Evaluation of a biological risk management tool on large western United States dairies

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ABSTRACT

Critical to changing biosecurity practices on the farm is an individual assessment of those practices contributing to disease transmission. The purpose of this project was to assess, implement, and refine a biological risk management survey for use on large western United States dairy farms. Assessment tools developed by Iowa State University Center for Food Security and Public Health (Ames, IA) were refined using a focus group process and by testing them on 40 dairy herds in California. Each question was evaluated using standard criteria and producer responses. Some survey questions required refinement for clarity and others were considered unnecessary. New questions were added based on a biosecurity literature review, resulting in a new set of questions that can be used by extension educators and food animal veterinarians to help identify disease risk areas and educate dairy producers.

Key words: biosecurity, dairy, risk assessment

INTRODUCTION

Dairy farms are at risk for introduction of new diseases and transmission of endemic diseases between animal groups on the farm. Biosecurity measures include management practices designed to reduce disease vulnerabilities in the dairy herd. Despite risks for disease introduction, dairy farms in the United States adopt biosecurity practices to varying degrees. Although other industries that involve intensive animal management, such as poultry and swine production, have adopted

strict biosecurity measures as a general rule, this may not be true of the dairy industry (Buttars et al., 2006). Numerous producer surveys have identified biosecurity gaps, such as not testing or examining purchased cattle for disease, allowing visitors to the farm without added precautions, and lack of a biosecurity plan (Rauff et al., 1996; Faust et al., 2001; Dalton et al., 2005a,b; Buttars et al., 2006; Hoe and Ruegg, 2006; Moore et al., 2009).

It is unclear why dairy producers have not adopted more thorough biosecurity or biological risk management measures given the potential consequences of disease introduction. Many extension education materials on biosecurity exist and extension educators and dairy advisors have been working with producers to implement management changes over time. However, encouraging real change on a dairy farm requires that the producer recognizes a change is needed (i.e., recognizes that an issue is a problem for him/her), learns what can be done, sees the change as meaningful and cost-effective, tries out the change, and receives reinforcement in the new practice, similar to any other behavior change an individual might make (Prochaska et al., 1992). One reason that producers might not see biosecurity as a problem for them is the mixed messages they get from outreach materials (Moore et al., 2008). Another reason is that they have not yet identified their farm-specific vulnerabilities.

Risk assessment surveys, when used on the farm by dairy advisors, are an effective means of identifying and changing management practices. Sisco et al. (1997) demonstrated that dairy producers changed their risk for antibiotic residues after a creamery field representative left a risk assessment survey with them to complete or review or went through the assessment with the producer. Quantitative risk assessment is one means to assess risk for an infectious disease as well as its effect and has been demonstrated for diseases such as *Cryptosporidium parvum* (Nydham and Mohammed, 2005), bovine viral diarrhea (Stott et al., 2003; Santarossa et al., 2005), and *Salmonella* (Boqvist and Vagsholm, 2005). On-farm risk assessment of farm bio-

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security practices is a common recommendation found in cooperative extension and state departments of agriculture educational materials for producers (Moore et al., 2008). The tool that professionals use to assess on-farm risk needs to accurately reflect the real risks for disease introduction and be easily completed and validated.

One way to assess risk is to identify the critical control points for disease entry onto the farm (Villarreal et al., 2007). Iowa State University's Center for Food Security and Public Health (CFSPH, Ames, IA) developed a set of tools to assess the risk for airborne, direct contact, and other modes of transmission of biological agents on dairy farms, termed biological risk management (BRM). This tool, a set of detailed questionnaires, was designed to identify specific management practices that put a dairy herd at risk for disease transmission, either for the introduction of a new disease onto the farm where the disease did not previously exist, or for transmission of an endemic disease between animals or groups of animals on the farm (Center for Food Safety and Public Health: Iowa State University, 2008). It was the purpose of the current project to refine, evaluate, and test the BRM tools for use on large western US dairy farms and evaluate the usefulness of individual risk management questions.

METHODS

Refining the Assessment Tool

Investigators at CFSPH developed a standardized assessment survey as the main element of the Dairy Biological Risk Management program. The original CFSPH survey tool consisted of 172 questions applicable to Midwest dairies. Within a focus-group setting, a team of University of California extension specialists and farm advisors evaluated the BRM questions for use on dairy farms in California. They refined and reduced the on-farm assessment questionnaire from 172 to 45 questions based on differences in facilities and management styles present on California dairies.

