASS) January 27, 2006, "Cattle Report." A goal for NAHMS national studies is to include States that account for at least 70 percent of the animals and producer population in the United States. The initial review of States identified 16 major States representing 82.0 percent of the U.S. milk cow inventory and 79.3 percent of U.S. operations with milk cows (dairy herds). The States were California, Idaho, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, New Mexico, New York, Ohio, Pennsylvania, Texas, Vermont, Washington, and Wisconsin.

A memo identifying these 16 States was provided in March 2006 to the USDA–APHIS–VS–CEAH Director and, in turn, the VS Regional Directors. Each Regional Director sought input from the respective States about being included in or excluded from the study. Virginia expressed interest in participating and was included, bringing the total number of States to 17.

2. Operation selection

The list sampling frame was provided by NASS. Within each State a stratified random sample was selected. The size indicator was the number of milk cows for each operation. NASS selected a sample of dairy producers in each State for making the January 1 cattle estimates. The list sample from the January 2006 survey was used as the screening sample. Among producers reporting 1 or more milk cows on January 1, 2006, a total of 3,554 operations were selected from the sample for contact in January 2007 during Phase I.

Operations with 30 or more dairy cows that had participated in Phase I were invited to participate in data collection for Phase II of the study. A total of 1,077 operations agreed via written consent to be contacted by veterinary medical officers to determine whether to complete Phase II.

3. Population inferences

a. Phase I: General Dairy Management Report

Inferences cover the population of dairy producers with at least 1 milk cow in the 17 participating States. As of January 1, 2007, these States accounted for 82.5 percent (7,536,000 head) of U.S. milk cows and 79.5 percent (59,640) of U.S. operations with milk cows. (See Appendix II, p 139, for respective data on individual States.) All respondent data were statistically weighted to reflect the population from which they were selected. The inverse of the probability of selection for each operation was the initial selection weight. This selection weight was adjusted for nonresponse within each State and size group to allow for inferences back to the original population from which the sample was selected.

b. Phase II: VS Initial and Second Visits

Inferences cover the population of dairy producers with 30 or more milk cows in the 17 participating States. For operations eligible for Phase II data collection (those with 30 or more dairy cows), weights were adjusted to account for operations that did not want to continue to Phase II. In addition, weights were adjusted for nonresponse to the questionnaire in each visit. The 17-State target population of operations with 30 or more dairy cows represented 82.5 percent of U.S. dairy cows and 84.7 percent of U.S. dairy operations with 30 or more milk cows (Appendix II).

C. Data Collection

1. Phase I: General Dairy Management Report
From January 1 to 31, 2007, NASS enumerators administered the General Dairy Management Report questionnaire. The interview took slightly over 1 hour.

2. Phase II: VS Initial Visit
From February 26 to April 30, 2007, Federal and State veterinary medical officers (VMOs) and/or animal health technicians (AHTs) collected data from producers during an interview that lasted approximately 2 hours.

3. Phase II: VS Second Visit
From May 1 to August 31, 2007, Federal and State VMOs and/or AHTs collected data from producers during an interview that lasted approximately 2 hours.

D. Data Analysis

Validation

a. Phase I: Validation—General Dairy Management Report
Initial data entry and validation for the General Dairy Management Report were performed in individual NASS State offices. Data were entered into a SAS data set. NAHMS national staff performed additional data validation on the entire data set after data from all States were combined.

b. Phase II: Validation—VS Initial and Second Visit Questionnaires
After completing the VS Initial and Second Visit questionnaires, data collectors sent them to their respective State NAHMS Coordinators, who reviewed the questionnaire responses for accuracy and sent them to NAHMS. Data entry and validation were completed by NAHMS staff using SAS.

E. Sample Evaluation

The purpose of this section is to provide various performance measurement parameters. Historically, the term "response rate" has been used as a catch-all parameter, but there are many ways to define and calculate response rates. Therefore, the table below presents an evaluation based on a number of measurement parameters, which are defined with an "x" (see table on next page) in categories that contribute to the measurement.

