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Attitudes of Canadian dairy farmers toward a voluntary Johne's disease control program

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ABSTRACT

The success of Johne's disease (JD) control programs based on risk assessment (RA) depends on producers' compliance with suggested management practices. One objective of this study was to describe the perception of participating Canadian dairy farmers of the impact of JD, the RA process, and suggested management strategies. The second objective was to describe the cost of changes in management practices following the RA. A telephone survey was conducted with 238 dairy farmers in Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia. The producers agreed to participate in this follow-up study after they had been enrolled in an RA-based voluntary JD control program and had tested their herd with the JD milk ELISA test in 2005 to 2007. The majority of farms had no JD test-positive cows and, although some producers thought they had experienced the economic impact of JD, many did not see JD as a current problem for their herd. The majority of producers enrolled in this program because they were concerned that *Mycobacterium avium* ssp. *paratuberculosis* could be perceived by consumers as a cause for Crohn's disease in humans, which could lead to altered purchasing behavior of milk and milk products. Fifty-two farm-specific recommendations had been made after the initial RA. Although the producers generally liked the program and found the recommendations reasonable and feasible, on average only 2 of 6 suggestions made specifically to them were implemented. The recommendation with the highest compliance was culling of JD test-positive cows. The main reasons for noncompliance were that the dairy producer did not believe a change of management practices was necessary or the available barn setting or space did not allow the change. Producers were generally uncomfortable estimating time and monetary expenses for management changes, but found that several suggested management practices actually saved time and money. In addition, 39% of the producers that implemented at least 1 recommendation thought their calf and herd health had improved subsequently. This indicates that the communication of associated benefits needs to be improved to increase the compliance of producers with recommended management practices.
Key words: perception, dairy farmer, Johne's disease, control program

INTRODUCTION

Paratuberculosis or Johne's disease (**JD**) is a slowly progressing, chronic wasting disease of ruminants caused by *Mycobacterium avium* ssp. *paratuberculosis* (**MAP**). In Canada, approximately 30% of farms have at least 2 test-positive cows (Tiwari et al., 2009). In the United States, estimates based on environmental samples suggest that 68% of herds are infected with MAP (NAHMS, 2008). However, the apparent within-herd prevalence seems comparable between Canada and United States, averaging around 2.5 to 5% (USDA, 2005; Tiwari et al., 2008).

Although most infected dairy cows have subclinical infections, the disease can lead to lost revenue as a result of reduced milk production, higher disease susceptibility, and premature culling of infected cows (Tiwari et al., 2008). Besides these farm-level economic effects, the dairy and beef industries could be severely affected if consumers change their purchasing behavior of milk, milk products, and meat based on their perception that MAP might cause Crohn's disease in humans, regardless of whether a causal link has been established. Therefore, the dairy industry is interested in introducing on-farm control programs to minimize the spread of the disease and to proactively work to ensure the trust of the consumer.

Although most cows are subclinically infected with MAP, they can shed the pathogen in their feces, milk, and colostrum. Consequently, around calving time,

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highly susceptible calves are exposed to the pathogen. Unfortunately, available tests have a low sensitivity for detecting subclinically infected animals. Therefore, not all infected and possibly shedding animals are detected. As a result, pure test-and-cull programs are insufficient for eradication of the disease from a farm because some subclinical shedders will go undetected (Kudahl et al., 2008).

Programs based on risk assessment (**RA**) aim to control the disease by modifying high-risk management practices on-farm and to break the infection cycle. The RA consists of a questionnaire that scores the management practices a dairy cow is exposed to during her life. The scores are summarized and the areas with high scores (i.e., high risk) are assessed more closely to identify possible improvements to existing management practices. Although voluntary RA-based control programs have been used in various countries (e.g., Australia and the United States) for years, little is known about their actual effectiveness in preventing the spread of the disease, costs, or practicality on a day-to-day basis in farms beyond demonstration herds (Ferrouillet et al., 2009). Studies from Australia indicated that dairy producers are not necessarily changing their practices as recommended (Wraight et al., 2000; Ridge et al., 2005) after embarking on a risk assessment-based JD prevention program. Clearly, the most crucial component in determining the success of these management-based control programs is the compliance of producers with the suggested management changes. A study from the United Kingdom showed that producers were more willing to change their behavior if they felt that the recommendation was reasonable and practical (Bennett and Cooke, 2005) and that the benefit could outweigh the costs. Cost and benefit can be measured on a monetary or emotional scale (Elahi, 2000). If they do not perceive the benefits as worth pursuing, for example because they find suggested management changes impractical, they were unlikely to modify their behavior, even if an incentive is offered (Bennett and Cooke, 2005). So to improve the success of a voluntary RA program, questions about its practicality or benefits on a day-to-day basis have to be asked and answered. Therefore, the objective of this study was to describe the perception of participating dairy farmers about the effect of JD, the RA process, and suggested management strategies. The second objective was to describe the cost of changes in management practices implemented following the RA.

