

Northern New York Agricultural Development Program 2021 Project Report

Assessing the Effect of E-Learning Training Systems on Milk Quality and Dairy Parlor Performance: Phase III — E-learning Training Systems as an Educational Approach for Dairy Farm Workers and the Effects on Milk Quality and Prudent Antimicrobial Use: Proper Sampling and Treatment Technique

Project Leaders:

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Collaborators:

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- Michael Zurakowski, DVM; Senior Extension Associate, QMPS Cobleskill Laboratory
- 15 dairy farms in Northern New York (Table 1.)

Table 1. Cooperating Producers; E-learning Training Systems as an Educational Approach for Dairy Farm Workers and its Effects on Milk Quality and Prudent Antimicrobial Use, NNYADP, 2021.

Jefferson County	St. Lawrence County	Lewis County	Clinton County
Doubledale Farm	C & M Farm	Moserdale Farm	Carter Farm
Goodnough Farm	Gebarten Acres	Kennell Farm	Rusty Creek Farm
Hillcrest Dairy	Kelly Farm	Silvery Falls Farm	Remillard Farm
Morning Star	McKnight River Br. Farm		
North Harbor Dairy			

Background:

Maintaining high milk quality standards depends on dairy employees and remains a constant need for many dairy farms mainly due to insufficiently trained work teams. There is no doubt that strategic management of human capital is a necessity in any business type and can lead to ongoing successes. However, access to strategic and focused training is a challenge in today's dairy industry. This has been especially true over the last year of COVID-19 related challenges that have severely limited in-person training events. Technology has helped by providing access

in more remote areas; however, the use of technology in this way is still emerging and focused tools that are targeted with the correct audience in mind are needed to help fill this gap.

Based on the most recent USDA–APHIS report, less than 60% of the milkers among all the dairies in the USA received any kind of training (USDA National Agricultural Statistics, 2014). In most cases, the native language of milkers is not English and, in some cases, the literacy level in their native language is limited (Maloney et al., 2016), leading to higher worker turnover on dairy farms (Durst et al., 2018). Most milkers and herdspersons are trained on the job by a colleague, who may have similar limitations in communication. Two recently published studies showed that employers underestimate the employees' interest in learning and commitment to the success of the farm (Durst et al., 2018) and that the lack of training or training materials has detrimental impacts on employee recruitment and retention (Moore et al., 2020).

Even though there are several services and opportunities to provide on-farm training in the herdsperson's native language, it is not possible to have these services there at all times when new employees may need them. Through Northern New York Agriculture Development Program (NNYADP) funding, we have been able to design, develop, and test an E-learning system to help educate milkers in an easy-to-follow format that could be used on the first day of work as part of onboarding, as ongoing training, or as a refresher. Our Phase I and II of the NNYADP-funded Assessing the Effect of E-Learning Training Systems on Milk Quality and Dairy Parlor Performance project, initiated in 2019, focused on milkers, specifically in the areas of milking routine and milking equipment training, identified by farms as high priority areas. The initial modules have been well received (see the NNYADP www.nnyagdev.org website About: Projects by Year tab for more details on Phases I and II).

During this start-up work and our normal QMPS services, we realized that another significant area of need on dairy farms is training for personnel who collect aseptic milk samples for culture and perform treatment techniques as warranted by the culture results. Depending on the farm, the personnel with this responsibility can be milkers and/or herdspersons. Many of these personnel have only received cursory training in these areas. That minimal level of training can have a significantly negative impact on udder health and inappropriate antibiotic use. For example, poor milk sample collection technique can lead to erroneous or useless results in applying a proper treatment protocol based on the pathogen identified. Poor treatment technique can also lead to the introduction of environmental pathogens that in some cases can cause additional mastitis cases, which affect the cow's immediate and long-term health or cause the death of the animal.

For the past few years, QMPS has been implementing pathogen-based treatment of clinical mastitis on dairies in the region along with the farm's herd veterinarian. This concept of only treating cases where antibiotics are likely to help and not treating ones that will most likely self-cure has resulted in farms decreasing antibiotic use in the treatment of clinical mastitis by more than 50% while not hurting animal health or production outcomes and making it more cost effective for the farm (Vasquez et al., 2016). This whole process and its benefits, though, rely heavily on proper sample collection. Furthermore, success is based on proper treatment technique and proper assessment of when a cow can be returned to the saleable milk pen.

