Investigating the dynamics of Johne's disease on Ontario Dairy farms

Jamie Imada, David Kelton, Steven Roche, Cathy Bauman
Department of Population Medicine, OVC, Guelph ON

Background

Johne's disease is an untreatable chronic progressive diarrhea disease caused by Mycobacterium avium subspecies paratuberculosis (MAP). The most frequent mode of transmission is through the fecal oral route. Typically young calves are infected but do not become clinical until 2 to 10 years of age. Most on farm Johne's control programs involve a test and cull approach along with risk assessments and management plans. The risk assessments are meant to identify high risk factors such as cattle purchase and exposure of young stock to mature cow manure in attempts to alter management and mitigate risk. Apart from the economic impact of Johne's, there has also been links to MAP and human autoimmune disease like type 1 diabetes and Crohn's. In 2013, the province of Ontario had a voluntary Johne's control program that consisted of whole herd testing by milk or serum ELISA with subsequent removal of high titre cows as well a risk assessment conducted by the herd veterinarian.

Methods

Bulk tank samples from all Ontario dairy farms were collected in 2013 at the end of the voluntary control program and again in 2017. Samples were tested at DHI laboratories with a hyper ELISA (modified ELISA technique). Samples from both years were dichotomized into herds that participated in the Ontario Johne's project and those that opted out. The test results were further categorized into 4 groups: Bulk tanks (BT) that had high ELISA titer in both 2013 and 2017, BT's that remained low in the two testing years, BT's that changed from low to high and BT's that changed from high to low. Score and risk assessment results from the herds that participated in the control program were matched to BT test results and put into a multivariable logistic model.

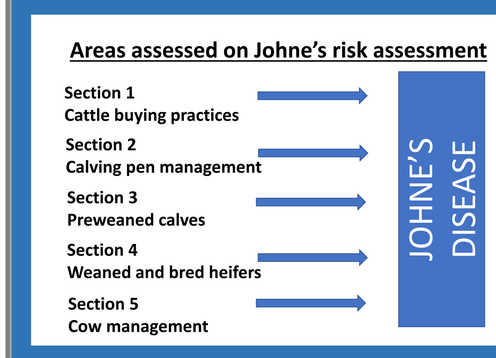
Results

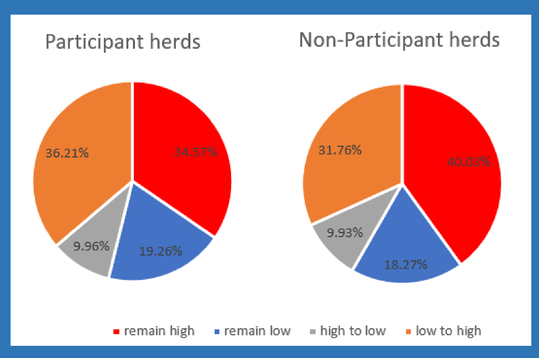
Hyper ELISA results indicate that 71.4% of BT samples tested positive (high) in 2017 compared to 46.8% in 2013. Logistic models of the data show that herds that tested low in 2013 had a decreased odds of testing high in 2017 if they had <10% of calves nursing their dams or if they had no prior history of a Johne's test and an increased odds of testing high if they had a high score on section 4 of their risk assessment. High ELISA herds in 2013 had an increased odds of testing low if their cows had manure present on their legs but not above their declaws or on their udders, or if there was no prior history of a Johne's test.

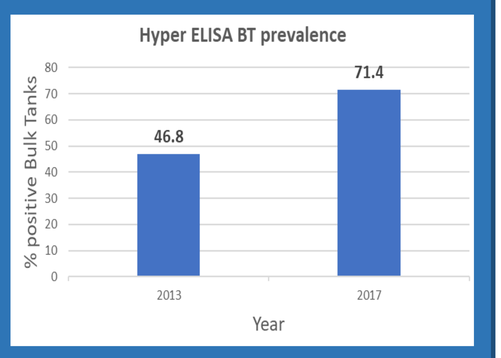
Discussion and Conclusion

The Johne's risk assessment used in the Ontario Johne's program had 38 questions which evaluated 5 different management areas to characterize herd Johne's risk. It is believed that young animals under 6 months of age are most at risk to infection from MAP. The Johne's risk assessments has questions meant to establish the risk surrounding calving, calf cleanliness, and calf health management. It also aims to investigate the cattle purchasing behavior to highlight risks in bringing in Johne's to the farm. Due to the long latent period of the disease, changes surrounding calf management aren't likely to see an effect in Johne's disease status until 4-6 years later. The logistic models that were made using 2013 risk assessments and 2013, 2017 BT test results did not have many significant predictors. The temporality of the answers contained in the risk assessments likely presents a challenge in their usefulness as predictors of a herds future Johne's status. The current results suggest that to fully understand a herd's disease risk it is important to have their most current up to date practices, as such, frequent risk assessments are required to ensure dairy advisors and veterinarians can make appropriate recommendations for management changes.

Johne's control requires frequent risk assessments for appropriate adjustments to farm management practices







71.4% test positive (3581 herds) compared to 46.8% in 2013 (3908 herds)

Using 0.089 as our ELISA cut-off

	2013		2017	
	Participants	Non-participants	Participants	Non-participants
Positive hyper ELISA	960/2161 (44.4%)	868/1747 (49.7%)	1294/1828 (70.8%)	1263/1753 (72.0%)

- Using 2013 test data we have 3207 matched samples
  - 1828 farms were participants in the Johne's Education and Management program

Status	Participants	Non-participants
High to low	10.0% (182)	9.9% (137)
Remain high	34.6% (632)	40.0% (552)
Low to high	36.2% (662)	31.8% (438)
Remain low	19.3% (352)	18.3% (252)
	1828	1379

- Of the farms with matched samples, 1786 had RAMPs results

Final models- results for subsequent BTM tests

2013 Low prevalence herds:
- **Decreased odds** of testing **high** if they had **no prior history of a Johne's test:** (OR= 0.53, p value=0.02)
- **Decreased odds** of testing **high** if they had **<10% of calves nursing their dams** (OR= 0.61, p value= 0.047)
- **Increased odds** of testing **high** if they if they have **a high score on section 4** (OR=3.08, p value=0.01)

2013 High prevalence herds:
- **Increased odds** of testing **low** if cows had **manure present on legs but not above their dewclaws and not on teats/udder** (OR= 2.78, p value= 0.004)
- **Increased odds** of testing **low** if there was **no prior history of a Johne's test:** (OR=2.42, p value=0.04)

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