

Alberta Johne's Disease Initiative

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■ Take Home Messages

- ▶ Johne's disease (JD) is an insidious production limiting disease of all ruminants for which there is no treatment. Only a few infected cattle ever show clinical diarrhea and are the "tip of the JD iceberg" in infected cattle herds.
- ▶ At least 50 percent of Canadian dairy herds contain infected cattle but this is likely an underestimation due to the poor sensitivity of current laboratory tests to detect infected cattle in the early stages of infection.
- ▶ The Alberta Johne's Disease Initiative is based on Canadian standards developed by the Canadian Animal Health Coalition with representatives from industry, academia, government and bovine veterinarians. These standards focus on reducing the risk posed by JD to the livestock industry and individual cattle herds through education and awareness, implementation of on-farm best management practices, and coordination of JD research initiatives.
- ▶ The Alberta Johne's Disease Initiative is producer driven and coordinated by the Faculty of Veterinary Medicine at the University of Calgary. Participation by herd veterinarians and producers is strictly voluntary.

■ The Disease

Johne's disease (JD) is a chronic, progressive and contagious disease of domestic and wild ruminant animals for which there is no treatment. The cause of JD is *Mycobacterium avium* subspecies *paratuberculosis* (MAP), a bacterium closely related to those bacteria that cause tuberculosis in animals, and tuberculosis and leprosy in humans. This bacterium is resistant to most common disinfectants and can persist in the environment under moist conditions for at least a year. Calves less than four to six months of age are generally thought to be the most susceptible to becoming infected when exposed to MAP. Current research at the Faculty of Veterinary Medicine at the University of Calgary (UCVM) is hoping to clarify the age susceptibility of cattle to becoming infected with MAP. Calves are usually infected by

swallowing fecal contamination on the dam's legs and udder, and on contaminated bedding. Calves may also become infected by consuming colostrum or milk obtained from MAP-infected cows or contaminated with infected manure. Calves from cows shedding high numbers of MAP are at risk of being born already infected with MAP.

Although probably infected as calves, most infected cattle do not shed MAP in their feces until the disease progresses over a period of one to three years. Infected animals then begin to shed MAP intermittently in their feces and milk in increasing numbers with decreasing intervals between periods of shedding. Less than 5% of infected cattle ever show signs of diarrhea, and those that do seldom do so before three to four years of age. Animals affected with clinical JD develop intermittent diarrhea and weight loss that slowly progress until the animal is emaciated and dies. Cows infected with MAP gradually drop in milk production as the infection progresses. As a consequence, JD has an economic impact in infected herds by causing decreased milk production, increased calving intervals and infertility, increased involuntary culling, and reduced slaughter value of culled animals. Studies estimate the economic losses caused by JD in infected herds range between \$20 and \$27 per animal in the herd. However, accurate estimates are difficult due to the inability to detect all subclinically infected animals (Barkema, 2010).

Cattle showing clinical signs of diarrhea are the "tip of the JD iceberg" in infected herds. This is because only a small proportion of MAP-infected cattle ever show clinical signs of disease, often being culled early for poor production and/or infertility before developing diarrhea. This is important when considering whether MAP might be present in a herd, or the number of MAP-infected animals silently existing in an infected herd. Cows in the later stages of infection, whether showing diarrhea or not, can shed billions of MAP bacteria per day in their feces and heavily contaminate the farm environment. These MAP-shedding cows are the primary, and "**invisible**," source of infection for young animals in the herd, as well as being the primary means of spreading MAP to other herds through the sale or movement of cattle.

Johne's disease has a worldwide distribution in farmed ruminants and has been recognized for over 100 years. There are a number of diagnostic tests available that use blood, milk, feces and other tissue samples to detect infected animals. Unfortunately, these tests only detect MAP-infected cattle in specific stages of infection and the test results are often difficult to interpret, especially in the early stages of infection. Because of the difficulties interpreting test results, the true level of MAP infection in the world's farmed ruminant populations is unknown.

Prevalence surveys estimate that at least 50% of dairy herds have at least one animal infected with MAP. Because the sensitivity of most diagnostic tests depends on the stage of infection with MAP, most surveys

underestimate the true prevalence of MAP-infected cows and herds. A report published in 2003 estimated that 74% of Alberta dairy herds contained at least one animal that would test positive for MAP, and 40% of herds contained at least two animals that would test positive (Sorensen et al., 2003).