MATERIALS AND METHODS

In 2005 a voluntary RA-based prevention and control program was introduced to dairy producers in Ontario by CanWest DHI Association and Ontario Ministry of Agriculture, Food and Rural Affairs. Besides the RA, the farmers were asked to test their entire milking herd with a JD milk ELISA test offered by CanWest DHI. Additionally, from 2006 to 2007, the program was extended to dairy farms in Manitoba, Saskatchewan, Alberta, and British Columbia. These provinces were chosen because CanWest DHI offers its services in these provinces. Because of funding constrains for testing, only a limited number of producers (10%) could enroll per province. Ultimately, 627 producers participated in this initial program.

For the current study, only farms that had participated in the initial voluntary JD RA-based control program, tested their entire milking herd, and were still operating were included. Some producers had neglected to test all first-lactation animals. Therefore, to make sure that the producers had tested all first-lactation animals, an additional inclusion criterion that at least 20% of the cows tested for the initial program had to be first-lactation animals was applied. In the end, a total of 499 producers were contacted by mail twice and invited to participate in a follow-up study.

The telephone survey was designed to inquire about the producer's beliefs about JD and their reasons for enrolling in and their perception of this RA program. The questions (n = 17) were the same for all producers and were either open-ended or multiple choice. The main part of the questionnaire was tailored to each farm, consisting of a list of up to 12 different management practices that were suggested to that particular dairy producer based on the previously conducted RA. For each of those suggestions, the producers were asked about their perception of the practicality of this management practice for their farm setting and whether they had implemented the procedure. If they had implemented it, to what extent (e.g., in which percentage of calvings did they remove the calf within 1 h) was it applied and how much had it cost in additional time and money to implement it compared with the previously used method. If they had not implemented the suggestion, they were asked why they had chosen not to do so. The telephone survey was pretested in early 2008 with 14 different persons, including veterinary researchers and farmers as well as dairy producers and veterinarians that had previously participated in a JD prevention program.

About 1 to 2 mo before the telephone contact, the producers were informed by letter about the nature of the questionnaire. The letter included a list of the recommendations that had been made for that specific farm as well as the exact wording of the question that would be asked by telephone regarding the implementation and costs of each suggestion. The producers were then contacted between February 1 and July 1, 2008,

Table 1. Response rate of herds per province based on the number of contacted herds, milk shipping herds, and herds enrolled at CanWest DHI in 2007

Province	n	Dairy herds contacted, n (response rate, %)	Dairy farms		CanWest DHI herds	
			n[1]	In study, %	n[2]	In study, %
Ontario	180	359 (50)	4,352	4.1	3,266	5.5
Manitoba	14	36 (39)	410	3.4	232	6.0
Saskatchewan	10	30 (30)	226	4.4	140	7.1
Alberta	17	34 (50)	638	2.7	481	3.5
British Columbia	17	40 (43)	556	3.1	335	5.1
Total	238	499 (48)	6,182	3.8	4,454	5.3

[1]Canadian Dairy Information Center (2008).
[2]CanWest DHI (2007).

by 1 investigator. One producer decided to drop out of the study after enrolling and another producer was excluded from the study because he could not be contacted despite repeated attempts over that period.