QMPS has also been exploring selective dry cow therapy in which we have shown in some initial trials that farms can selectively treat cows according to data-based algorithms and decrease antibiotic use by more than 50% without hurting cow health and still improving the financial

performance of the farm (Vasquez et al., 2018). One of the crucial components of this process is that proper, i.e., absolutely hygienic, dry cow treatment technique is performed, especially in the case where only internal teat sealants are administered.

The main goal of this 2020-2021 NNYADP-funded pilot project is to provide dairy farms with a proven training tool that will result in more skilled dairy workers as demonstrated by better adherence to sampling procedures and treatment techniques. In consequence, cow health should be improved and antibiotic drug use decreased. This NNYADP-funded e-learning development and testing research was conducted on 15 commercial dairy farms across four counties in NNY (Table 1) between August 2021 and January 2022.

Methods:

Development of E-learning Modules on the LMS System

Over a nine-month period in 2021, we developed and designed an interactive online training course using the Visme platform[©] as an authoring tool. Our goal was to keep the course simple and concise in order to train farm employees to correctly execute five common, but highly relevant, tasks related to dairy animal health and prudent antibiotic use. The five modules were: 1) Collecting an aseptic milk sample, 2) Administering intramammary treatment, 3) Deciding on saleable milk, 4) Treating a cow at dry-off, and 5) Administering teat sealants.

Each module is arranged in three sections with color-coded titles of: 1) What do I need? (green), 2) How do I do it? (blue), and 3) Why is it important? (orange). Individual slides have a few lines of text and either a picture or embedded video to further clarify the point. Navigation is by arrows at the bottom of the screen and includes a "Menu" button to return to the home screen. For a few words within some of the modules that might not be familiar to the user, we created a pop-up definition that could be accessed by clicking on the word.

We developed a landing page at: <u>https://www.dairyroutines.com/</u> where the participant can choose either English or Spanish and then select the individual module that they want to complete. We also created a QR code to make the log-in simpler for cellphone users. Based on our Phases I and II experience with some participants being illiterate, all modules have the option to watch a video in which the text is read to participants as the slides are advanced.

In addition, we inserted three knowledge-check multiple choice questions at the end of each module to gauge how well the participant understood the main concepts. An example question is: "Paolo is ready to disinfect the teat ends prior to administering dry cow intramammary antibiotics. The order that he should disinfect teats in is" followed by four choices from which the participant can select. See Appendix 1 for screen shots from the course.

Baseline Survey and Pre-Training Assessment

For each of the cooperating farms, we first performed an extension survey, which consisted of an assessment in the following areas:

- 1) Equipment working order analysis involving average claw vacuum, milk line vacuum during milking, and graphing all pulsators,
- 2) Milker assessment including: milking routine timing, milk flow rate analysis, unit alignment scoring, teat end cleanliness scoring, and dip coverage, and
- 3) Cow assessment involving teat scoring, strip yields, and udder hygiene scoring.

This baseline survey assessed the opportunity areas for the farms to reduce the risk of mastitis and identify bottlenecks that might impede employee performance. For each farm we prioritized our recommendations and then only looked at the top three priorities.

A pre-training assessment of individual employees was performed at the time of the baseline survey or shortly thereafter. This consisted of using an objective-structured clinical examination (OSCE) (see Appendix Figure 5 for scoring template) and scoring all employees by watching them perform the dry-off procedure. All employees were scored with two OSCEs: 1) treating a cow at dry-off and 2) administering internal teat sealant or external teat sealant depending on the farm protocol.

The OSCEs consisted of a checklist of 15 statements and were weighted with either one or two points based on how critical the statement was to the procedure. A total of 20 points was possible for each OSCE. If possible, all employees were scored performing the procedure on two cows. An example of a statement from the OSCE weighted with 2 points is: "Milker prevents the tip of the tube from touching any surface." See Appendix 1 for the complete OSCE form for treating a cow at dry-off.

On-Farm Training Using the E-learning Course

The training visit for this e-learning tool was performed as a one-hour visit with the employees being paid by the farm for this training. The employees were instructed to log-in to the course either on their smartphones or with a tablet that we provided to complete the course during the next 50 minutes. In addition, the farm manager or owner was given access to the course as well.

