

Johne's Disease on U.S. Dairies, 1991–2007

Johne's disease is caused by *Mycobacterium avium* subspecies *paratuberculosis* (MAP). This organism is also referred to as *M. paratuberculosis* and *M. paratub.* The clinical manifestation of MAP infection, termed Johne's disease, is also referred to as paratuberculosis. In addition to cattle and other ruminants, many species of domestic and wild animals worldwide have been diagnosed with MAP infection. MAP has a long incubation period, and clinical manifestation of disease (Johne's) does not commonly occur for two or more years after initial infection. Clinical signs of Johne's disease include chronic diarrhea, weight loss despite a normal appetite, and decreased milk production.

NAHMS Dairy 2007 study

In 2007, the U.S. Department of Agriculture's (USDA) National Animal Health Monitoring System (NAHMS) conducted the Dairy 2007 study. In all, 17 of the Nation's major dairy States* representing 79.5 percent of U.S. dairy operations and 82.5 percent of U.S. dairy cows participated in the study.

Dairy 2007 is the fourth national NAHMS study of the U.S. Dairy industry. Previous studies were the 1991 National Dairy Heifer Evaluation Project (NDHEP), Dairy 1996, and Dairy 2002.

Specific objectives of the Dairy 2007 study relating to Johne's disease were to:

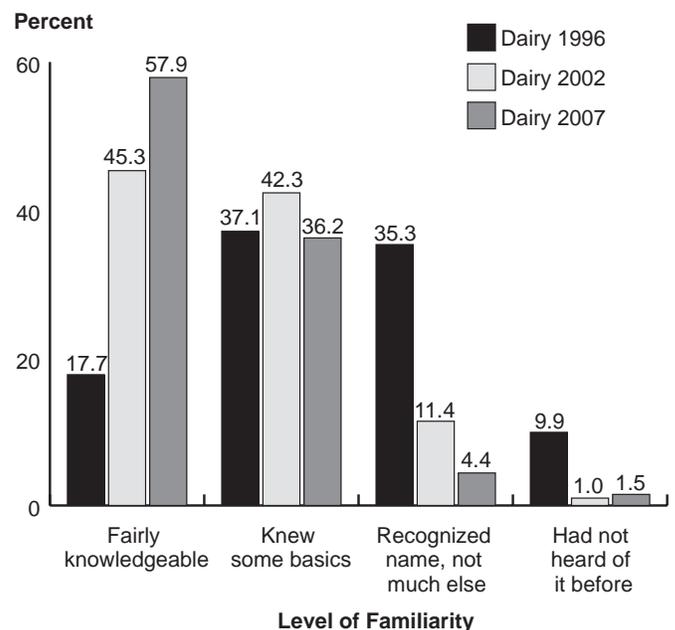
- Estimate herd-level prevalence (number of herds infected with MAP) in the United States.
- Compare and evaluate management practices related to perceived risk of MAP transmission between the previous NAHMS Dairy studies.

Producer familiarity

Although Johne's disease was first described in the late 1800s and has since been reported in most countries around the world, results of the Dairy 1996 study revealed that almost 10 percent of producers had not heard of Johne's disease. Dairy 1996 also revealed

that just 17.7 percent of producers were fairly knowledgeable about the disease, indicating a need to increase Johne's disease education efforts. In contrast, Dairy 2007 indicated that 57.9 percent of producers were fairly knowledgeable about Johne's disease, and only 1.5 percent had not heard of the disease. In 2007, 94.1 percent of producers were either fairly knowledgeable or knew some basics about the disease, compared with only 54.8 percent of producers with these characteristics in the Dairy 1996 study (figure 1). These results indicate that educational efforts to increase awareness of the Johne's disease have been quite effective.

