

Lessons Learned from the Canadian Johne's Disease Programs

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■ Take Home Messages

- ▶ Participation in regional Johne's disease (JD) programs was very high.
- ▶ proAction Biosecurity module is based on JD risk assessment.
- ▶ Involvement of veterinary practitioners is crucial for success of a dairy disease control program.
- ▶ Concurrent research is important to improve a program, but also to keep participants engaged.
- ▶ There is a need for a national infectious disease herd status program.

■ Introduction

Johne's Disease (JD) has long been identified as an important production-limiting disease in dairy cattle. In recent years, concern over public scrutiny of *Mycobacterium avium* subspecies paratuberculosis (MAP) as a potential zoonotic agent has brought the disease to the forefront among producer groups across Canada. Although programs targeted at JD control have been developed and implemented provincially, coordination of these programs at the national level remains an important issue to ensure some degree of uniformity, as cattle frequently move among provinces.

The Canadian Johne's Disease Initiative (CJDI) has coordinated provincial JD control activities across Canada. Since its inception in July 2009, the CJDI,

funded by Dairy Farmers of Canada and the Canadian Cattlemen's Association, has been guided by its Advisory and Technical Committees (each with representation from industry, veterinary schools, and provincial programs). The CJDI priorities were to: 1) increase education about and awareness of JD across Canada among dairy producers, veterinarians and allied industries; 2) encourage development and implementation of control programs in all 10 provinces and where possible, to support coordination among programs; and 3) facilitate development and funding of research programs in areas that support the coordinated mission of JD control. The CJDI reached the end of its funded mandate in 2013 and the future of a coordinated national JD initiative is uncertain.

Aims and Objectives

Given that JD control is being delivered at a provincial level, the aim of this manuscript is to describe the structure, similarities and differences among these dairy programs and to highlight important lessons learned. Objectives are to:

- 1) Briefly compare provincial dairy cattle programs (key components, program administration, program delivery, status programs, testing, and participation).
- 2) Describe lessons already learned.

■ Herd-level Prevalence of MAP Infection in Canada

The first Canadian National Dairy Study (NDS) was completed in 2015 with an overarching objective to benchmark the health, productivity and management of the national dairy herd. The study included > 1,340 dairy farms (11% of all dairy farms in Canada), of which 46% had participated in a voluntary regional Johne's disease control program. Regional programs in Canada are based on either fecal culture or PCR of environmental samples, or cow/bulk tank milk ELISA tests, thereby limiting the ability to compare herd-level prevalence estimates among regions. As part of the NDS, 375 farms in all 10 provinces were visited, with environmental fecal and bulk tank milk samples collected for testing. A composite manure sample was collected from three areas on each farm: breeding-age heifer pen, milking cow area (alleyways), and manure storage (liquid manure pit or manure pile). Each of these three samples underwent DNA-based (PCR) testing for MAP. Bulk tank milk samples were collected either by study personnel or after the visit by accessing samples collected by milk transporters. Milk was tested with a commercial ELISA kit. Based on one-time environmental fecal testing, the percentage of test-positive farms was highest in Western Canada and Ontario (20%), moderate in Eastern Canada (12%), and lowest in Quebec (5%). Recognizing that these one-time herd level tests lack sensitivity and are likely

only detecting herds with a higher within-herd prevalence of MAP infection (Wolf et al., 2014), regional differences are of interest and may be related to herd size and/or housing systems. Results of bulk tank milk testing are pending and will be presented for comparison. Data from the NDS will be used to identify factors associated with these differences.

■ Provincial Programs

Nine of the 10 Canadian provinces currently have or have had voluntary JD control programs. In most cases, programs were producer initiated (in Québec the program was initiated by the provincial government, but with strong producer support) and are managed by committees with representation from producer groups, provincial governments, universities, milk recording and veterinary associations. Details are shown in Table 1.

Table 1. Canadian Provincial JD Initiatives.