At this training, each farm was provided with a strip cup to go along with the course material in module three which covers how to use a strip cup to determine saleable versus non-saleable milk.

As each milker completed the course, we verbally asked how they liked the modules and if they had any suggestions for how to improve them.

Post-Training Assessment

Approximately two to three weeks after the training event, the farm was re-visited on dry-off day. All employees who performed the dry-off procedure were scored using the same OSCE as the pre-training assessment. The data was then compiled and compared for the employees that we had both a pre- and post-training assessment.

Results/Data Analysis:

Baseline Survey Findings

From the baseline survey, 40% of the farms had one or more of the top three priorities that involved a significant issue with the dry off procedure that was significantly increasing the risk of mastitis on that dairy. This data reinforced the need for additional employee training on this subject on these farms. This also was very informative to our program and educational efforts to veterinarians and producers as for many farms this has been previously overlooked.

Eighty percent of farms had a milking equipment problem as one or more of the top three priority issues although only 27% of the farms had a milking equipment issue that milkers could have detected. Milking routine challenges were identified on 73% of the farms as one or more of the top three priority issues.

Overall the baseline survey findings helped to reinforce the ongoing need for training in the areas that our phase I, II, and III courses are focused on.

Pre-Training Assessment

A total of 35 employees were assessed using the treating a cow at dry-off OSCE prior to completing the training. The average total OSCE score of all 35 employees was 12.3 out of a possible 20 points. The range of scores for individuals was from 5 to 18 points.

Table 2 shows the results summarized by individual statements on the OSCE for treating a cow at dry-off. For this data analysis, an individual needed to have a correct score on both cows scored in order to be counted as having performed the statement correctly. It should also be noted that for the statement, "If the cow kicks at the teats, milker disinfects the teats again" the results were calculated out of a total of only 17 employees since not all cows kicked.

The largest opportunity areas identified on the pre-training assessment as shown in Table 2 are in the areas of putting leg bands on cows (31% correct), putting on new gloves (37% correct), how employees disinfect teats (34% correct), order of treatment (54% correct), and how they massage the product out of the teat cistern (29% correct).

Treating a Cow at Dry Off OSCE	Correct Performance
	(Percent)
1) Milker organizes all materials well	94
2) Milker double checks cow ID	91
3) Milker keeps tubes clean	60
4) Milker applies appropriate leg band prior to administering treatment	31
5) Milker puts on a new pair of gloves	37
6) Milker inspects teats and implements appropriate action	80
7) Milker cleans teats in right order	69
8) Milker disinfects and inspects teats and gauze and if need be	
disinfects again	34
9) If the cow kicks at the teats, milker disinfects teats again	6*
10) Milker treats teats in the right order	54
11) Milker prevents the tip of the tube from touching any surface	69
12) Milker gently inserts the tip into the teat canal 1/8 inch	60
13) Milker massages the product out of the teat cistern	29
14) Milker post-dips entire teats	100
15) Milker records treatment in the appropriate paperwork	100

Table 2: Results for Pre-Training OSCE Assessment on 15 NNY farms; E-learningTraining Systems as an Educational Approach for Dairy Farm Workers and its Effect onMilk Quality and Prudent Antimicrobial Use, NNYADP, 2021.

*Calculated out of a total of only 17 participants in which a cow kicked during the assessment

In addition, 24 employees were scored using the OSCE for administering internal teat sealants. The average total OSCE score of all 24 employees was 11.6 out of a possible 20 points. The range of scores for individuals was from 6 to 18 points. The largest opportunity areas identified for internal teat sealant administration involved putting leg bands on cows (21% correct), putting new gloves on (29% correct), disinfecting the teats (25% correct), partial insertion of the tip of

the sealant tube (38% correct), and squeezing off the teat base during administration (25% correct).

The results of the pre-training assessment reinforce a need for training dairy farm employees, who are performing the dry-off procedures, as many are currently doing parts of it incorrectly and putting cows at risk of mastitis and death. We believe this is the first time this type of data, quantifying the pre-training areas of opportunity, has been published and can serve as a guide for other dairy farms considering areas for attention.