Farm Assessments

Each of 7 dairy extension farm advisors was asked to enroll at least 5 producers from their county to participate in the BRM assessment and evaluation process. Dairies were enrolled based on the producer's willingness to participate. Producers were first contacted by telephone and asked to participate and those willing to participate were mailed a preassessment questionnaire to be completed before a farm visit. The preassessment questionnaire consisted of 14 questions on herd demo-

graphics, general farm information, production levels, and some management practices on the farm. For the on-farm assessment, advisors completed the revised 45 California-specific questions with the producer as they conducted a walk-through of management areas on the farm. Producers had the choice of "yes," "no," or "maybe" for each of the 45 questions. A "yes" answer correlated with a "better" BRM practice for each of the 45 questions. Completed assessments were assigned an identification number and faxed, without personal identifiers, to the lead investigator. These reports were entered into the CFSPH online BRM assessment tool, from which several reports were generated. One report consisted of the list of BRM questions and the individual producer's responses. Another report consisted of specific disease transmission risk pie charts that highlighted the routes of transmission at highest risk on the producer's farm with a complementary report on why those practices were important. The reports were sent to the farm advisor, who made a second farm visit to review the reports with the producer. After each follow-up visit, the farm advisor completed an evaluation survey that asked questions about the tool and the assessment process at each step to evaluate the entire process and gather their impressions for further refinement of the survey tools.

Statistical Analysis

The evaluation and assessment tools were linked by farm code, and all data were captured into an electronic spreadsheet (Excel, Microsoft Corp., Redmond, WA). Data were checked for data entry accuracy and analyzed using a statistical software package (SAS software version 9, SAS Institute Inc., Cary, NC). Response results were analyzed to determine usefulness of each question so as to discriminate important management practices and identify trends and relationships from the data. In addition, from management practices considered most risky, we identified potential vulnerabilities in this group of dairies.

Survey Question Evaluation and Refinement

Each of the 45 questions refined from the original BRM survey tool was evaluated individually using specific survey question criteria (Appendix A). In addition, questions with a response frequency of 90% or greater "yes" or "no" responses were evaluated to assess why the responses might be uniform. Conditional questions were evaluated to consider whether there were appropriate response options or if the question needed to be rewritten, moved, or changed to offer the option to skip to a follow-on question. Double-barreled questions

Table 1. Summary of herd data from a biological risk management assessment of 40 California dairies in 2006

Item	Mean	Median	Range
Animals/dairy, n			
Heifers (<24 mo)	692	602	67–2,500
Nonlactating cows	143	120	10–700
Lactating cows	918	850	135–2,850
Breed	Farms, n	%	
Holstein only	30	75	
Jersey only	4	10	
Mixed/other	6	15	
Herd production data	Mean	Median	Range
305-d mature-equivalent milk production, kg	10,944	11,016	7,074–13,903
Average DIM	190.8	189.0	162–222
Average herd SCC, cells/mL	249,205	250,000	110,000–474,000
Herd cull rate, %/yr	31.2	31	19–41
	Milking frequency, times/d		
	2	3	>3
Herd practices			No answer
Lactating cows, n (%)	30 (75)	9 (22.5)	0 (0)
Postpartum cows, n (%)	30 (75)	5 (12.5)	3 (7.5)

(questions containing more than one question combined with a conjunction) were reduced to single questions to avoid confusion. Finally, all questions that received “no answer” and questions with greater than 10% “maybe” responses were further evaluated.

The BRM questions were compared with published biosecurity recommendations from government agencies, universities, and scientific literature, to determine if management recommendations were consistent with the “most important” practices for controlling transmission and spread of disease including (1) closed herd or all in/all out system; (2) quarantine new additions or returning stock; (3) examine or test new additions for common diseases; (4) control visitor access; (5) perimeter fence or limit contact with other livestock and people; (6) foot baths or disposable boots; (7) vehicle access control; (8) equipment and tool disinfection; (9) vector control (pets, wild animals, birds, and insects); and (10) locked gates and doors (Moore et al., 2008). Vehicle tire disinfection was not included in this list, but is a key transmission prevention practice in the face of an outbreak that can be carried on tires, such as foot and mouth disease.

