Northern New York Agriculture Development Program
2020 Project Report

Determining the Enteropathogens Causing Neonatal Diarrhea and The Association with Antibiotic Usage on NNY Dairy Farms

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Cooperating Producers:
- 16 dairy farms in Jefferson, Lewis, St. Lawrence, Franklin, and Clinton counties

Background:
Neonatal diarrhea, or scours, is reported to be one of the two biggest challenges on U.S. dairy farms and is the leading cause of pre-weaned heifer death according to the 2014 National Animal Health Monitoring System (NAHMS) Dairy Health and Management Report.

Previously, a 2017 Northern New York Agricultural Development Program research project titled "Calf Health Treatment Protocols, Compliance and Economic Impact on NNY Dairy Farms" indicated that calves between the ages of 8 and 31 days were most commonly treated with antibiotics for diarrhea.

Diarrhea can be caused by a variety of different enteropathogens, including bacteria, viruses, and protozoa. In some cases, multiple agents can be responsible for causing diarrhea. Identification of the diarrhea-associated pathogen(s) can be difficult to achieve on-farm yet many producers routinely make the decision to treat affected calves with antibiotics without identification of the responsible pathogen.

Broad-spectrum antibiotics have proven to be an effective treatment plan for calves affected by bacterial diarrhea; however, antibiotics will not treat viral, protozoal, or parasitic agents. Antibiotic treatment of viral, protozoal, or parasitic diarrhea is not only an ineffective and unnecessary cost to the farm, but also may increase the chance of antibiotic resistance on-farm.

Additionally, recent research has demonstrated that milk production in the first lactation was not different between cows that as calves had had diarrhea and those that had not. However, if as calves they were treated with antibiotics, those cows produced more than 1,000 lb. less milk during their first lactation compared to cows that as calves were not treated with antibiotics (Soberon, 2012).

All of this information highlights the importance of disease and antibiotic management for calves. Furthermore, previous studies have observed that bacteria account for only 30% of diarrheic calves, yet the NAHMS 2011 report indicates that more than 87% of diarrheic calves are treated with antibiotics. Taken together, this suggests that there is a huge opportunity to minimize antibiotic use for diarrheic calves.

Research conducted in 2019 in Northern NY (NNY) confirmed that the most common use for antibiotics on-farm was for the treatment of diarrheic calves. On the other hand, it is universally recommended that free choice water provision and electrolyte therapy are beneficial for supportive care of calves with diarrhea. Therefore, it is important to characterize how often each of these practices (antibiotic use and water and electrolyte therapy) are part of normal calf management and if there is opportunity to more efficiently apply these practices on NNY farms. Over the past decade, considerable focus has been placed on antibiotic use in production animals with a heavy focus on antibiotic resistance. It is important to note that the aim of this research was not to discredit the efficacy of antibiotic treatment or to suggest that antibiotics should not be used for diarrheic calves. Rather, the objective of this research was to identify an opportunity to minimize antibiotic use in situations where the animal will not benefit from the antibiotic. A further goal was to understand additional forms of supportive care, including electrolyte therapy and providing ad libitum water access, that can be offered to calves that have diarrhea.

METHODS:
Selection of Farms
Dairy farms across the six-county NNY region were contacted in various ways to enroll in this study, including in-person farm visits, phone calls, advertisement in the Cornell Cooperative Extension (CCE) North Country Ag Advisor newsletter, through local CCE County staff, and through herd veterinarians. From these methods, a total of 16 dairy farms across five counties were enrolled and agreed to collect fecal samples from diarrheic calves that were treated with antibiotics. Participating dairies were notified that their farm-specific information and results would be kept confidential.

The participating dairy farms included both tie-stall and freestall housing systems for the mature herd. Herd size ranged from 50 to more than 1,000 milking cows. Herds were selected based on the criteria that they treat calves that have diarrhea with antibiotics. Over the course of 9 months, fecal samples were taken from diarrheic calves prior to antibiotic treatment. The criteria used to

identify calves with diarrhea and the decision to administer antibiotics to a calf was solely at the discretion of the farm and was not influenced by the investigators.