The data set included the responses to the questionnaire as well as production data and JD milk ELISA test results from initial JD prevention project. The data were analyzed using SPSS (version 16.0.1 for Windows, SPSS Inc., Chicago, IL). Open-ended questions could yield multiple answers and, therefore, frequencies of answers could add up to more than the total number of producers surveyed. The prevalence of Johne's disease used for analysis was the apparent prevalence, based on the JD milk ELISA test results of the initial program. The same milk ELISA test was used for all herds enrolled in this study and performed in the same laboratory. The milk ELISA test is estimated to have a sensitivity of 51% and specificity of 99% (Collins et al., 2005). The optical density cutpoints of the test were defined as <0.07 for classification as negative, 0.07 to 0.1 for suspect, and >0.1 for positive. Test results of milk ELISA test-suspect cows were combined with milk ELISA test-positive results to calculate the apparent prevalence. We hypothesized that dairy farmers with milk ELISA test-positive or test-suspect cows were more likely to receive more recommendations and to implement them compared with farmers with test-negative herds. Statistical procedures were mostly descriptive statistics. The recorded variables were not normally distributed. Therefore, comparisons between continuous, categorical, and dichotomous parameters were addressed with either Mann-Whitney U test, Spearman rank correlations, chi-square test of association, or Fisher's exact test where appropriate. The cutpoint for α was set at 0.05.

RESULTS

Response Rate

A total of 238 dairy producers (48% response rate) participated in this study (Table 1). The proportion of JD-negative (60%; n = 142) or positive (40%; n = 96 producers with at least 1 milk ELISA test-suspect or test-positive cow) farms that responded was almost identical to the proportion among the farms originally contacted for this study (62 and 38%, respectively). The distribution of apparent prevalence per province is shown in Table 2.

The study herds averaged 60 milking cows, ranging from 13 to 352 milking cows at the time when the RA was conducted. The average 305-d milk production at that time was 9,528 ± 1,278 kg. Depending on the number of farm-specific suggestions and questions or

Table 2. Johne's disease milk ELISA test characteristics of enrolled herds

Province	n	Herd status[1]		Within-herd apparent prevalence[2]	
		Test-negative, %	Test-positive, %	Min–max, %	Mean ± SD, %
Ontario	180	59	41	0–42.3	2.55 ± 4.9
Manitoba	14	43	57	0–2.9	0.92 ± 1.0
Saskatchewan	10	80	20	0–0.7	0.09 ± 0.2
Alberta	17	71	29	0–6.3	0.96 ± 1.8
British Columbia	17	59	41	0–3.0	0.67 ± 0.9

[1]Test-positive = at least one cow tested positive or suspect using the Johne's disease milk ELISA test.
[2]Because of low numbers of cows classified as suspect, Johne's disease test-positive and test-suspect results were combined and reported as test-positive. Min = minimum; max = maximum.

comments from the producer about JD and the JD program, the survey took between 10 and 50 min (average = 25 min) to complete. The survey was conducted between 7 and 31 mo (mean = 17.6 ± 5.1 mo) after the initial RA had been conducted on farm.

General Comments About JD and JD Program

Most responding producers did not see JD as a problem for their farm (n = 172; 72.3%) at present, which exceeded the number of herds that had a negative herd test (n = 142; 59.7%). Some producers (n = 21; 8.8%) saw JD as a problem that had existed in the past, and 3 producers (1.3%) thought of it as a problem under control. However, when asked why JD is important to them and why they had joined the program, 121 producers said they were concerned about the impact that consumer perception of a link between Crohn's disease and MAP could have on the dairy industry and therefore thought it an important issue for the industry. The next most common concerns were with the overall economic impact that this disease can have on a farm (n = 100), the desire to be proactive (n = 75), the desire to keep JD low in the herd (n = 65), curiosity to see if they had JD (n = 36), or because they saw the program as an opportunity to improve the marketability of their livestock (n = 36). Whereas concern about the link of MAP to Crohn's disease was independent of the JD status of the herd ($P = 0.233$), producers were more likely to mention the economic impact of the disease as reason to join the program if they had JD milk test-positive cows on farm ($P = 0.006$).

Recommendations

A total of 52 different management recommendations were made. Most producers had received 6 ± 2 suggestions (minimum = 1, maxumim = 12) after the RA and found those recommendations reasonable and valid for their farms (61.8%). However, 7 producers (3%) did not find them practical or thought that too many recommendations were made; the number of suggestions made to the latter did not differ from the other producers ($P = 0.674$).

The most commonly made recommendations are listed in Table 3. Despite being provided questions ahead of time, producers were not comfortable estimating the time or monetary input for the changes and provided only crude estimates.