Completion of E-learning Course by Milkers

Sixty employees participated in the trainings with 47 of these having Spanish as their native language and thirteen with English as their native language. The majority of participants (72%) watched the video in which the text was read to them as the slides were automatically advanced.

Although we did not require it, the majority of participants finished all five of the modules and answered the knowledge-check questions at the end of each module. The reason that we did not require all employees to complete all modules is that on some farms the employee did not perform all these procedures. As we have learned from Phases I and II, it is important to give the employees dedicated time to complete the trainings even though it is online and theoretically available at any time.

Post-Training Assessments

Within the course we asked participants three knowledge-check questions after the end of each of the five modules and the results of their responses are shown in Table 3.

	Partic	cipants	Congre	gate # of tions	Questions correctly answered			
			ansv	vered	Absolute		Percent	
Module	English	Spanish	English	Spanish	English	Spanish	English	Spanish
Collecting an aseptic milk sample	13	43	39	129	32	88	82.1	68.2
Administering intramammary treatment	11	39	33	117	29	81	87.9	69.2
Deciding on saleable milk	11	39	33	117	24	78	72.7	66.7
Treating a cow at dry off	11	35	33	105	28	60	84.8	57.1
Administering teat sealants	11	40	33	120	30	82	90.9	68.3

Table 3: Results of knowledge-check questions within the modules for employees on 15	
NNY farms; E-learning Training Systems as an Educational Approach for Dairy Farm	
Workers and its Effect on Milk Quality and Prudent Antimicrobial Use, NNYADP, 2021.	

The summary data from the knowledge-check questions was encouraging as it shows the majority of employees did comprehend the main points of the module and were able to correctly answer the questions. It is interesting to note a consistent difference in the percent answered

correctly between the English versus Spanish modules and that the participants in the Spanish module did not do as well.

Thirty-one and 23 employees were scored post-training using the OSCE assessment for treating a cow at dry-off and administering internal teat sealants, respectively. Twenty-nine employees for treating a cow at dry-off and 19 employees for administering teat sealants had been scored pretraining, allowing for a comparison between pre-training and post-training assessment OSCE scores. Six employees for treating a cow at dry-off and five employees for administering teat sealants that were scored pre-training were either not available on the day of the post-training assessment or had left the farm.

It is remarkable that there was an improvement in the average OSCE score for treating a cow at dry-off from 12.4 pre-training to 15.3 post-training out of a total of 20 possible points (Table 4). When comparing the individual employees for the OSCE scores pre-training and post-training for treating a cow at dry-off, 83% improved, 14% stayed the same, and 3% became worse.

Also shown in Table 4 are the results for the OSCE scores for administering an internal teat sealant, showing an improvement from 11.3 pre-training to 13.7 post-training. When looking at this by the individual participants, there was an improvement after the training of 90% of the participants. Five percent of the participants stayed the same and five percent became worse.

Table 4:	Results of a	comparis	on of pre- a	nd post-trai	ning OSCE sco	ores on 15 NN	NY farms;
E-learnin	g Training	Systems	as an Educa	ational Appi	roach for Dairy	y Farm Worl	kers and its
Effect on Milk Quality and Prudent Antimicrobial Use, NNYADP, 2021.							

Comparison of Pre and Post-	Pre-	Post-	Participants	Participants	Participants
Training OSCE scores	Training	Training	Whose Scores	Whose Scores	Whose
	Assessment	Assessment	Became	Stayed the	Scores
	OSCE	OSCE	Worse	Same	Improved
	Score	Score	(Percent)	(Percent)	(Percent)
OSCE of treating a cow at dry	12.4	15 3	3	14	83
off (29 participants)	12.7	13.5	5	14	05
OSCE of administering internal	11.3	137	5	5	90
teat sealant (19 participants)	11.0	10.7	5	5	70

The results shown in Table 4 are very encouraging that an online training can make a difference in improving the actual skills that employees perform. Using the OSCE scores in this Phase III trial provides objective data demonstrating that employees are not only comprehending the information as shown in the knowledge-check questions but also actually changing how they perform the procedure. It should be recognized, though, that the average post-training assessment scores are still lacking from the total possible points of 20. This suggests that there is still a need for some hands-on training in order to demonstrate the skills to the employees and correct any misunderstandings that may be present.