Sampling Process
Due to the COVID-19 pandemic, the research team limited contact with the participating farms and asked the farms to collect samples and information themselves. As a result, the number of participating farms was less than originally proposed because the research team was unable to assist with collection of samples. However, we feel that the farms included do represent farms from NNY and their management of calves.

All fecal samples were shipped to the Wisconsin Veterinary Diagnostic Lab in Madison, Wisconsin, for analysis. The lab used polymerase chain reaction (PCR) techniques to determine the presence of various pathogens in the fecal sample. Pathogens eligible to be detected included: *E. Coli Intimin, E. Coli K99, Salmonella,* Cryptosporidium, Coronavirus, and Rotavirus. If *Salmonella* was detected, the samples underwent further diagnostic testing to determine the specific isolate. Participating dairies were sent a copy of their farm-specific results. If a farm was experiencing a diarrhea outbreak, they were invited to submit samples from non-treated calves to assist with troubleshooting efforts.

Results:
Overall, 90 fecal samples were collected and submitted for diagnostic testing. Of those 90 samples, 72 were from calves that were treated with antibiotics, and 18 were from calves not treated with antibiotics.

The prevalence of pathogens infecting neonatal calves was variable across the region (Figure 1). The most prevalent pathogen across farms was Rotavirus, with 61.1% of calves sampled testing positive. The least common pathogen was *Salmonella* with only 5.6% of calves sampled testing positive. The Salmonella isolates included *Salmonella muenster* and *Salmonella kiambu*.

Interestingly, of the calves that were sampled and treated with antibiotics (n=72), only 33% of those calves required antibiotic treatment based on the identified pathogen, i.e., bacterial species (Figure 2). However, this assumes that all cases of *E. Coli and Salmonella* were suitable candidates for antibiotic treatment, which is not necessarily the case. Out of all the calves sampled (n=90), 89.6% had free choice access to water, and approximately 61.7% were administered electrolytes (Figure 3). It is promising to see that a majority of calves had access to supportive therapy (water and electrolytes) as it is such a cost-effective strategy.

It is important to note that farms that treated diarrheic calves with antibiotics were specifically targeted for this project. This introduces a bias to the results that warrants consideration. The purpose of this research project was to identify an opportunity to reduce antibiotic usage for diarrheic calves; to accomplish this only farms that currently treat diarrheic calves with antibiotics were enrolled.
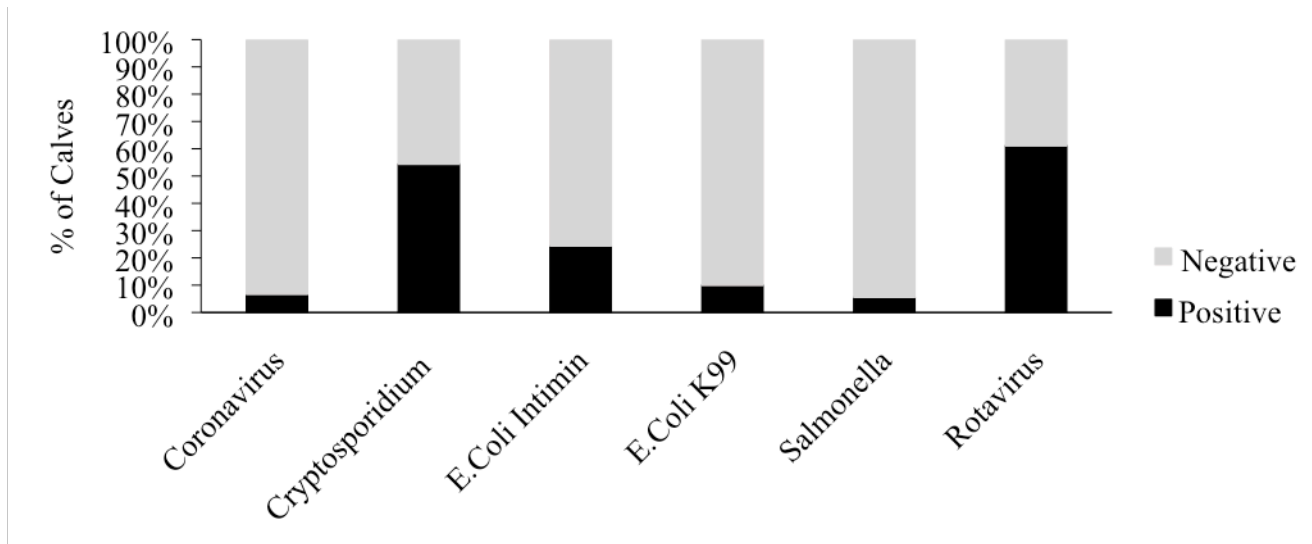
Figure 1. Prevalence of various pathogens infecting neonatal calves on NNY dairy farms, NNYADP project, 2020.
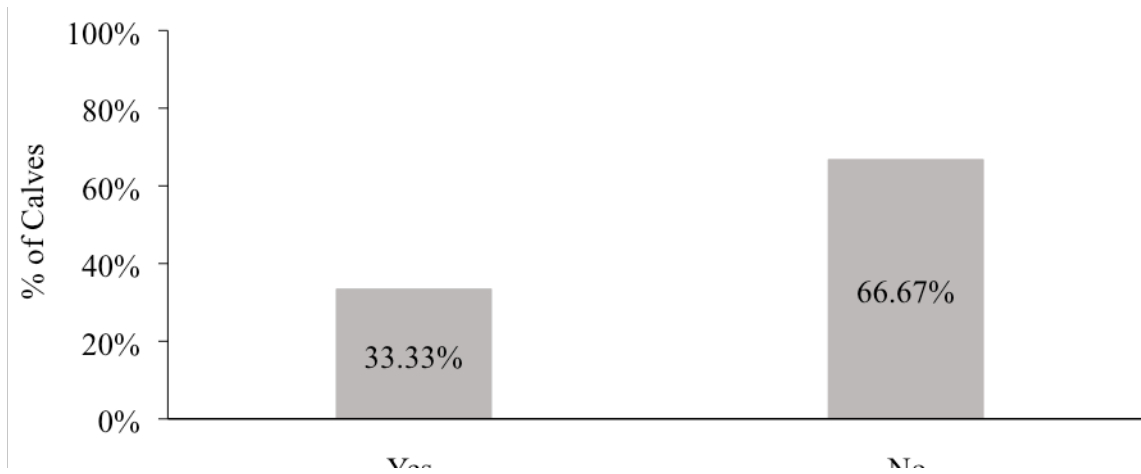