RESULTS

Forty dairies participated in the biological risk assessment between February and June 2006. The pre-assessment survey, Dairy BRM tool, and postsurvey evaluation were completed for each dairy. Dairies were located in 7 California counties representing the major

milk-producing areas of the state. Participating farms averaged 918 lactating cows and 10,944 kg of 305-d mature-equivalent milk production (Tables 1 and 2). However, over 85% of the dairies averaged more than 10,000 kg of milk per cow per year in these predominantly Holstein herds. About 30% of farms did not raise their own calves. Over 90% of farms maintained young stock and cattle in separate groups (pens, pasture, or dry-lot). The herds had an average bulk tank SCC of 249,205 cells/mL with a range of 110,000 to 474,000 cell/mL. Annual herd culling rates averaged 31%.

The preassessment questionnaire also asked producers about record keeping. Over 80% of producers kept health records but there was a wide variety of types of records maintained at each dairy. Forty percent kept production records, 47.5% kept DHIA records, 67.5% had treatment records, and 50% kept records of cattle vaccinations. More than 60% of farms reported more than 19 visitors to their farm per week but only 12.5% had a visitor protocol in place. Over 60% of farms had animals coming on to or returning to the farm, two-thirds of which had no isolation facility; and 75% did not answer the question about quarantine times. However, 85% of producers indicated that they tested animals during isolation.

BRM Question Evaluation

Using question evaluation criteria (Appendix A), some questions were targeted for change. For several questions, producers chose not to select any choices

Table 2. Summary of biosecurity question responses from a biological risk management preassessment survey of 40 California dairies in 2006

Item	Category	n	%
Individual health records	Yes	33	82.5
	No	6	15
	No answer	1	2.5
Visitor protocol	Yes	5	12.5
	No	35	87.5
Visitors/week	<20	15	37.5
	20–39	15	37.5
	>39	1	2.5
Frequency animals leave and reenter herd	Never	17	42.5
	Rarely or seldom (1–6 times/yr)	9	22.5
	Frequently	14	35.0
Isolation facilities	Yes	10	25
	No	27	67.5
	Sick only	1	2.5
	No answer	2	5
Isolation period	<2 wk	2	5
	2–4 wk	8	20
	No answer	30	75
Tests during isolation	Yes	34	85
	No	5	12.5
	No answer	1	2.5

provided, resulting in “no answer.” Thirteen of the 45 questions were double-barreled questions, all with the conjunction “and” (Table 3; questions 3, 4, 5, 7, 8, 14, 18, 20, 30, 31, 33, 34, and 36). However, for all the questions except 36, the second half of the question was considered an important modifier and necessary to obtain the appropriate response. One term was unfamiliar to producers (standard 150-d milk production). In 4 questions, at least 90% of the responses were “yes” (Table 3; questions 16, 18, 38, and 41), and 3 had at least 90% “no” responses (questions 4, 8, and 13). Two questions had 30% “maybe” responses (questions 19 and 22). Nine received “no answer” responses, 5 of which had greater than 20% that did not answer (questions 5, 24, 35, 36, and 43). Eight questions may have overly constrained the respondents’ ability to answer by using words such as “all,” “always,” or “never” (questions 15, 16, 19, 30, 31, 32, 38, and 43).

Postassessment

The postassessment survey was completed by farm advisors for each farm. Farm advisors reported that the preassessment survey took producers an average of 24 min to complete. In 75% of the cases, the preassessment was considered easy to use; questions were easy to follow and most were applicable to large, western

US dairies. Two advisors did not understand the meaning of “standard 150-d milk,” supported by the fact that there were no responses to this question on the producer survey. The farm visit and assessment took an average of 32 min to complete. One producer reported that the questions were difficult to understand. All others reported that it was easy to use and that the questions applied to large western US dairies.