It was discouraging to see that a small percentage of participants became worse after the training but this was data from just two individuals. Both of these individuals had scores greater than 15 points and so were doing a better-than-average job. For one individual, the farm had changed the dry cow antibiotic between the pre- and post-training scoring which caused a need for partial insertion on the new antibiotic that had not been there on the previous antibiotic. After the scoring was complete, a quick discussion with the employee helped them to correct the issue

they had lost points for on the post-training OSCE scoring which is why their performance was scored as being worse.

Our unit of analysis for this work has been at the individual participant level. This level was selected because it allows us to compare the pre-training results to the post-training results for each individual and therefore assess the knowledge gained from the training.

Individual Farm Management and Milker Feedback

Overall, the 15 participating farms were eager for training tools to better educate their employees in the area of proper sampling and treatment technique and many of the farm owners were happy that we had a course available. As we have seen across the industry, a number of the farms that participated in this training began doing selective dry cow therapy during the period that we were working with them. They thanked us for providing an excellent tool at the right time so that their employees were well-trained on the individual techniques necessary to make selective dry cow therapy work well.

Similar to our experience in Phase II, we did not receive any pushback on having the milkers on the payroll for the one-hour training session. Compared to the 2019 Phase 1 pilot testing that did not include any paid training time, this resulted in a much higher completion rate by the workers. This observation again demonstrated that owners were not unwilling to pay employees to be trained in a dedicated session, especially if it was a structured training done by outside people. If we asked them, however, to give employees paid time to complete a training on their own, the training was unlikely to happen. This may also demonstrate why providing owners with a systematic approach to trainings and training tools may be important in order for them to establish a training culture with routine ongoing trainings to milkers. It appears that for most managers either they do not have enough time or they are not convinced of the value of coming up with their own training plans for their employees. In Phase III, the implementation of the OSCE exams provided a practical means to quantify the benefit of training to the farm owner.

One of the farm owners asked if he could put the website in the cooperative newsletter so that all the farms belonging to this cooperative would have access to this training material. We took this as a very positive sign that he felt this module was worth opening up to other farms.

We did receive some feedback on the knowledge-check questions and observed that some participants spent a longer amount of time on these than was our intention. One observation was that there were too many words in the questions and answers, making them difficult to follow as the workers had to scroll up and down on the phone. Another challenge with the knowledgecheck questions was with the employees that were illiterate as the questions had to be read to them by our Spanish facilitator.

Conclusions/Outcomes/Impacts:

This project indicates that farms in NNY, and likely elsewhere in New York State, could benefit from additional employee training in the area of sample collection and treatment technique. Our e-learning course was built to help milkers learn new skills or sharpen their existing skills in this area. Based on the knowledge-check questions and the improved OSCE scores of the majority of the participants we did successfully achieve this goal of educating the employees about proper sampling and treatment technique. This will have an impact on these farms in terms of properly diagnosing and treating mastitis during the lactating period as well as implementing proper dry-

off procedures in order to prevent new mastitis cases during the dry period. This effect will not only have a positive impact on the economics of the farm and cow welfare but will also have an impact on the prudent use of antimicrobials on these farms.

We did more completely address the literacy problem that we encountered in the 2019 and 2020 with the narrated videos which many of the participants took advantage of. The one hurdle that we still need to overcome is how to deal with the literacy problem for the knowledge-check questions. Our idea for this is to make the knowledge-check questions less word-focused and more image-focused and to explore other options such as matching or ordering of pictures versus just multiple choice questions.

Furthermore, this project reinforced what we had found the previous two years that there is not an ongoing learning culture on many farms due to the lack of a structured training program. It is our hope that the e-learning system that we are developing through this NNYADP-funded project can help to change this culture on farms. However, we acknowledge that having appropriate tools is only one part of the picture. More work is needed to help farm managers realize the importance of developing a learning culture where training and feedback are provided to employees on a regular basis. This could help to promote continued improvement and job satisfaction, and, in so doing, improve the farm's efficiency and production success.

Outreach:

- 1. Cooperative Extension Dairy Days. January 19, 2022; virtual presentation.
- 2. NMC Annual Meeting Presentation. February 1, 2022; as part of short course lecture.
- 3. One-page summary of NNYADP grant and results will be distributed to QMPS clients and provided to Cornell Cooperative Extension for potential inclusion in newsletter or on websites.
- 4. Hoard's Dairyman article on e-training system for dry cow procedures; Early 2022.