Figure 1. Percentage of Operations by Level of Familiarity with Johne's Disease, and by Study Year



Management practices

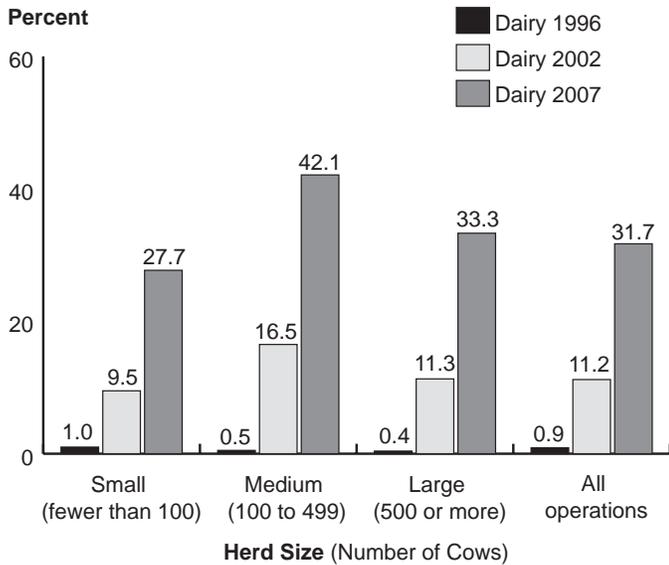
In 2007, nearly one of three operations (31.7 percent) participated in a Johne's disease certification or control program. This was an increase compared with operations in 1996 and 2002 (figure 2). Note that in 1996 participants were asked if they were currently in a Johne's disease certification program, whereas in 2002 and 2007 participants were asked if they participated in a Johne's disease control or certification program (State-sponsored or a unique program developed specifically for their operation).

*States/Regions

West: California, Idaho, New Mexico, Texas, and Washington

East: Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Vermont, Virginia and Wisconsin

Figure 2. Percentage of Operations that Participated in a Johne's Disease Control or Certification Program, by Study Year and by Herd Size



Separating calves from cows and their manure immediately after calving reduces the potential of newborn calves ingesting MAP. From 1991 to 1996, the percentage of operations that removed newborn calves from their dams immediately after birth increased dramatically. The percentage of operations that removed calves immediately increased steadily from 1996 (see table below). Despite these increases, in 2007 only a slight majority of producers (55.9 percent) removed calves immediately after birth, indicating that many producers still allow calves to nurse their dams.

Percentage of Operations by Time Following Birth that Calves were Normally Separated from Their Dams

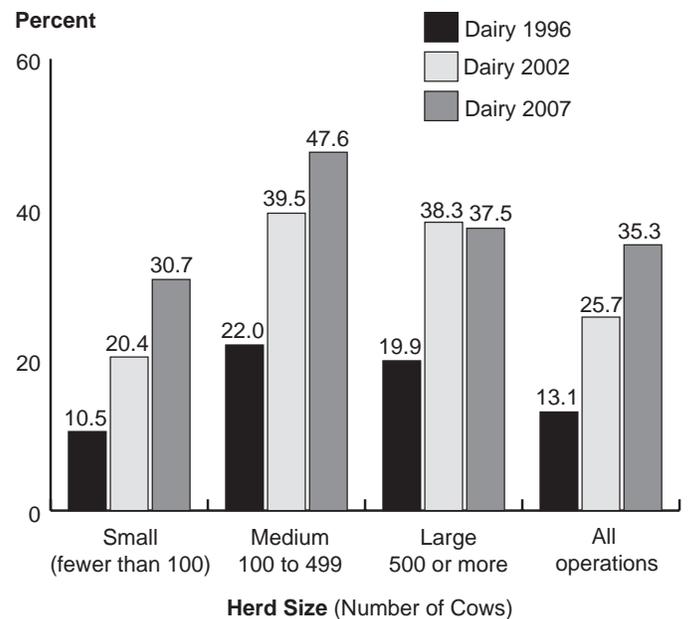
Time	Percent Operations			
	NDHEP 1991	Dairy 1996	Dairy 2002	Dairy 2007
Immediately (no nursing)	28.0	47.9	52.9	55.9
After nursing but less than 12 hours	39.6	20.8	22.5	22.2
12 to 24 hours	22.0	17.4	15.9	14.6
More than 24 hours	10.4	13.9	8.7	7.3
Total	100.0	100.0	100.0	100.0

Organism detection and measuring antibody response are the two main methods used to test for MAP infection. For organism detection, fecal culture is used most commonly. For antibody response, an enzyme-linked immunosorbent assay (ELISA) blood test is used most often. Fecal-culture testing takes more time

to complete than the ELISA and is more expensive. Neither of these tests detects 100 percent of infected animals, due to variation in incubation periods, intermittent fecal shedding, and the varied immune response of individual animals to infection.