The report-delivery visits averaged 27 min and were conducted, on average, 44 d after the on-farm survey visit. Many producers did not see value in the recommendations, felt comfortable with their current program, and did not feel the need to make changes to management based on the results. Several said they would consider changes only if they “had a problem.” However, most advisors agreed that the BRM assessment was a good tool to educate producers on biological risk management: “This tool is an effective educational tool. I believe that it could be used as a one-on-one method of teaching producers who don’t give much thought to biological risk. Many producers (in the area) don’t implement many of the methods for BRM that are brought forward in this survey.... It also opens up dialogue to discuss why or why not the producer agrees or disagrees.” Another advisor commented, “There is always room for improvement and many producers will admit that they relax on protocols that they know

Table 3. Response frequencies to a biological risk management survey tool from 40 California dairies in 2006

Question	Response, n (%)			
	Yes	No	Maybe	No answer
1. Are your cows kept away from fence to fence contact with other livestock?	22 (55)	15 (37.5)	0 (0)	3 (7.5)
2. Do you limit nose to nose contact between animals from different stages and/or age groups?	12 (30)	26 (65)	2 (5)	0 (0)
3. Do you have a designated visitor and employee vehicle parking area?	11 (27.5)	28 (70)	1 (2.5)	0 (0)
4. Are signs posted and very visible restricting access to your facility to anyone not employed by the operation?	3 (7.5)	37 (92.5)	0 (0)	0 (0)
5. If animals are rendered, is the pickup area located on the perimeter and away from all other entrances to your operation?	15 (37.5)	13 (32.5)	0 (0)	11 (27.5)
6. Do you have a fly control program?	32 (80)	7 (17.5)	1 (2.5)	0 (0)
7. Do you have a set schedule and designated person to check all pest control programs to ensure they are kept current?	22 (55)	15 (37.5)	1 (2.5)	2 (5)
8. Do you require visitors to sign in and disclose their last known cattle contact?	1 (2.5)	39 (97.5)	0 (0)	0 (0)
9. Do you minimize animal contact with anyone entering your operation?	18 (45)	20 (50)	2 (5)	0 (0)
10. Do you require clean clothes on everyone entering your operation (visitors, service personnel)?	4 (10)	34 (85)	2 (5)	0 (0)
11. Do you require clean footwear on everyone entering your operation (visitors, service personnel)?	7 (17.5)	32 (80)	1 (2.5)	0 (0)
12. Do you request that your employees avoid contact with livestock outside of your operation?	6 (15)	33 (82.5)	1 (2.5)	0 (0)
13. Are employees required to change clothing when moving into special areas of the farm such as the maternity and calf areas?	1 (2.5)	39 (97.5)	0 (0)	0 (0)
14. Are employees required to clean and disinfect their boots when moving into special areas of the farm such as the maternity and calf areas?	5 (12.5)	34 (85)	1 (2.5)	0 (0)
15. Do you keep treatment records for all animals?	29 (72.5)	7 (17.5)	4 (10)	0 (0)
16. Are all animals inspected daily for signs of illness?	37 (92.5)	2 (5)	1 (2.5)	0 (0)
17. During chores, do you move from "clean" younger animals to "older" animals, to "dirty"/sick animals, and finally isolation animals?	14 (35)	19 (47.5)	6 (15)	1 (2.5)
18. Are animals that are not going to recover killed humanely and promptly?	39 (97.5)	0 (0)	0 (0)	1 (2.5)
19. Do you have a veterinarian necropsy all animals that die from undetermined causes?	3 (7.5)	25 (62.5)	12 (30)	0 (0)
20. Is the dry lot area regularly maintained to prevent manure buildup and areas of stagnant water?	33 (82.5)	2 (5)	5 (12.5)	0 (0)
21. Do you keep your alley ways clean (scraped or flushed at least one time daily)?	32 (80)	6 (15)	2 (5)	0 (0)
22. Do you keep your stalls clean (scraped at least one time daily)?	24 (60)	4 (10)	12 (30)	0 (0)
23. Do you separate sick cows (potentially contagious) from healthy cows as soon as possible?	33 (82.5)	6 (15)	1 (2.5)	0 (0)
24. Do you have an area used only for quarantine for newly introduced animals?	6 (15)	21 (52.5)	1 (2.5)	12 (30)
25. Are cows kept on their feet for at least 30 to 45 min after milking to allow keratin plug formation in the teat canal?	24 (60)	6 (15)	10 (25)	0 (0)
26. Is your somatic cell count routinely under 200,000 cells/mL?	13 (32.5)	25 (62.5)	2 (5)	0 (0)
27. Do you use a CMT paddle on individual cows to monitor for mastitis?	11 (27.5)	26 (65)	3 (7.5)	0 (0)
28. Do you limit your calving pens to calving only and not for isolation animals?	28 (70)	10 (25)	2 (5)	0 (0)
29. Do you remove calves from mothers at birth, not allowing them to nurse?	25 (62.5)	11 (27.5)	4 (10)	0 (0)
30. Do you collect colostrum within the first 2 h after calving?	13 (32.5)	17 (42.5)	10 (25)	0 (0)
31. Do you immediately freeze your colostrum if it will be stored for more than 24 h in a labeled, sealed, single use container?	17 (42.5)	19 (47.5)	3 (7.5)	1 (2.5)
32. Do you only use single source colostrum, not pooled from multiple cows?	17 (42.5)	20 (50)	3 (7.5)	0 (0)
33. Do you give newborns 3/4 to 1 gallon of colostrum within the first six hours of life?	26 (65)	8 (20)	6 (15)	0 (0)
34. Do you give a second dose (1/2 to 3/4 gallon) of colostrum 12 h later?	27 (67.5)	8 (20)	5 (12.5)	0 (0)
35. Do you pasteurize waste milk before feeding to calves?	9 (22.5)	19 (47.5)	0 (0)	12 (30)
36. Do you utilize individual calf housing for newborn calves and ensure there is no direct contact between them?	17 (42.5)	14 (35)	0 (0)	9 (22.5)
37. Do you clean water troughs/cups frequently (at least weekly)?	23 (57.5)	14 (35)	3 (7.5)	0 (0)
38. Do you examine all feedstuffs closely for manure, mold, foreign material, and overall quality?	38 (95)	0 (0)	2 (5)	0 (0)
39. Are your pen entrances designed to prevent people from stepping into the feed bunk?	21 (52.5)	17 (42.5)	2 (5)	0 (0)
40. Do you avoid feeding leftover/uneaten feed from lactating animals to young stock?	12 (30)	28 (70)	0 (0)	0 (0)
41. Do you investigate animals that will not eat or do not consume all of their feed?	37 (92.5)	1 (2.5)	2 (5)	0 (0)