Initiative	Year Initiated / Duration	\$ Invested / \$ to Invest	Initiative Partners
Quebec Voluntary Paratuberculosis Prevention and Control Program	2007 - 2016	\$1.6 M	Government – Academia-Industry
Ontario Johne's Disease Education and Management Assistance Program	2010 - 2014	\$2.4 M	Industry – Academia - Government
Manitoba Johne's Disease Initiative	2010 - 2013	\$175 K	Government - Industry - Academia
Alberta Johne's Disease Initiative	2010 - 2013	\$730 K	Industry – Academia-Government
Atlantic Johne's Disease Initiative ¹	2011 - 2014	\$1.1 M	Government - Academia-Industry
British Columbia Johne's Disease Initiative	2011 – 2013	\$100 K	Government-Industry - Academia
Saskatchewan Johne's Disease Working Group	Periodic meetings	–	Government - Academia – Industry

¹Atlantic Canada includes Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador

All programs have four key elements: 1) education of producers, veterinarians and the public; 2) an on-farm risk assessment administered by a veterinarian; 3) testing (herd and/or cow levels); and 4) applied research. Details can be found on the following websites:

- ▶ Canadian Johne's Disease Initiative: http://www.animalhealth.ca/asp/public/program_id.aspx?languageid=eng&groupid=4
- ▶ Alberta: <http://www.albertajohnes.ca>
- ▶ Atlantic Provinces: <http://www.atlanticjohnes.ca/>
- ▶ Ontario: <http://www.johnes.ca/>
- ▶ Québec: <http://www.mapaq.gouv.qc.ca/fr/Productions/santeanimale/mala-diesanimales/paratuberculose/>

JD control programs have reached >4,700 (>35%) Canadian dairy farms and >60% of dairy veterinarians across Canada (Table 2). Priority on-farm JD risk areas have been identified (calving management, young calf management, and cattle additions) and targeted herd-management changes were implemented on many farms to reduce JD risks.

Table 2. Impact of Regional – Provincial JD Programs

Program	Participating farms (%)	Dairy vets trained # (%)	Herd risk change over time (RAMP score out of 300)
Atlantic	459 (69)	49 (60)	POS herds improved 19 points NEG herds improved 6 points
Quebec	1362 (22)	161 (47*)	N/A
Ontario	2339 (58)	246 (>95)	ALL herds improved 8 points
Manitoba**	~200 (57)	~20	N/A
Saskatchewan	20 (12)	~10	N/A
Alberta	350 (61)	78 (95)	ALL herds improved 16 points
BC	30 (6)	11 (50)	N/A
CANADA	4,759 (>35)	575 (>60)	Reduced risks in herds

(# number; * 95% if indirect training was included; ** estimated; NA not available; ~ approximate)

Education of Producers, Veterinarians and the Public

Education about MAP, including spread and control, is central to all provincial initiatives. Delivery included articles in magazines and journals, presentations at conferences and meetings, as well as novel approaches, such as small group facilitated self-directed learning. Clearly, education is a core element critical to the success and long-term viability of these programs.

On-farm Risk Assessment

The Animal Health Risk Assessment and Management Plan (RAMP) is a questionnaire that guides the herd veterinarian and the producer through a step-by-step assessment of calving, calf raising and hygiene practices associated with promoting calf and cow health, and excellent milk quality. The goal is to identify risk factors, allowing MAP from a shedding cow to infect calves on the farm. After completing the questionnaire (risk assessment), the producer and the veterinarian decide what can and will be done in the next year to mitigate some of the identified risks as part of developing the "management plan". Generally, acceptance of recommendations is good when producers realize that steps taken to reduce new MAP infections will also reduce other calf diseases caused by fecal-orally transmitted pathogens (Barkema et al., 2018). The RAMP is the most uniform component of the provincial programs, at least in part because there is a national standard for the process developed by the CJD technical committee. Each provincial program has adhered to the standard, although the method of delivery varies. Since private veterinary practitioners are conducting these assessments, training becomes an important component of the overall program. Methods used to train veterinarians range from one-on-one training to group training to on-line web-based methods. The proAction Biosecurity risk assessment is based on the JD RAMP.