The most commonly made recommendation was to remove the newborn calf from the environment with the dam immediately by either removing the calf as soon as possible to hutches or calf pens (n = 123) or placing the calf in a clean mini pen (e.g., bath tub or

Table 3. Most frequently made recommendations, compliance, main cost factors, and main reasons for noncompliance quoted by producers who received the recommendation

Rank	Recommendation	n	Producer implemented, %	Main costs	Main reason for noncompliance
1	Remove newborn calves quickly from maternity area to individual pens or hutches Or: Separate newborn calf from cow and create a mini pen in maternity pen	123 67	54 21	Labor/time Gates	Unnecessary Remove calf to hutches or pens immediately
2	Collect and feed low-risk colostrum (e.g., of first or second lactation or known Johne's disease test-negative cows)	109	55	Colostrum replacer	Unnecessary
3	Blood test dry cows and cows that were not tested with the milk ELISA test	107	21	Johne's disease tests	Unnecessary
4	Feed low-risk milk to calves	69	39	Milk replacer	Unnecessary
4	Feed more colostrum per calf	69	51		Unnecessary
6	Do not feed nonsaleable milk (waste milk: high SCC, fresh cows, milk from treated cows) to calves	62	24	Milk or milk replacer	Unnecessary; do not want to waste the milk
7	Wash pails and bottles for calves daily with soap and water	60	33	Materials (e.g., soap)	Always did it; unnecessary
8	Visibly identify all Johne's disease test-positive cows and their offspring	58	54	Materials	Unnecessary
9	Give each calf its own pail/bottle (e.g., number on pail and pen)	52	19	Materials (e.g., buckets)	Unnecessary
10	Do not walk through feed or calf pens with manure on boots	48	21		Not practical; unreasonable
11	Do not calve Johne's disease test-positive cows in the same area or pen as Johne's disease test-negative cows	45	33	Culling sick cows	Culled Johne's disease test-positive cow or lack of space

gated corner) in the calving pen so that the dam could lick it dry (n = 67). The farmers preferred to remove the calf from the pen altogether (54% complied) over using the mini pen (21% complied). The attributed additional time was negligible and no monetary costs were incurred for implementation because the farmers said they would have to remove the calf eventually anyway. However, some producers did not comply because they either did not see the need to change their timing of removal of the newborn calf or they liked leaving the calf with the dam for a while because they felt it was better for the general health of the calf.

The second most commonly made recommendation was to feed colostrum only from low-risk cows (either from test-negative cows or first-lactation cows) or to use artificial colostrum (n = 109). More than half of the producers (55%) tried to implement this recommendation and estimated that no additional costs in money or time were associated with this change.

The third recommendation was to blood test the dry cows, which were not tested with the herd milk ELISA test (n = 107). However, only 21% of producers complied and tested their dry cows. Those producers that tested their dry cows found that the associated costs (approximately $15 CAD/cow) were mainly for the test itself and the time spent collecting the samples. Most of the producers decided against testing their dry cows because they did not see the necessity or importance of doing so and were therefore not willing to pay the costs for the testing. This is in accordance with the general observation that most herds (n = 169) did not test again for JD after the RA within the time frame before this follow-up. However, producers with test-positive animals in their herd were more likely to initiate another test (45%) compared with those that did not have test-positive cows (16%; $P < 0.001$).

Compliance

Compliance with the recommendations was fairly low. On average, the producers implemented one-third (median = 33%) of the recommendations made to them. The majority of producers (59.6%) executed either 1 (23.1%), 2 (19.7%), or 3 (16.8%) recommendations (median = 2 recommendations), but 38 producers did not employ any. The percentage of recommendations implemented was correlated with neither the herd size ($P > 0.7$) nor average herd production level ($P > 0.9$). However, the apparent prevalence of the first JD test was positively correlated with the number of suggestions made (r = 0.209; $P = 0.001$) as well as the percentage of recommendations implemented (r = 0.299; $P < 0.001$). If at least 1 recommendation was put into practice, the producers usually (76%) implemented a change within the first month after the RA was completed. The JD herd status could not be linked to the implementation of certain management practices ($P > 0.1$). The only exceptions were that herds with JD test-positive cows were more likely to identify those ($P < 0.001$) and that test-positive herds tended to stop feeding leftover feed to heifers ($P = 0.059$). In addition, the reported implementation of suggested management practices was not affiliated with the time between the RA and the survey.