1. Phase I: General Dairy Management Report (GDMR)

A total of 3,554 operations were selected for the survey. Of these operations, 3,304 (93.0 percent) were contacted. There were 2,519 operations that provided usable inventory information (70.9 percent of the total selected and 76.2 percent of those contacted). In addition, there were 2,194 operations (61.7 percent) that provided "complete" information for the questionnaire. Of the 2,067 operations that provided complete information and were eligible to participate in Phase II of the study, 1,077 (52.1 percent) consented to be contacted for consideration/discussion about further participation.

			Measurement Parameter		
Response Category	**Number Operations**	**Percent Operations**	**Contacts**	**Usable[1]**	**Complete[2]**
Survey complete and VMO consent	1,077	30.3	x	x	x
Survey complete, refused VMO consent	990	27.9	x	x	x
Survey complete, ineligible[3] for VMO	127	3.6	x	x	x
No dairy cows on January 1, 2007	214	6.0	x	x	
Out of business	111	3.1	x	x	
Out of scope (prison, research farm, etc.)	6	0.2			
Refusal of GDMR	785	22.1	x		
Office hold (NASS elected not to contact)	126	3.5			
Inaccessible	118	3.3			
Total	3,554	100.0	3,304	2,519	2,194
Percent of total operations			93.0	70.9	61.7
Percent of total operations weighted[4]			94.0	74.1	59.6

[1]Usable operation—respondent provided answers to inventory questions for the operation (either zero or positive number on hand).
[2]Survey complete operation—respondent provided answers to all or nearly all questions.
[3]Ineligible—fewer than 30 head of milk cows on January 1, 2007.
[4]Weighted response—the rate was calculated using the initial selection weights.

2. Phase II: VS Initial Visit

There were 1,077 operations that provided consent during Phase I to be contacted by a VMO for Phase II. Of these 1,077 operations, 582 (54.0 percent) agreed to continue in Phase II of the study and completed the VS Initial Visit Questionnaire; 380 (35.3 percent) refused to participate. Approximately 10 percent of the 1,077 operations were not contacted, and 0.4 percent were ineligible because they had no dairy cows at the time they were contacted by the VMO during Phase II.

			Measurement Parameter		
Response Category	Number Operations	Percent Operations	Contacts	Usable[1]	Complete[2]
Survey complete	582	54.0	x	x	x
Survey refused	380	35.3	x		
Not contacted	111	10.3			
Ineligible[3]	4	0.4	x	x	
Total	1,077	100.0	966	586	582
Percent of total operations			89.7	54.4	54.0
Percent of total operations weighted[4]			87.5	50.8	50.4

[1]Usable operation—respondent provided answers to inventory questions for the operation (either zero or positive number on hand).
[2]Survey complete operation—respondent provided answers to all or nearly all questions.
[3]Ineligible—no dairy cows at time of interview, which occurred from February 26 through April 30, 2007
[4]Weighted response—the rate was calculated using the turnover weights.

3. Phase II: VS Second Visit

Of the 582 operations that completed the VS Initial Visit Questionnaire, 519 (including one operation that did not complete the VS Initial Visit on time) completed the VS Second Visit Questionnaire; 47 (8.1 percent) refused to participate. Approximately 3 percent of the 583 operations were not contacted, and 0.3 percent were ineligible because they had no dairy cows at the time of the VS Second Visit.

			Measurement Parameter		
Response Category	**Number Operations**	**Percent Operations**	**Contacts**	**Usable[1]**	**Complete[2]**
Survey complete	519	89.0	x	x	x
Survey refused	47	8.1	x		
Not contacted	15	2.6			
Ineligible[3]	2	0.3	x	x	
Total	583	100.0	568	521	519
Percent of total operations			97.4	89.4	89.0
Percent of total operations weighted[4]			98.1	90.6	90.3

[1]Usable operation—respondent provided answers to inventory questions for the operation (either zero or positive number on hand).
[2]Survey complete operation—respondent provided answers to all or nearly all questions.
[3]Ineligible—no dairy cows at time of interview, which occurred from May 1 through August 31, 2007.
[4]Weighted response—the rate was calculated using the turnover weights.