Figure 2. Percentage (%) of calves sampled and treated that required antibiotic treatment based on pathogen identified in the fecal sample, NNYADP project, 2020.
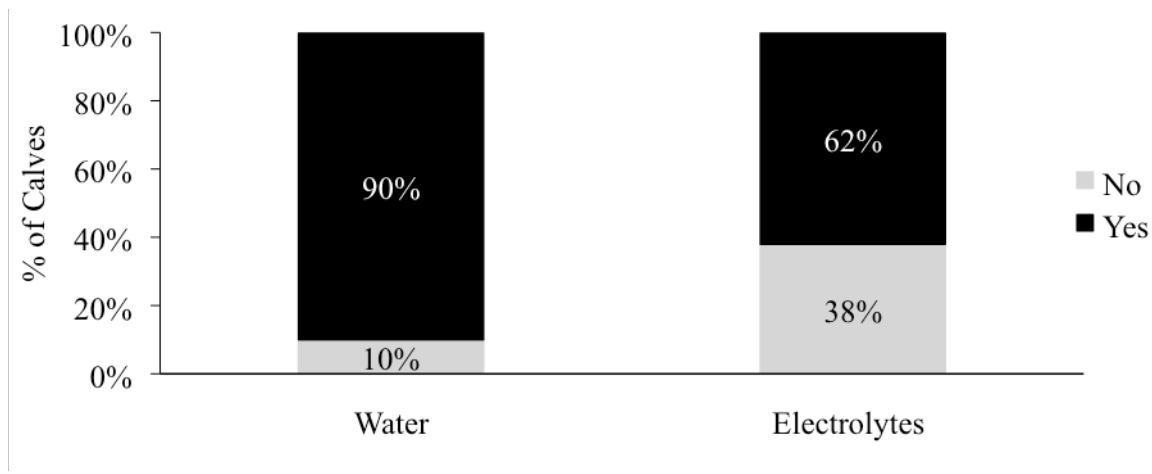
Figure 3. Water and electrolyte administration for diarrheic neonatal calves on participating NNY dairy farms, NNYADP project, 2020.