The recommendations that had the highest compliance (≥75% of producers that received them implemented them) dealt with adding additional bedding to calving areas or freestalls and with identifying JD test-positive cows and their offspring. Whereas the additional bedding was associated with additional costs in time and money, the record keeping and identifying of animals did not appear to have any associated costs for the producers. The recommendation with the highest compliance was the culling of JD test-positive cows. Most producers (89%) said they culled JD test-positive cows after they had received that recommendation. After the initial test, 74 producers had culled milk test-positive cows from their herd because they were test-positive. Most herd owners culled JD test-positive cows (81%) within the same lactation they were tested positive, but the reason for culling was not necessarily JD. Among the other reasons for removal that producers mentioned: "She left for other reasons" (n = 2), "she wasn't a great cow anyway" (n = 1), "I was over quota" (n = 1), or the cow died (n = 2). Additionally, producers were either unable to quantify costs or did not associate any costs with the culling of JD test-positive cows (highest cost named = $0). One farmer elaborated on the estimated $0 that he perceived the JD test-positive cows as sick animals that were expected to be lost to JD shortly anyways and he did not want those cows to "contaminate" the environment with MAP before they would leave the farm.

Five suggestions were not implemented at all. All of those recommendations were made 3 times (except 1, which was made only once) and asked the producer to change the setup of pens (e.g., move gates to avoid contact of heifers <6 mo old with cows) or to split up groups of cows and heifers. The main reasons for noncompliance with these 5 recommendations were the lack of space on farm to do so, followed by the producer's comment that they did not find the recommendation practical for their farm setting and it would cost too much money to make the changes.

For the other 47 recommendations, producers decided against changes to their management practices for other reasons: either they did not find them applicable to their farm setting (n = 45) or they felt they had

always done what was suggested (n = 98). The latter comment was made for 32 of the 52 recommendations. Most of these recommendations were to improve hygiene (e.g., bedding condition in the calving pen) or the management around calving (e.g., remove the calves quickly from their dam), whereas only 5 of these recommendations addressed the handling of JD test-positive or clinical cows. Most producers responded for only 1 recommendation (n = 69) that they had always done what was suggested. However, other producers said this about 2 (n = 18), 3 (n = 6), 4 (n = 2), 5 (n = 1), or even 6 (n = 2) recommendations that were made specifically to them.

On the other hand, almost half of the recommendations (8/18) that the farmers (n = 45) thought not applicable to their farm were recommendations that concentrated on the handling of JD-positive animals. Interestingly, 24 of these 45 producers (53%) never had any JD test-positive or suspect cows in their herd when the recommendations were made or had culled all known JD-positive cows (n = 18) shortly after the first test.

Costs

Although the costs associated with the implementation of recommendations were difficult to estimate, the majority of producers stated that they did not have to spend additional time or money to execute 34 and 32 of the 52 recommendations, respectively.

For some recommendations, the producers felt that they even saved time (n = 2), money (n = 8), or both (n = 2) by implementing the suggested management practices. Four of those recommendations targeted maternity pen management (e.g., faster removal of newborn calves or adding more bedding) and 5 aimed at the improvement of feeding of newborn and preweaned calves (e.g., to feed more colostrum or to avoid feeding waste milk). For example, some producers (n = 2) mentioned that they would actually save money by feeding milk replacer and selling their milk under quota prices. Only 20 producers (8%) indicated that they needed to employ off-farm resources to make any of the changes associated with this JD prevention program.

Challenges and Benefits

The main challenges the producers faced when trying to implement the recommendations were space or barn layout or setup restrictions (n = 61), closely followed by the difficulties of breaking the habit of doing things the "old way" (n = 52), the costs for implementing the changes (n = 39), and limited time (n = 35) or labor (n = 31) availability. Among the other challenges, some producers also mentioned their problems with employee compliance (n = 14) or the lack of perceived value of a change (n = 13).

However, despite those problems, producers (n = 129) also perceived benefits in implementing the advised management practices. The benefits most often noticed were improved herd health (n = 78; 61%), in particular calf health, as well as the positive feeling of being aware of JD (n = 16; 12%) and doing something about it proactively (n = 26; 20%).

Should there ever be a mandatory JD control program, most producers (52%) said they would be willing to share the costs for testing with whoever implemented the program (e.g., government). However, 36% were not willing to pay any contribution to the testing in a mandatory JD control program.

Additional Changes

Although compliance with the recommendations made by their herd veterinarian was generally low, more than half of the producers (n = 137) changed their behavior and management practices beyond the recommendations with at least 1 additional change. The majority of these producers said that they improved the overall cleanliness on their farm (including more bedding or washing of boots more often; n = 78) or that they modified their heifer-rearing management (n = 38) to reduce the contact between the younger animals and the mature milking herd. These additional changes are listed in Table 4.