During the 12 months prior to the Dairy 2007 study, a higher percentage of medium operations (47.6 percent) performed any testing for Johne's disease compared with small operations (30.7 percent), a finding consistent with both the Dairy 1996 and Dairy 2002 studies as well. Compared to 1996, the percentage of all operations testing for Johne's disease increased in 2002, and an increase was seen again in 2007 (figure 3). Note that in the Dairy 1996 study, producers were asked if they performed Johne's testing during the 24 months prior to questionnaire administration rather than 12 months prior as in the 2002 and 2007 studies.

Figure 3. Percentage of Operations that Tested for Johne's Disease, by Study Year and by Herd Size



More than 2 of 10 operations (22.7 percent) reported that Johne's disease was confirmed in their herd during the previous 12 months. A lower percentage of small operations (17.4 percent) confirmed the disease compared with medium and large operations (35.0 and 34.1 percent, respectively). Almost one-quarter of operations in the East region (23.6 percent) confirmed Johne's disease compared to 12.8 percent in the West region. A diagnosis of Johne's disease was confirmed using blood, feces, and milk on 70.3, 36.4, and 12.4 percent of operations, respectively.

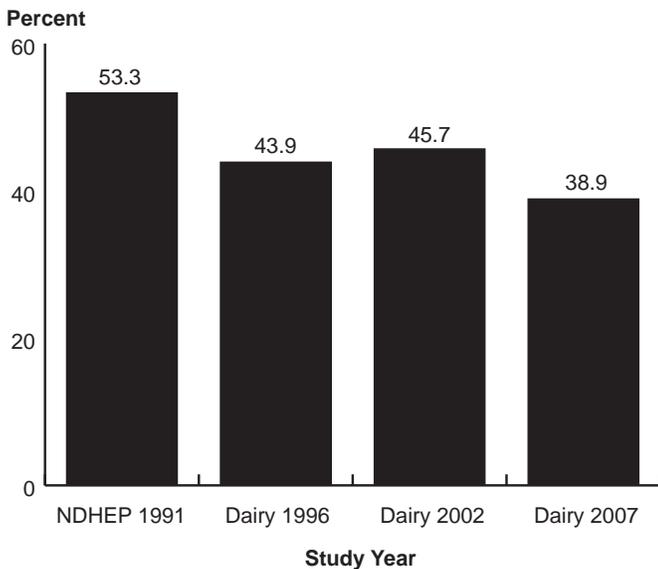
Although it has been an important component of control strategies for many years, vaccinating against MAP is a controversial management tool in the United States. Vaccine use reduces clinical manifestation of MAP infection,^{1,2} but there are discrepancies among studies as to whether vaccine reduces the number of infected cattle.^{1,3} Accidental self-injection may present a risk to veterinarians administering the vaccine.⁴

Additionally, MAP vaccine can interfere with tuberculosis tests, and as a result the vaccine's use is under strict state control.

Despite the limitations, vaccination remains a viable tool for controlling Johne's disease in certain infected herds and is cost-effective due to the reduction of clinically infected cattle.² However, it is not a widely used practice in the United States. The small percentage of operations that normally vaccinate heifers against Johne's disease has remained essentially unchanged since 1996, with 5.0 percent of operations reporting this practice in 2007.

Bringing animals onto an operation can introduce new diseases or add to the disease burden of the herd. Careful scrutiny of the source of new additions and a brief isolation or quarantine once the animals are on the dairy are good management practices. A higher percentage of operations brought any cattle onto the operation in 1991 compared with operations in 1996, 2002, or 2007. However, there has been little change in the percentage of operations bringing cattle onto the operation since 1996 (figure 4).

Figure 4. Percentage of Operations that Brought Any Cattle Onto the Operation During the Previous 12 Months, by Study Year



For operations that bring on new animals, knowing the MAP-infection status of the herd of origin can be more reliable than testing purchased animals individually. In Dairy 2007, less than one of five operations that brought cattle onto the operation during the previous year (17.2 percent) required herd-of-origin information regarding MAP-infection status. Approximately 1 of 10 operations (11.4 percent) tested individual animals brought onto the operation. A higher percentage of medium operations (16.6 percent) tested purchased animals compared with large operations (7.2 percent). For operations that did not perform individual animal testing of animals brought on, 22.3 percent reported that testing had been done by the herd-

of-origin, and 28.6 percent reported that MAP infection was not a concern to their operation.