Other ruminants that can be infected with MAP include sheep, goats, deer, elk, bison, buffalo, moose, caribou and reindeer. Non-ruminants, such as the pig, horse, fox, weasel, badger and raven occasionally become infected but don't shed MAP, and are thought to be dead end hosts. Wild rabbits and hares in Scotland have exhibited disease caused by MAP and may be reservoirs for the infection on affected farms. This peculiarity has not been reported in other countries.

Johne's disease is similar in many respects to Crohn's disease (CD) in humans. Because of these similarities, there has been speculation about a link between MAP and CD since 1913. Although an association between MAP and CD has been proven, a cause-and-effect relationship has never been established. Should such a relationship be proven, the impact on Canada's dairy and beef industries could be serious.

■ Background

Over the past decade, there have been a number of JD "test and cull" programs implemented in various jurisdictions in an attempt to reduce the prevalence of the disease. These programs have required the commitment of significant financial and human resources to harvest the animal samples and conduct the laboratory analyses. These "test and cull" programs have had mixed success at best in controlling the spread of JD, as evidenced by the evaluation of the United States Voluntary Johne's Disease Herd Status Program. A major contributor to the poor results of these programs has been the inability of the current testing methods to reliably detect MAP-infected animals in the early stages of infection. It is not so much that the tests are "bad" but rather due to the nature of the disease itself. Computer modeling conducted at the University of Pennsylvania revealed that the prevalence of JD will gradually increase in a herd without implementation of a control program, even if "test and cull" methods are implemented (Groenendaal and Galligan, 2003).

The failures of "test and cull" programs and the costs associated with them led the Canadian Animal Health Coalition (CAHC) to develop standards for a national JD control program in Canada. In partnership with Dairy Farmers of Canada, Canadian Cattlemen's Association, Holstein Canada, Canadian Livestock Genetics Association, Canadian Animal Health Institute, Canadian Food Inspection Agency, provincial governments, veterinary schools, and bovine veterinary practitioners, the CAHC developed the Canadian Johne's

Disease Initiative (CJDI) (4). The purpose of this initiative is to strengthen Canada's beef and dairy industries' capacities to:

- ▶ Control the incidence of JD and prevalence of MAP infection
- ▶ Reduce animal and economic losses related to JD
- ▶ Ensure continued access to, or accelerate resumption of, market access
- ▶ Proactively position the Canadian dairy and beef industries to respond if a proven link between MAP and CD in humans is established.

The CJDI consists of two streams: a) prevention and control of JD, and b) JD Herd Status. Participation by producers in either stream is optional. The prevention pathway focuses on implementing best management practices that will prevent the spread of JD within a herd and minimize the risk of replacement calves being exposed to MAP. No laboratory testing is required of a herd that adopts the prevention pathway. The JD Herd Status pathway requires testing animals for MAP using milk, blood or fecal samples. There are four levels of JD herd risk status and the level of JD Herd Status achieved depends on the proportion of animals in the herd tested, the results of the laboratory tests, and the length of time the herd is enrolled in the program. Animals testing positive for MAP must be culled if the JD Herd Status pathway is chosen.

The most important results of the CAHC efforts are the national standards developed for conducting a herd risk assessment for JD, a list of best management practices (BMP) that will reduce the spread of JD, and educational materials to increase producer and veterinarian awareness of measures to prevent and control JD. The intent is for provincial jurisdictions to lead JD control initiatives within their own province and encourage producers to implement BMPs aimed at minimizing the risk of JD. The CJDI also coordinates concurrent and ongoing research projects related to JD to ensure the most efficient use of resources and dissemination of the research results.

In 2007, Quebec initiated a JD control program for beef and dairy cattle and in January 2010, Ontario commenced a JD control program for dairy cattle. Milk producers in the Atlantic Provinces are seeking funding to help implement their JD control program. All of these programs are based on the national standards developed as part of the CJDI.

■ General

The Alberta dairy industry proactively implemented the AJDI in 2010. Again, the national standards are the foundation upon which the Alberta initiative was designed. The AJDI is producer-driven, designed to meet the needs of

Alberta's dairy industry, is coordinated by UCVM, and is supported by Alberta Milk. Why should producers take the threat of JD seriously and implement this prevention and control initiative on their farms?