Next Steps:

1. Revision of knowledge-check questions

As outlined above, we did receive feedback that the knowledge check questions were a struggle for some participants and we plan to revise them as noted.

2. Assessment and training package for farms or farm advisors

The novel combination of OSCE scoring and training leading to a measurable outcome generated a promising idea for pilot testing. We propose to have an assessment and training package all available online. Our thought with this is that we would have a scaled down version of the OSCE scoring system available as an online tool to pair with the training. The current vision we have for this is that a herd manager or herd veterinarian would perform a pre-training assessment of the farm employees using the online OSCE scoring system, then the employees would be responsible for completing the online training module. As a follow up, the herd manager or herd veterinarian would perform a supervisor or trusted advisor and that this coupled with the online training would result in a sustained improvement in their skill set.

3. Updating of Milking Routine (Phase I) and Milking Equipment (Phase II) Modules.

Based on our very positive experience with the Visme platform and the new format, we plan to update and transform our first two courses (milking routine training and milking equipment training) onto the Visme platform. In the process of doing this we would use the experience over the last three years to improve the first two courses. This would then create a suite of e-learning training courses that, as our baseline surveys show, would address many of the ongoing risk factors for mastitis on our dairies.

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Northern New York Agricultural Development Program 2021 Project Report APPENDIX

Assessing the Effect of E-Learning Training Systems on Milk Quality and Dairy Parlor Performance: Phase III

E-learning Training Systems as an Educational Approach for Dairy Farm Workers and the Effects on Milk Quality and Prudent Antimicrobial Use: Proper Sampling and Treatment Technique

https://www.dairyroutines.com/



Left: Figure 1. Screen shot from the English version of the milker-training e-learning module tested on 15 farms; E-learning Training Systems as an Educational Approach for Dairy Farm Workers and its Effect on Milk Quality and Prudent Antimicrobial Use, NNYADP, 2021.

Right: Figure 2. Screen shot from the English version of the milker-training e-learning module showing the 3 sections tested on 15 farms; E-learning Training Systems as an Educational Approach for Dairy Farm Workers and its Effect on Milk Quality and Prudent Antimicrobial Use, NNYADP, 2021.





Left: Figure 3. Screen shot from the Spanish version of the milker-training e-learning module tested on 15 farms; E-learning Training Systems as an Educational Approach for Dairy Farm Workers and its Effect on Milk Quality and Prudent Antimicrobial Use, NNYADP, 2021.

<u>Right:</u> Figure 4. Photograph of employee completing the training; E-learning Training Systems as an Educational Approach for Dairy Farm Workers and its Effect on Milk Quality and Prudent Antimicrobial Use, NNYADP, 2021.

OSCE Assessment Dry Cow Treatment

Milker:

Pos	Step	Po	ints	Max	NA
		Rep1	Rep2	1	
1	Milker organizes all materials well			1	
2	Milker double checks cow ID			1	
3	Milker keeps tubes clean			1	
4	Milker applies appropriate leg band prior to administering treatment			2	
5	Milker puts on a new pair of gloves			1	
6	Milker inspects teats and implements appropriate action			1	
7	Milker cleans teats in the right order			1	
8	Milker disinfects and inspects teats and gauze and if need be disinfects again			2	
9	If the cow kicks at the teats milker disinfects teats again			1	
10	Milker treats teats in the right order			1	
11	Milker prevents the tip of the tube from touching any surface			2	
12	Milker gently inserts the tip into the teat canal 1/8 inch			2	
13	Milker massages the product out of the teat cistern			1	
14	Milker post-dips entire teats			1	
15	Milker records treatment in the appropriate paperwork			2	

Key: Rep1 column is used for scoring the participant on the first cow; Rep2 column is used for scoring the participant on the second cow. The Max column identifies the maximum number of points that could be given to each participant for each statement. The NA column is used to mark if a particular statement is not applicable to this farm or cow being scored.

Figure 5. OSCE Template for Pre- and Post-Training Assessment of Treating a Cow at Dry-Off.; E-learning Training Systems as an Educational Approach for Dairy Farm Workers and its Effect on Milk Quality and Prudent Antimicrobial Use, NNYADP, 2021.