Testing

Although all Canadian programs have a testing component, the approach and test(s) used vary, as do monetary incentives/subsidies to test. Some programs use environmental testing alone, or in combination with individual-cow testing, whereas others are based solely on individual cow test results. Cow tests in use include milk ELISA, serum ELISA, fecal culture and fecal PCR (e.g. Lavers et al., 2013; Wolf et al., 2014; Laurin et al., 2015; Arango-Sabogal et al., 2017). All testing is done through a provincial or regional diagnostic laboratory or the Dairy Herd Improvement (DHI) milk recording laboratory, all of which are accredited for the tests they provide. However, the way these test results are used by the program and by veterinarians/producers varies among provinces (see program websites for details).

Many dairy producers who participate in these voluntary control programs, and have therefore demonstrated a desire to control JD in their herd, wish to have their efforts recognized. They also want to know how other herds in the country compare, particularly if they want to buy cattle. To meet this demand, most provincial programs have either a status or recognition program. In some cases, the program simply issues a certificate of completion once a herd has met all program requirements, whereas others have a more complex status system that distinguishes among herds and recognizes herds of

different JD risk. Given that cows are frequently sold, and that they move within and between provinces, there is a need to harmonize status programs.

The other major concern among dairy producers is disposition of test-positive cattle. Again, programs vary in how they deal with cattle identified as being test-positive with any approved test method. For instance, in Québec, all producers who wish to access their individual cow test results must sign an affidavit stipulating that they will not sell any test-positive cattle. This restricted animal movement is enforced through a provincial animal traceability program that is currently unique to Québec. Conversely, from 2010 to 2013, Ontario participants who wished to qualify for program funding had to remove all cows found with high titre (HT) tests (based on the milk ELISA test currently in use, a positive test result is >0.1 or greater, whereas a High Titre is >1.0) NOT to another dairy herd or to the food chain within 90 days after the test date. Producers who removed these HT cows as required by the program received \$500 per cow.

Applied Research

All provincial programs also have research activities focused on JD control. Some programs fund research directly from operating budgets, whereas others make program dollars available to researchers for provincial and federal matching fund applications. These research programs are generally coordinated by faculty at the local/provincial veterinary colleges. These researchers gather annually at a relatively informal research conference where findings are shared and new ideas for collaborative research are developed.

■ Lessons Learned

Interpretation of Test Results

Many of the challenges posed by JD and its control relate to the prolonged interval between exposure to MAP and development of clinical disease, as well as the generally poor performance characteristics of tests currently available for identifying infected individuals. As a direct consequence, it is imperative that veterinarians and producers understand the implications and terminology used in discussing JD control (Ritter et al., 2015; Ritter et al., 2017). For instance, there is generally a poor understanding of the difference between a 'test-negative' herd and a 'Johne's free' herd. Perhaps this is not surprising, given that our previous disease control programs focused on Brucellosis and Tuberculosis (TB), diseases with which we have been successful in eradicating with a 'test and cull' strategy. During the active stages of these eradication programs, herds were tested annually and designated 'test-negative' herds if 'free' of disease. That we test herds for JD,

but are not willing to call 'test-negative' herds 'Johne's free' has confused producers and dairy industry advisors (Roche, 2014; Roche et al., 2015). Therefore, there is a clear need to continue to educate all participants regarding this important distinction.

Involvement of Veterinary Practitioners

Involvement and training of veterinarians to deliver the RAMP were critical. Private practitioners gave the program credibility and were instrumental in recruiting herds. RAMP facilitated discussions between the producer and herd veterinarians focused on areas of the farm (e.g. calf pens and calving area) that are frequently ignored. Deficiencies were often easily corrected, representing strategic control of contagious diseases transmitted fecal-orally, including calf diarrhea. The JD control programs provided examples of successfully implementing targeted biosecurity on Canadian dairies.

Differences Among Provincial Programs

Given the current focus on biosecurity in livestock and poultry, JD control programs are proving to be very effective examples of implementation of targeted biosecurity on dairy farms across the country.

One of the most striking differences among the provincial JD programs is the approach to testing. These differences have been noted (see details on program websites). These differences in testing have prompted many discussions among researchers, veterinarians and producers. Despite no 'best' approach, dialogue about various strengths and weaknesses has contributed to an understanding of the limitations of testing in general, and has prompted further collaborative research evaluating tests and test strategies. Probably the biggest lesson that needs to be learned by most dairy producers is that JD cannot be easily eradicated by solely testing and culling test-positive cows. The notion that false-negative test results are common when testing individual animals with milk or serum ELISA, or fecal culture/PCR, is unsettling at best.