Environmental sample testing

Recommendations have been published on the "best test" for detecting MAP in U.S. cattle.⁵ The authors indicate that culturing six composite fecal samples taken from the farm environment is sensitive and the most cost-effective means by which to determine whether a dairy operation is infected with MAP.⁵ Based on results from previous research,^{6,7,8} environmental sampling was established as an acceptable testing strategy to achieve level 1 of the test-negative component of the U.S. Voluntary Bovine Johne's Disease Control Program.⁹

To estimate Johne's herd-level prevalence for the Dairy 2007 study, 6 composite environmental samples were taken from each of 524 participating operations. The environmental samples were taken from six different adult-cow areas where manure accumulates.

Recommended locations for sampling included, but were not limited to, common pens or alleyways, manure pit or other manure storage area, holding pens or exit ways from the milking parlor, gutter cleaners, and manure spreaders. For each composite sample, approximately 4 ounces of manure/slurry were taken from each of six sites within the respective area. For example, for a cow alleyway sample, 4 ounces of manure were taken from six different locations within the alleyway and combined to form a single composite sample of approximately 24 ounces. Samples were sent to the National Veterinary Services Laboratories and cultured on Herrold's egg yolk agar and evaluated at 4 and 8 weeks. Positive cultures were confirmed as MAP by PCR methods.

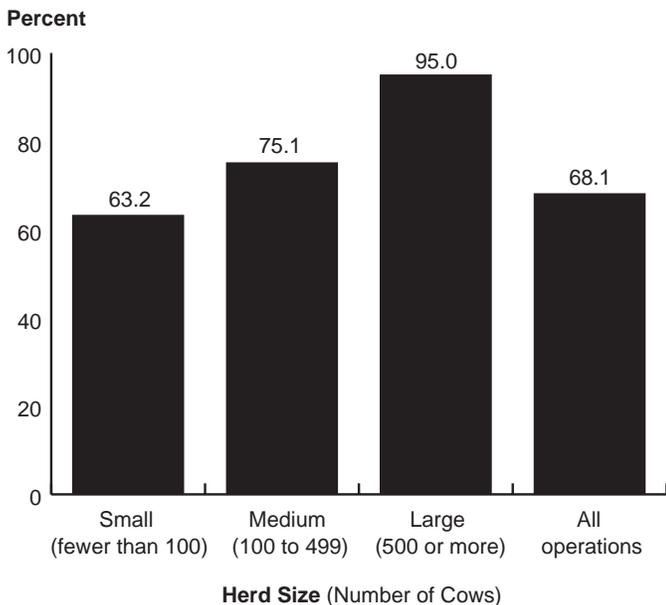
Environmental culture results

In 2007, MAP was isolated from at least one environmental sample on 68.1 percent of operations, and prevalence increased as herd size increased (figure 5). In comparison, Dairy 1996—the last study before Dairy 2007 to report the U.S. prevalence of Johne's disease—estimated that 21.6 percent of operations had at least 10 percent of their cattle infected with MAP. Additionally, the Dairy 1996 study used ELISA instead of fecal-culture. For these reasons, MAP prevalence estimates from Dairy 1996 are not directly comparable with Dairy 2007 prevalence estimates.

There were no differences in MAP prevalence between operations in the West and East study regions.

Although environmental sampling is an effective method of detecting operations infected with MAP, it will not detect all infected operations. Thus, reported percentages will be less than the true prevalences.

Figure 5. Percentage of Operations in Which at Least One Environmental Sample Cultured Positive for MAP in 2007, by Herd Size



About one-fourth of operations had six culture-positive environmental samples. Operations with one to five culture-positive samples were less common. These results suggest that at least one-fourth of U.S. dairy operations may have a relatively high percentage of infected cows in their herds.

Conclusions

In Dairy 2007, 94.1 percent of producers either were fairly knowledgeable or knew some basics about Johne's disease compared with 54.8 percent of producers in Dairy 1996. The Dairy 2007 study indicates that 68.1 percent of U.S. dairy operations are infected with MAP. Results from the NAHMS Dairy 2007 study indicate that producers are implementing management practices aimed at reducing MAP transmission, suggesting Johne's disease educational efforts are working.

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