Continued

Table 3 (Continued). Response frequencies to a biological risk management survey tool from 40 California dairies in 2006

Question	Response, n (%)			
	Yes	No	Maybe	No answer
42. Do you use different equipment for feed and manure handling?	30 (75)	9 (22.5)	1 (2.5)	0 (0)
43. If you use the same equipment for manure and feed, do you clean all manure off the bucket and tires and disinfect before using for feed?	10 (25)	3 (7.5)	3 (7.5)	24 (60)
44. Do you prevent young animals from coming in contact with manure from older animals?	24 (60)	12 (30)	4 (10)	0 (0)
45. Is the origin of all replacement heifers known?	34 (85)	6 (15)	0 (0)	0 (0)

should be implemented every day. Reminders from farm advisors and veterinarians are effective ways of bringing them back to sound management (this has been expressed to me on occasion; that our messages are valuable reminders to raise the bar when it gets lowered)."

Current Vulnerabilities on Sampled Dairies

A "yes" response was considered a positive BRM practice. Dairies with higher "yes" response rates could be considered to have better BRM. The average "yes" response per farm was 21 (48.1%; 95% CI = 20, 23) out of 45. Comparing response frequencies to the 10 most commonly recommended BRM practices, the following vulnerabilities were identified for these farms: (1) 57% of producers reported moving animals on and off the farm; (2) only 25% had isolation facilities for new/returning stock; (3) most (97.5%) did not require visitors to sign in and disclose their last animal contact; (4) 50% did not minimize contact between animals and visitors; (5) about 40% did not prevent nose-to-nose contact of their cattle with other livestock; (6) most (92.5%) did not have signs posted restricting access to the facility; (7) 80% did not use footbaths for visitors; (8) 70% did not have designated visitor and employee parking; and (9) only 15 (37.5%) had a designated area on the perimeter and away from other entrances for rendering pick up.