Appendix I: Sample Profile Dairy 2007

A. Responding Operations

1. Number of responding operations, by herd size

	Phase I: General Dairy Management Report	Phase II: VS Initial Visit	Phase II: VS Second Visit
Herd Size (Number of Cows)	**Number of Responding Operations**		
Fewer than 100	1,028	233	211
100 to 499	691	215	188
500 or more	475	134	120
Total	2,194	582	519

2. Number of responding operations, by region

	Phase I: General Dairy Management Report	Phase II: VS Initial Visit	Phase II: VS Second Visit
Region	**Number of Responding Operations**		
West	426	108	93
East	1,768	474	426
Total	2,194	582	519

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

Number of milk cows on January 1, 2007*

Region	State	Number of Milk Cows, January 1, 2007 (Thousand Head)		Number of Operations 2007		Average Herd Size	
		Milk cows on operations with 1 or more head	Milk cows on operations with 30 or more head	Operations with 1 or more head	Operations with 30 or more head	Operations with 1 or more head	Operations with 30 or more head
West	California	1,790	1,788.2	2,200	1,920	813.6	931.4
	Idaho	502	501.0	800	620	627.5	808.1
	New Mexico	360	358.9	450	180	800.0	1,993.9
	Texas	347	344.2	1,300	660	266.9	521.5
	Washington	235	234.3	790	540	297.5	433.9
	Total	3,234	3,226.6	5,540	3,920	583.8	823.1
East	Indiana	166	154.4	2,100	1,150	79.0	134.3
	Iowa	210	203.7	2,400	1,870	87.5	108.9
	Kentucky	93	86.5	2,000	1,180	46.5	73.3
	Michigan	327	320.5	2,700	1,910	121.1	167.8
	Minnesota	455	441.3	5,400	4,800	84.3	91.9
	Missouri	114	108.3	2,600	1,400	43.8	77.4
	New York	628	612.3	6,400	5,100	98.1	120.1
	Ohio	274	252.1	4,300	2,400	63.7	105.0
	Pennsylvania	550	536.3	8,700	7,000	63.2	76.6
	Vermont	140	137.2	1,300	1,100	107.7	124.7
	Virginia	100	97.0	1,300	820	76.9	118.3
	Wisconsin	1,245	1,213.9	14,900	12,800	83.6	94.8
	Total	4,302	4,163.5	54,100	41,530	79.5	100.3
Total (17 States)		7,536	7,390.1	59,640	45,450	126.4	162.6
Percent of U.S.		82.5	82.5	79.5	84.7		
Total U.S. (50 States)		9,132.0	8,958.5	74,980	53,680	121.8	166.9

*Source: NASS Cattle report, February 1, 2008, and NASS Farms, Land in Farms, and Livestock Operations 2007 Summary report, February 1, 2008. An operation is any place having one or more head of milk cows, excluding cows used to nurse calves, on hand at any time during the year.

Appendix III: Methodology Overview, Phase I (1991–2007)

	NAHMS Dairy Studies			
	1991	**1996**	**2002**	**2007**
Data collection dates	4/1991-7/1992	1/1-1/26 1996	12/31/2001-2/12/2002	1/1-1/31 2007
Minimum number of dairy cattle	30	1	1	1
Number of States	28	20	21	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
Cows	81.3	83.1	85.7	82.5
Respondent Sample profile (herd size)				
Small (fewer than 100 cows)	931	1,480	1,131	1,028
Medium (100-499 cows)	705	873	820	691
Large (500 or more cows)	175	189	510	475
Response category				
Survey complete	1,811	2,542	2,461	2,194
Percent of total	54.1	56.3	63.5	61.7
No milk cows	NA	646	227	214
Out of business/ no milk sold in 1995		179	183	111
Out of scope (prison, research farm, etc.)		16	45	6
Refused		969	821	785
Did not contact		NA	2	126
Inaccessible		164	137	118
Total	3,346	4,516	3,876	3,554

Appendix IV: Methodology Overview, Phase II VS Initial Visit (1996–2007)