Interestingly, some producers who made additional changes had either not applied any of the veterinarian's recommendations (12%) or had already implemented more than two-thirds of the recommendations (12%) made to them (up to 6 recommendations had been already implemented).

Comments and Questions from the Producers

The last question of the telephone survey asked the producers if they had any further comments or questions about the study, JD, and the control program. The questions most frequently asked were regarding the test accuracy for JD tests: how test results should be interpreted (n = 40) and whether MAP could cause Crohn's disease (n = 28). Additionally, many producers found that JD was a complicated disease and asked questions about JD in general (n = 14), the prevalence of JD in Canada (n = 13), or the effectiveness of vaccination for the eradication of the disease on farms (n = 3). They would like to see more education of producers about this disease (n = 6) and a top 10 list of manage-

Table 4. Additional voluntary management changes, beyond the recommendations made by the herd veterinarian, as reported by 137 producers participating in the Johne's disease prevention program

Management change	n
Improved on-farm hygiene	
General on-farm cleanliness improved	33
Maternity pen cleaned more often	13
More bedding added	10
Boots washed more often	7
Cleaning more often	6
More aware of own behavior	11
Building of a new barn or maternity pen	12
Separation of equipment for feeding and manure handling	6
Calf management	
Calves removed more quickly from maternity pen	19
Change in feeding of calves (e.g., switch to milk replacer)	11
Change in colostrum management	9
Started the use of hutches	2
Heifers sent to a custom heifer raiser	1
Johne's disease	
Testing for Johne's disease more and routinely now	8
More aware of Johne's disease and Johne's disease-positive cows	9
Asking now about Johne's disease status when buying animals	4
Stopped buying animals/closed the herd	3
Stopped spreading manure on hayfields	2
Other general changes	
Cows culled more quickly	4
Changed the setup of groups	7
Improved record keeping	2
Other	4

ment procedures that could help to reduce or prevent JD on farms (n = 3).

Furthermore, producers commented that they appreciated that research about JD was conducted (n = 26) and they would like to see a mandatory JD program established in Canada (n = 33). Whether a mandatory JD control program would come to Canada was also among the questions (n = 7). Also, some producers seemed to like the program (n = 15) and some producers found it made too much additional work (n = 3) or did not see JD a disease that needed to be addressed as a priority (n = 7).

DISCUSSION

The producers who enrolled in this study may have differed from other dairy producers in Canada because they voluntarily enrolled not only in the first part of the JD prevention program but also in this follow-up study and had to meet the inclusion criteria. However, the average size and annual milk production of the herds in this study are fairly similar to that of all dairy herds in Canada (Canadian Dairy Information Center, 2008) and therefore the enrolled producers are at least similar in that respect to producers in the target population. A cautious interpretation of presented results is warranted because the participating producers likely represent producers that are very interested in JD prevention and that actively chose to participate. Therefore, it can be hypothesized that nonparticipants might be less informed about JD and possibly even see less need to change management practices voluntarily.

Nevertheless, the fairly high response rate indicated that JD seems to be on the mind of many dairy producers because the contacted producers responded almost equally among all 5 provinces and the proportion of positive and negative herds remained almost identical to the initial control program. Also, the high percentage of participants in this follow-up study that previously had a negative herd test might indicate that participation was mainly driven by the concern of producers that MAP might some day be perceived as linked to Crohn's disease in humans and could result in a reduced demand for retail dairy products. Although many producers had personally experienced the negative economic impact of JD on dairy farms or had test-positive herds, they rarely saw it as a problem for their dairy herd currently. The enrolled producers wanted to be proactive before JD posed a problem for their farm. They therefore welcomed the program and the continued research on JD. This generally positive perception of the program was previously observed by Groenendaal and Wolf (2008) in a survey of dairy producers in Michigan.

Overall, the producers found that the recommendations made by their herd veterinarian were principally reasonable and feasible. However, it can be assumed

that some veterinarians simply made too many recommendations at once. Given that producers implemented, on average, only 2 recommendations, more recommendations seem to discourage and overwhelm producers. With the high number of recommendations, they were most likely unable to implement all of them at once and were also not able to distinguish between most important and less important recommendations. In addition, some recommendations discouraged the producers because they would have required a major change in farm setup or change was generally limited by restrictions in available space and facilities. The latter was one of the biggest challenges that hindered producers from implementing recommendations. Similar observations were made by Jonsson and Matschuss (1998). They found that high costs associated with the installation of necessary facilities for a tick-control program in Australia stopped producers from implementing tick control on farms.