- ▶ Because clinical signs of JD are just the "tip of the JD iceberg." Many producers are not aware of this disease and may not know whether or not their herd already contains MAP-infected animals. Unless requesting specific information on JD when purchasing replacement cattle, a producer may unwittingly import MAP into his/her herd in a subclinically infected replacement animal purchased from another herd that is equally unaware of the presence of MAP-infected cattle.
- ▶ JD is a production-limiting disease, just like mastitis and lameness. Affected cattle produce less milk, take longer to become pregnant, and are worth less when culled. The total economic impact of these production losses is dependent on the number of MAP-infected cows in the herd.
- ▶ In the later stages of infection, MAP-infected cows shed billions of MAP bacteria daily into the farm environment and pose a serious threat to replacement calves. MAP bacteria are difficult to kill and can survive in harsh environments for up to a year or longer.
- ▶ An additional benefit to implementing BMPs on farm to reduce the risk of JD is the positive impact they will also have on controlling other diseases, such as salmonellosis and viral calf scours that impact the health of calves and dairy replacements on many dairy farms.
- ▶ Internationally, animal health agencies are increasingly concerned about JD and some are, or are contemplating, banning importation of animals from exporting countries without a JD control program in place. In today's shrinking world, market access is increasingly focused on non-tariff animal health issues with the potential to threaten the importing country's livestock industry or human population.
- ▶ Although there is a definite association between MAP and CD in humans, a cause-and-effect link has never been made. Research continues in the hope of clarifying whether or not MAP can cause CD. Should a causative link be established, an effective JD prevention and control initiative should position the Alberta dairy industry to be able to minimize the impact of a potential food safety concern.

The AJDI consists of four elements: a) education, b) conducting an on-farm risk assessment for JD and development of a management plan to prevent/control JD, c) research to improve the initiative and monitor its success, and d) JD herd status for those producers desiring to proceed beyond the control of JD.

Initiative Objective and Goals

Objective: The Alberta dairy industry is aware of Johne's disease and implements best management practices to reduce its prevalence.

At a joint meeting of the Alberta Milk Animal Health and Environment and Research Committees on April 19, 2010, the objectives and goals of the AJDI were developed and clarified. It is important to note that the objective of the AJDI is not to eradicate JD, although that may happen if the initiative is continued over a number of years. Rather, the focus is to minimize the spread of MAP/JD, reduce its prevalence, and minimize the economic impact of this production-limiting disease on the industry.

The goals for the AJDI are as follows:

- ▶ Fifty percent of producers are enrolled in the initiative, have done a risk assessment (RA) and implemented BMPs by December 2011.
- ▶ Eighty percent of producers are enrolled in the initiative and have done a RA and implemented BMPs by December 2012.
- ▶ Participating herds have done a second RA to measure improvement (with a possible reduction in score).

As seen above, awareness of JD and implementation of measures to minimize the risk of spreading MAP in or between herds are the focus of this initiative. Participation by producers is strictly voluntary but it is hoped that the majority of Alberta dairy herds will be participating by the end of 2012.

■ AJDI Implementation

The AJDI is being implemented in three phases. The focus in Phase one has been on developing the initiative criteria and increasing the awareness of veterinarians and producers for JD, as well as the importance of implementing on-farm BMPs to control its spread. Educational materials were obtained through the CJDI and additional ones created; both have been distributed to producers and veterinarians. Forty-three veterinary practitioners are ready to participate in the initiative after attending one of the three orientation seminars sponsored by Alberta Milk in early September.

Currently, we have entered Phase two, in which individual producers are enrolling in the initiative. Producers wishing to participate in the initiative notify their veterinarian who will in turn contact the Initiative Coordinator at UCVM to obtain the appropriate materials. The herd veterinarian will make an appointment with his/her client to conduct the on-farm JD Herd Risk Assessment (JDRA). He/she then discusses the results of the JDRA with the

producer and they jointly develop the herd JD Management Plan (JDMP). The Alberta Livestock and Meat Agency (ALMA) committed funding to Alberta Milk to cover a portion (\$200) of the cost of the veterinarian's fees to conduct the JDRA and complete the JDMP. These forms and detailed herd production and management information are then provided to the Initiative Coordinator as part of the UCVM's JD research projects. All information provided to UCVM will be kept strictly confidential. Phase two is expected to extend over a 12 to 24 month period.

Phase three is currently under development and will consist of a JD herd status component that will be available to those producers wishing to go beyond the control of JD. Since 2001, several Alberta dairy farms participated in Alberta Agriculture and Rural Development's JD Herd Status program. The ARD program has been dormant for about a year and the dairy herds that participated in it will be given an opportunity to take part in the new AJDI JD herd status component, subject to an assessment of each herd's present risk for JD. It is anticipated that phase three will be operational by mid 2011.