Conclusions/Outcomes/Impacts:

The goal of this project was to determine the main enteropathogens that contribute to neonatal diarrhea in dairy calves and to associate them with antibiotic usage on NNY dairy farms, as well as to determine the frequency of electrolyte usage and free choice water access as a supportive therapy for diarrheic calves.

Overall, it was impactful to determine the frequency of potentially unnecessary antibiotic usage for diarrheic calves on the participating NNY dairy farms. Antibiotic usage in agriculture is a topic that has received attention over the past several years as consumers are becoming more aware, and concerned, about antibiotic resistance. Recently, Wemette et al. (2021) surveyed 1,000 U.S. citizens on their perceptions of antibiotic usage in the dairy industry. Of those that responded, 90.7% reported that "antibiotic usage on dairy farms pose some level of threat to human health" and 71.5% reported that "they would be willing to pay more for milk produced from cows raised without antibiotics" (Wemette et al., 2021). These findings highlight the importance for dairy farmers to improve their antibiotic stewardship and present an opportunity for herds to continue to work with their veterinarians on treatment protocol options for calves with diarrhea.

Overall, the results of the study of the frequency of electrolyte usage and water provision for diarrheic calves are promising as 89.6% of calves had free choice access to water, and 61.7% were given electrolytes. Dairy producers should be reminded that water provision starting at 3 days of age is now a mandatory requirement according to the FARM 4.0 requirements. Furthermore, pre-weaned calves given free choice water from birth may be able to achieve higher body weight gains compared to calves offered water later (i.e., 17 days of age) in life (Wickramasinghe et al., 2018). This highlights the importance of water provision very early in life. Additionally, keeping calves hydrated using electrolytes is a very cost-effective and efficient way of helping calves to recover from a case of infectious diarrhea. One critical component of electrolyte administration is to first understand the level of dehydration that calves are experiencing so that calves are supplemented with the appropriate amounts, at the right time. For assistance, farmers are advised to contact their farm veterinarian or CCE dairy specialist.

Preliminary results from this study were presented at Cornell Cooperative Extension North Country Regional Ag Team's Virtual Dairy Day Program in early January 2021. Audience response questions were integrated into the presentation. When asked if participants currently treat diarrhea with antibiotics, 19% of respondents said "never", 50% said "very rarely", 25% said "often", 6% said "almost always", and 0% said "always". At the end of the presentation, participants were asked if their views or motives on antibiotic usage changed upon learning the results of this trial. Of those that responded, 56% said "yes", 31% said "maybe", and only 12% said "no". These are promising results as the dairy industry moves forward on the topic of antibiotic stewardship.

Lastly, while the information collected in this study was helpful in characterizing the issue of antibiotic usage in calves with diarrhea on NNY dairy farms, it did not address the problem that producers do not have a consistent and reliable way of identifying the enteropathogen(s) causing diarrhea at the calf level as a way to determine if a calf is a suitable candidate for antibiotic treatment. There is a need for future research to focus on validating calf-side diagnostic tests so that producers can readily access the information necessary for making appropriately-targeted treatment decisions in real-time.

Overall, the results from this research project suggest an opportunity for NNY dairy herds to improve their antibiotic stewardship as well as an opportunity for farms to improve their supportive fluid therapy protocols.

Outreach:
- The results of this project were presented at the CCE NCRAT Virtual Dairy Day: January 13–15, 2021; and the Quality Milk Production Service's Milk Quality Meeting, February 8, 2021.
- Each participating farm received a project report summarizing the project data and their farm-specific data.
- A newsletter article will be published in one of the Spring 2020 editions of the CCE North Country Ag Advisor newsletter.
- A recording of the presentation highlighting the results will be posted to the CCE North Country Regional Ag Team YouTube page and linked on the NNYADP website at www.nnyagdev.org.

Next Steps:
- Review project data and farm-specific results with each participating farm.
- Collaborate with a company to help validate a calf-side diagnostic test for the specific pathogenic cause of diarrhea.
- Continue educating producers on good antibiotic stewardship and on the importance of supportive therapies when dealing with calf diarrhea.

Acknowledgements:

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