In addition, many producers found that they had always been doing what was suggested or that the recommendation was not applicable to them. Two different possible explanations could apply: 1) the producers were mixing up the time frame of when they started with the management practice (i.e., recall bias), or 2) the communication from the veterinarian to the producer about their observation/expectations were unclear. In either case, veterinarians need to be even more precise when making herd-specific recommendations to avoid miscommunication that will lead to noncompliance.

The main reason producers did not comply with recommended management practices was that they perceived a change as unnecessary, followed by the challenges to implement the suggestion in a given barn setting. This is similar to what was reported by Lue et al. (2008) and Jonsson and Matschoss (1998). They found that the perceived lack of necessity was the main reason animal owners did not comply with treatment recommendations. According to Lue et al. (2008), the skill of the veterinarian in communicating the reasons for a procedure was crucial for the implementation of treatments in pets. Therefore, the communication of what is recommended and the reasoning behind its importance has to be improved to increase compliance. Especially in herds that have no JD test-positive or clinical cows, the veterinarian should turn the producer's attention to expected benefits or downfalls beyond JD (e.g., effect on other calf diseases and calf health. Otherwise, producers will not understand and agree with the necessity to modify their management practices, nor perceive any benefits from change.

The inconvenience of breaking a habit seems to hinder producers from changing, again most likely because they do not expect to see any obvious benefits from the change. With risk-averse behavior they are avoiding management changes with unknown outcome (Willock et al., 1999). In this study, most dairy herds had either no or very few JD test-positive animals and again did not see JD as a problem for their herd currently. It can be assumed that they felt safe after they had culled the JD test-positive cows from their herds. This notion is supported by the fact that many farmers with test-positive herds did not implement other suggested management changes because they did not see the need to do so after removing the test-positive cow.

However, it is interesting that they still implemented on average 2 of 6 recommendations, and that about half of the producers also changed other management practices to make improvements beyond the recommendations made to them. It is not surprising that they generally seemed to choose the management practices that were easy to implement, those that had an immediate visual effect (e.g., more bedding or cleaning of stalls), or those that were not associated with high costs. Yet, a major limiting factor of this study was the description of costs attributable to changing management practices. Although attempts had been made to prepare producers for these questions by providing the dairy producers with the questionnaire and the recommendations before the telephone survey as a reminder, most producers struggled to name the time and monetary costs associated with certain management practices. However, if management practices were associated with quantifiable attributes (e.g., bales of straw or new facilities), they could name the costs. Overall, costs associated with the implementation of a particular management practice seemed to be a less important reason for following recommendations. More than two-thirds of the implemented recommendations were not associated with additional costs. Like in the study of Lue et al. (2008), it appeared that the perceived value of a management practice or change drove compliance more than the actual costs.

This can also be seen in the distribution of herds that did further testing for JD after the RA. Producers that had JD test-positive cows were more likely to have experienced the negative economic impact of the disease on their farm. Hence, they were also more likely to invest in further testing of their herd. On the other hand, farmers that did not have JD test-positive cows were less likely to retest their herd. To them the expense of testing did not seem to be worth the benefit of monitoring the JD herd status. A factor that could have contributed to this perception is the fact that many producers were insecure about the interpretation of JD test results, as indicated by their focus in questions.

It is interesting that producers indicated they would be willing to pay an incentive if a mandatory program

were established. It may be that producers were assuming that a mandatory program would imply that a real problem exists, which would increase the necessity and pressure to change.

Based on the questions that were asked at the end of the survey, it became clear that educational efforts should focus on improving the producers' knowledge of the disease, its possible effects on the herd, and, mostly, on the interpretation of test results.

CONCLUSIONS

Although the interviewed dairy producers saw JD as an important issue for the dairy industry, most did not see it as a problem on their farm. They generally regarded the recommendations made to them as reasonable and logical best management practices but were unaware of possible additional, associated benefits for their herd health beyond JD prevention. In the authors' opinion, to become a successful and implemented program, veterinarians need to describe to producers the added positive benefits of the recommended best management practices suggested as part of JD prevention. Better communication will lead to an improved adaptation of suggested management practices by participating dairy producers.

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