	NAHMS Dairy Studies		
	1996	**2002**	**2007**
Data collection dates	2/20-5/24	2/25-4/30	2/26-4/30
Minimum number of dairy cattle	30	30	30
Number of States	20	21	17
Data collectors	State and Federal VMOs and AHTs		
Participating States as a percentage of U.S. population coverage			
Operations	85.6	86.6	84.7
Cows	82.7	85.5	82.5
Respondent Sample profile (herd size)			
Small (fewer than 100 cows)	630	400	233
Medium (100-499 cows)	502	392	215
Large (500 or more cows)	87	221	134
Response category			
Survey complete	1,219	1,013	582
Percent of total	76.0	70.4	54.0
Refused	340	335	380
Did not contact	16	76	111
Ineligible	29	14	4
Total	1,604	1,438	1,077

Appendix V: Study Objectives and Related Outputs

1. Describe trends in dairy cattle health and management practices
   - Part II: Changes in the U.S. Dairy Cattle Industry 1991–2007, March 2008
   - Part V: Changes in Dairy Cattle Health and Management in the United States, 1996–2007, July 2009

2. Evaluate management factors related to cow comfort and removal rates
   - Dairy Facilities and Cow Comfort on U.S. Dairy Operations, 2007, Interpretive Report, expected spring 2010

3. Describe dairy calf health and nutrition from birth to weaning and evaluate heifer disease prevention practices
   - Part I: Reference of Dairy Cattle Health and Management Practices in the United States, 2007, October 2007
   - Off-Site Heifer Raising on U.S. Dairy Operations, 2007, info sheet, November 2007
   - Colostrum Feeding and Management on U.S. dairy Operations, 1991–2007, info sheet, March 2008
   - Part IV: Reference of Dairy Cattle Health and Management Practices in the United States, 2007, February 2009
   - Calf Health and Management Practices on U.S. Dairy Operations, 2007, Interpretive Report, February 2010
   - Calving Management on U.S. Dairy Operations, 2007, info sheet, January 2009
   - Passive Transfer Status of Heifer Calves on U.S. Dairies, 1991–2007, info sheet, March 2010

4. Estimate the prevalence of herds infected with bovine viral diarrhea virus (BVD)
   - Bovine Viral Diarrhea (BVD) Detection in Bulk Tank Milk and BVD Management Practices in the United States, 1996–2007, info sheet, October 2008

5. Describe current milking procedures and estimate the prevalence of contagious mastitis pathogens
   - Part III: Reference of Dairy Cattle Health and Management Practices in the United States, 2007, September 2008
   - Milking Procedures on U.S. Dairy Operations, 2007, info sheet, October 2008

6. Estimate the herd-level prevalence and associated costs of *Mycobacterium avium* subspecies *paratuberculosis*
   - Johne's Disease on U.S. Dairies, 1991–2007 info sheet, April 2008

7. Describe current biosecurity practices and determine producer motivation for implementing or not implementing biosecurity practices
   - Part I: Reference of Dairy Cattle Health and Management Practices in the United States, 2007, October 2007
   - Part III: Reference of Dairy Cattle Health and Management Practices in the United States, 2007, September 2008
   - **Biosecurity Practices on U.S. Dairy Operations, 1991–2007, Interpretive Report, May 2010**

8. Determine the prevalence of specific food-safety pathogens and describe antimicrobial resistance patterns

- Antibiotic Use on U.S. Dairy Operations, 2002-07, info sheet, October 2008
- *Listeria* and *Salmonella* in Bulk Tank Milk on U.S. Dairy Operations, 2002–07, info sheet, June 2009
- *Salmonella* and *Campylobacter* on U.S. Dairy Operations, 2002–07, info sheet, July 2009
- Food Safety Pathogens Isolated from U.S. Dairy Operations, 2007, Interpretive Report, expected spring 2010
- Prevalence of *Coxiella burnetti* on U.S. Dairy Operations, 2007, info sheet, expected spring 2010

Additional informational sheets

- Dairy Cattle Identification Practices in the United States, 2007, info sheet, November 2007
- Reproduction Practices on U.S. Dairy Operations, 2007, info sheet, February 2009
- Bovine Leukosis Virus (BLV) on U.S. Dairy Operations, 2007, info sheet, October 2008
- Injection Practices on U.S. Dairy Operations, 2007, info sheet, February 2009
- Methicillin-Resistant *Staphylococcus aureus* (MRSA) Isolation from Bulk Tank Milk in the United States, 2007, info sheet, expected spring 2010

Appendix VI: References

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