DISCUSSION

The focus of this study was to evaluate and refine a survey tool that could assess risk of disease transmission onto and within western US dairies and educate and motivate producers to improve disease management practices. The original 172-question survey was evaluated in 2 ways to refine it. First, the focus-group method, using expert opinion and consensus on important survey questions, helped reduce the survey size to 45 questions applicable to large western dairy farms. Second, a question-by-question evaluation using

standard criteria and a test of the 45-question survey with dairy producers and farm advisors helped identify problem questions for further refinement. This method was parsimonious because it took an already established questionnaire and molded it for use in a specific setting. Pretesting a survey is the only way to identify possible problems for interviewers and respondents (Presser et al., 2004). Although the selected dairies represented a convenience sample, this pilot study provided data to test survey questions and refine them to ensure the tool could be used more widely.

The preassessment survey was designed to gather herd demographic and production data but some questions were actually discovered to be risk management questions and could be modified for inclusion in the BRM assessment. The herds represented the range of dairy farms found in the western United States. Several questions on the preassessment survey were open-ended and may be more useful with a limited number of responses to improve the response rate and narrow the choices. As written, responses varied and could not be used in the analysis without subjective grouping or coding by investigators.

Questions for the California BRM evaluation were selected from the original 172-question survey and modified for application on western US dairies based on field experience of the project team. After testing the subset of 45 questions, producer responses and question evaluation indicated that some questions might not have been completely clear. For example, some questions had 2 themes and a few questions may have been too limiting by including words such as "all," "always," or "never." Response options could be expanded by including "yes/always," "frequently," "sometimes," and "no/never" to reduce the number of "maybe" and "no answer" responses. Questions that received greater than 90% "yes" responses might indicate that those management practices were already widely adopted by producers, making it unnecessary to include such a question. For questions with greater than 90% "no" responses, one might ask, what are the major barriers

to implementing this practice? or, how important is this practice to reducing disease transmission?

Based on the refinement and evaluation of this risk assessment tool, a new survey tool for large western US farms is suggested (Appendix B). This assessment tool consists of 43 questions revised from the original survey, including some from the preassessment, and some based on the 10 most commonly recommended BRM practices. Questions were written to elucidate single themes, offer several response options to make questions easier to answer, and provide some graded estimates of "risk." Weighting of questions was not done, but should be considered in quantitative risk assessments for disease introduction because some routes of transmission may be riskier than others (Wells, 2000).

Although the assessment tool needed the final refinement to reduce possible response errors, some risky management practices in our participating herds were elucidated using the 45-question BRM tool developed from the focus group. Cattle movement onto the farm, lack of isolation facilities, and lack of farm visitor restrictions were a few of the important vulnerable management practices. Farm advisors reported that identifying some of these vulnerabilities helped to open up a dialogue with the dairy producer.

CONCLUSIONS

Assessment of risk is the first step toward making meaningful management change. An effective, easy-to-use assessment tool is critical to this endeavor. This project evaluated the implementation of an established biological risk assessment tool for dairies so that it could be more effectively used in the future to identify risk areas and educate producers. The tool could form the basis for audits conducted by farm advisors and veterinarians and could be the underlying structure for BRM in agriculture in the future.

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Appendix A: Survey Question Evaluation Criteria

The following criteria were adapted from Dillman (1978):

Appropriate use of open-ended questions or closed-ended questions?

Will the words be uniformly understood?

Do the questions contain abbreviations or unconventional phrases?

Are the questions too vague?

Is the question too precise?

Is the question objectionable?

Is the question too demanding?

Is it a double question?

Does the question have a double negative?

Are the answer choices mutually exclusive?

Have you assumed too much knowledge?

Has too much been assumed about respondent behavior?

Is the question technically accurate?

Is an appropriate time referent provided?

Can the responses be compared with existing information?

Are the questions too cryptic?