Movement of MAP-Positive Cows

A key element continuously emphasized by dairy producer representatives on our management committees is the importance of NOT allowing MAP-infected cows to move freely from one herd (region) to another. Although enforcement of movement restriction is currently limited to Québec, the importance of educating dairy producers who must buy replacement cattle to ask about the health status of potential herd additions (Buyer Beware) needs to be a constant message.

Need for a National Program

Program evaluations demonstrated the extreme importance of a national standardised, simplified, prioritized risk assessment and management practice (i.e. RAMP) process to enable producers and trained herd veterinarians to effectively change management to control JD.

Additionally, there is a need for a national infectious disease herd status program. It is extremely important that a herd status for a certain disease in one province means the same for all provinces. Leaders of provincial JD initiatives have started discussions to make this happen for JD. However, it is important that the same happens for other infectious diseases included in a national biosecurity effort. A status program must be national in scope and developed by farmers for farmers. Leadership from national organizations such as Dairy Farmers of Canada and the national breed associations is needed to move this forward.

Importance of Research Program

Canada's significant advances related to the control of JD over the past decade have primarily resulted from coordination of integral research – education – and program development activities by enthusiastic JD control champions from industry, academia, and the provinces. The CJDI Technical Committee has enabled this forum and the national coordination of JD Program components (research, farm, and laboratory) and standardised approaches for JD program planning/delivery at annual MAP Researchers Meetings since 2008. Results of concurrent research programs have not only led to improvements in JD programs, but due to frequent presentations by graduate students, they have also had an important role in keeping JD as a priority in the mind of Canadian dairy producers and their veterinarians.

Keeping Producers Motivated

The final lesson and challenge regarding JD relates to voluntary participation in the various programs (Sorge et al., 2010; Ritter et al., 2015; Ritter et al., 2017). Given that these programs are producer-initiated and industry led, initial enthusiasm drives uptake in the first year or two, but with time, many programs suffer from decreases in profile, interest and participation. Canadian JD programs voluntarily attracted up to 70% producer participation. How do we reach the remaining herds, which may include a disproportionate number of JD problem herds?

The support of veterinarians and industry staff (DHI testers in Ontario played a key role in reminding producers about testing opportunities) was very important and effective. However, we need to continuously find new ways to keep the program prominent in the minds of producers and to show program

value to not only maintain enrolment but also bring the sceptics and late adopters on board. Extension outreach and farm focus research have been enabled by the JD initiatives.

■ Building on JD - Transitioning to Canadian Biosecurity Initiatives

Recently, Dairy Farmers of Canada (DFC) and the Canadian Food Inspection Agency (CFIA) published two documents on dairy farm biosecurity: Biosecurity for Canadian Dairy Farms: National Standard:

http://www.inspection.gc.ca/DAM/DAM-animals-animaux/STAGING/text-texte/terr_biosec_dairy_standards_1360169547274_eng.pdf

Biosecurity for Canadian Dairy Farms: Producer Planning Guide:

<http://www.inspection.gc.ca/animals/terrestrial-animals/biosecurity/standards-and-principles/producer-guide-dairyfarms/eng/1374262804030/1374262928209>

Additionally, biosecurity is one of the six programs that will be implemented as part of DFC's proAction Initiative:

<http://www.dairyfarmers.ca/what-we-do/programs/the-proaction-initiative-on-farm-excellence>

The proAction initiative was accepted by the board of DFC in June 2013 and will be implemented in the coming years. It was decided that the proAction Initiative will be the same in all Canadian provinces.

Applying successful methods and leveraging the JD Initiative lessons learned may optimise the launch of Canadian dairy farm biosecurity. The Technical Committee enabled positive integration of current science into practical field applications and the resultant delivery of effective, standardised provincial/regional JD control programs. With strong leadership from industry, all veterinary schools, key provincial programs, and the Canadian Food Inspection Agency, substantial progress in JD was achieved in a modest interval. The CJDI Technical Committee strongly supports Dairy Farmers of Canada's proAction and the Biosecurity initiative.

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