■ **AJDI Components:**

There are key elements in the national guidelines developed through the CJDI that are incorporated into the Alberta initiative so as to maintain consistency with the JD control programs implemented in other provinces. The details may differ slightly from the national guidelines in order to meet local circumstances but the end result will be a reduced risk of spreading MAP within and between herds in Alberta.

- ▶ **Voluntary.** The AJDI is producer-driven and herd participation is strictly voluntary.
- ▶ **Veterinarian participation.** Veterinarians must complete an orientation seminar in order to participate in the initiative to ensure they all understand their responsibilities under the AJDI and to facilitate consistent on-farm JDRAs on Alberta dairy farms. This consistency is essential for the success of the associated UCVM research projects. Three seminars have already been held and additional sessions will be conducted on an as-needed basis.
- ▶ **JD Risk Assessment.** An *on-farm* risk assessment conducted by the herd veterinarian is essential to detect those management practices employed on the farm that create or increase the risk that MAP poses to the herd. The JDRA is a detailed questionnaire designed to assist the veterinarian in evaluating the herd's management as it is related to the potential risk of MAP. The results of the risk assessment should facilitate an in-depth and herd-specific discussion of JD between the producer and

the veterinarian so as to create a common understanding of the risk MAP poses to the herd.

- ▶ **JD Management Plan.** This is simply a *farm-specific* plan of action agreed to by the producer based on the outcome of the discussion of the JDRA with his/her veterinarian. It might appear obvious that there are a number of management changes that could be made to totally offset the risk posed by MAP. However, trying to make too many changes at once may overwhelm the human and financial resources available on the farm. This could potentially lead to frustration and failure to fully implement a key BMP to enhance the control/prevention of MAP. In order to encourage successful implementation, at least one BMP should be targeted and agreed to for implementation over the coming year. This BMP must be one the producer agrees can and will be implemented. To accomplish this, the most cost-effective BMP must be agreed to and forms the basis of the JDMP. If the herd owner insists in making more than one management change, **a maximum of three BMPs** should be targeted.

■ **Johne's Disease Research**

The AJDI is, and will continue to, take advantage of JD research being conducted in other parts of Canada, the USA, and internationally. As well, the AJDI is supporting JD research and funding applications for research that will improve the initiative. The research projects in progress within the AJDI or awaiting funding decisions will determine the prevalence of MAP-infected herds in Alberta, measure the effect of implemented BMPs on the prevalence and incidence of other diseases with a mode of transmission similar to JD, conduct producer surveys to evaluate producer awareness and knowledge of JD, and measure the rate of adoption of BMPs and evaluate their effect on the prevalence of JD.

Other JD research initiatives that will impact directly on the AJDI include strain-typing isolates of MAP bacteria, determining age and dose dependent susceptibility of cattle for MAP, determining the role of wildlife in transmission of MAP, and developing more practical and cost-effective sampling strategies for JD control programs.

■ **Advisory Committee**

An AJDI Advisory Committee has been formed to provide oversight and direction to the Initiative Coordinator to ensure the AJDI meets the needs and expectations of individual producers, as well as the entire dairy industry in Alberta. Committee members include representatives of Alberta Milk's Animal Health and Environment Committee and Research Committee, as well as UCVN, Alberta Veterinary Medical Association, Western Canadian

Association of Bovine Practitioners, Alberta Holstein, and Alberta Beef Producers. The Initiative Coordinator and the Office of the Chief Provincial Veterinarian have ex officio status on the committee. At the Advisory Committee's first meeting on October 22, Mr. Tim Hofstra, a prominent producer in the Rollyview area, was elected by his committee peers to be the first to fill the Chairperson position of this new committee.

■ Summary

The same characteristics of MAP/JD that create intrigue in the scientific community also create frustration and disappointment for producers and their veterinarians working to control this disease. There are no easy and quick methods available to easily control and eliminate JD. The 'test and cull' methods that worked so well for other problem diseases, such as brucellosis and tuberculosis, will not be successful unless management changes are made on the farm to minimize the risk of spreading MAP within and between farms. Because of the nature of the disease, current technology is unable to reliably detect all MAP-infected cattle, especially those in the early stages of infection. The bottom line is implementation of enhanced biosecurity measures by the industry as a whole, and on-farm specifically to protect young animals. I firmly believe that MAP/JD can be beaten but preventing and controlling JD will require a sustained and determined commitment on the part of the entire dairy industry to be successful.

■ References

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