The following criteria were adapted from Bowden (2002):

No negative questions and therefore no double negative answers

There are not two questions in one

Level of language is not too high/old-fashioned/unusual in any sense

The question is free from jargon

Singular and plural "you" is clear

The same idea is not contained in another question

The question is sensitive to measure change over time

Captures current views

Meaning and interpretation of question is clear

Time period is clear

Question makes sense to everyone

A "yes" response is clear and unambiguous in meaning

A "no" response is clear and unambiguous in meaning

Appendix B: Recommended Dairy Biological Risk Management Assessment Questions

Table A1. Assessment questions^{1,2}

Question	Top ten	Original	Revised	Pre
Cattle purchases and livestock movement				
1. Do you have a closed herd? (Do not bring new animals onto the dairy or allow animals to leave and return to dairy. This means no replacements, bulls, or show animals.) If YES, skip to Question 8	X			
2. How often did you bring <i>new</i> animals (including all calves, heifers, bulls, cows) into the herd in the last 12 mo? (More than three times, once or twice)	X			†
3. Do you quarantine new herd additions? (Quarantine means keeping new animals separate from the rest of your cattle for two to four weeks before they have direct contact.)	X		*	
4. If YES to Question 3, do you have an area used only for the quarantine of new animals?	X	O		
5. Do you examine and test new additions for common diseases <u>or</u> require testing before purchase?	X			†
6. How often do animals <i>leave/reenter</i> the herd (for shows, veterinary clinic, embryo transfer, etc.)?				†
7. Do you quarantine livestock returning to the farm?	X			†
Reducing transmission onto the farm				
8. Do you have a perimeter fence or other farm perimeter control?	X			
9. Do you have highly visible signs posted to restrict access to your facility?	X		*	
10. Do you require visitors to sign in when entering your facility and disclose recent animal contact?	X		*	
11. Do you minimize animal contact with people entering your facility?	X		*	
12. Do you require clean clothing or coveralls on visitors entering your facility?	X	O		
13. Do you require clean footwear or disposable boots on visitors entering your facility?	X	O		
14. Do you have a designated visitor parking area?	X		*	
15. Do you request that your employees avoid contact with livestock outside of your operation?	X	O		
16. Do you require clean clothing or coveralls on your employees when entering your facility?	X	O		
17. Do you require clean footwear on your employees when entering your facility?	X	O		
18. Do you have a designated employee parking area?	X		*	
19. Is rendering pickup designed to prevent rendering vehicles from bringing contamination to animal areas?	X	O		
20. Are animals kept from contact with other livestock?	X		*	
Reducing transmission within the farm				
21. Do you limit calving pens to calving only (no isolation animals)?	X	O		
22. Do you remove calves from their mothers at birth before they've had a chance to nurse?		O		
23. Do you use single source colostrum (not pooled from multiple cows)?		O		
24. Do you raise your calves on the dairy? If NO, skip to Question 29				
25. Do you use single source colostrum (not pooled from multiple cows)?		O		
26. Do you utilize individual calf housing for newborn calves?				†
27. Do you avoid feeding waste milk to calves?		O		
28. If NO to 27, do you pasteurize waste milk before feeding it to calves?				
29. Do you limit nose-to-nose contact between animals of different groups?	X	O		
30. Do you prevent young animals from coming into contact with manure from older animals?		O		
31. Do you avoid feeding leftover/uneaten feed from lactating animals to young stock?		O		
32. During chores, do employees move from "clean" younger animals to adult animals to dirty/ill animals, then to isolation animals or are employees designated to work with specific groups of cattle—only calves, only sick cows, only maternity, etc.?			*	
33. Do employees clean and disinfect boots when moving to special areas of the farm such as maternity and calf areas?	X		*	
34. Do you use different equipment for feed and manure handling?	X	O		
35. If NO to 34, do you clean equipment used for both manure/feed handling before using it for feed?	X	O		
36. Do you have a pest control program?	X	O		
37. Do you follow a set schedule for pest control maintenance?	X		*	
38. Do you have a veterinarian necropsy animals that die from unexpected causes?			*	
39. Do you keep common housing areas clean to prevent manure buildup or areas of stagnant water?			*	
40. Do you keep bedding areas clean?			*	
41. Are feed bunks designed to prevent people from stepping in them?	X		*	
42. Are manure-contaminated truck or tractor tires kept from contaminating the feed (in alleys or on feed pads)?			*	
42. Do you separate sick cows (potentially contagious) from healthy cows as soon as possible?		O		
43. Do you isolate sick animals? (Isolation means no contact between sick and healthy cattle.)	X			

¹Top ten = top 10 recommendations of Moore et al. (2008); Original = original dairy biological risk management survey; Revised = revised question from original survey; Pre = question adapted from preassessment survey.

²Response options: yes/always, frequently, sometimes, no/never, and not applicable.