Journal of Extension
www.joe.org

October 2019
Volume 57
Number 5
Article # 5RIB8
Research In Brief

Developing Herd Health Education for and Assessing Risky Practices of Cow-Calf Producers

Abstract

Bovine respiratory disease (BRD) is an often unrecognized problem in cow-calf herds. We describe a program we used to help producers identify and avoid practices that could increase their herds' risk for BRD. The greatest knowledge gains occurred for the topics of costs associated with BRD, BRD risks at the feedlot, and biosecurity measures. Through producer self-assessments, we found that the number of risky practices conducted by producers ranged from none to 22 per operation, averaging 10 per operation. Extension professionals should consider combining producer self-assessment with education on management as an effective strategy for informing producers of risks in their operations.

Keywords: bovine respiratory disease, beef, calves, Extension beef education, self-assessment

Andrew J. Allen
Assistant Professor
Department of Veterinary Clinical Sciences
College of Veterinary Medicine
aallen@wsu.edu

Donald A. Llewellyn
Regional Livestock Specialist
College of Agriculture, Human and Natural Resources
Don.Llewellyn@wsu.edu

Susan R. Kerr
Regional Extension Specialist
College of Agriculture, Human and Natural Resources
kerrs@wsu.edu

Tipton D. Hudson
Regional Extension Specialist
College of Agriculture, Human and Natural Resources
hudsont@wsu.edu

J. Shannon Neibergs
Associate Professor and Extension Economist
College of Agriculture, Human and Natural Resources
sneibergs@wsu.edu

Sarah M. Smith
Regional Extension Specialist
College of Agriculture, Human and Natural Resources
smithsm@wsu.edu

Dale A. Moore
Clinical Professor
Department of Veterinary Clinical Sciences
College of Veterinary Medicine
damoore@wsu.edu

Washington State University
Pullman, Washington

Introduction

Bovine respiratory disease complex (BRD) is the most economically damaging disease of beef cattle operations in North America (Griffin, 1997). Survey data have suggested that respiratory disease accounts for approximately 29% of all calf death losses in the United States (U.S. Department of Agriculture, 2011). The reported incidence of BRD in preweaned calves on cow-calf operations is between 3.3% and 38.0% (Hanzlicek et al., 2013; Muggli-Cockett, Cundiff, & Gregory, 1992; Snowder, Van Vleck, Cundiff, & Bennett, 2005), with an average incidence of 10.5% (Snowder et al., 2005).

Workshops such as Beef Quality Assurance education programs are popular with producer audiences (Duffey,

Paterson, King, & Rolfe, 2008) and serve as models for education of this audience to improve carcass quality in the feedlot. However, producer education focusing on risk factors for BRD in preweaned calves is lacking despite the fact that such education could help producers reduce both their losses and subsequent losses on feedlot or other postweaning operations. We undertook a project in which we developed a curriculum for educating cow-calf producers about common risk factors for BRD in preweaned cattle and, during initial program delivery, identified the most common BRD-related risky practices of program attendees for the purpose of personalizing the educational experience.

Methods

Educational Program and Knowledge Assessment

Members of the Washington State University (WSU) Beef Team developed an educational curriculum for cow-calf producers based on risk factors known to influence the incidence of BRD in preweaned calves. Topic areas of the curriculum aligned with the risk factors and were as follows:

- effects of pregnant cow management and nutrition on calf health,
- effects of dystocia (calving difficulty) on calf health,
- identification and treatment of BRD in calves,
- reduction of weaning stress,
- low-stress cattle handling practices,
- use of vaccinations to reduce BRD,
- factors at feedlot arrival that can influence BRD,
- reduction of transportation-related stress,
- organisms that cause BRD and relevant biosecurity measures,
- financial costs and benefits of preconditioning calves to reduce BRD, and
- costs associated with BRD.

We first developed a set of evidence-based educational fact sheets highlighting potential BRD risks (WSU BRD fact sheets) and then converted these resources to risk factor presentations organized by subject. Members of our team presented the materials at cow-calf producer meetings in seven locations throughout Washington State. After completion of the educational program, participants received a notebook of the aforementioned fact sheets that included best management practices for reducing BRD risk. The notebooks served as durable reference materials for participants for making sound cattle management decisions in their operations.

We used pretest and posttest evaluations to assess knowledge change as a result of the presentations. The pretest and posttest comprised the same set of questions, with one question for each of the 11 curriculum topic areas. For each question, the respondent indicated his or her level of knowledge on the topic, choosing from the following response options: *no knowledge, very little, some, quite a bit.* Because we used an audience response system (TurningPoint, ©Turning Technologies) for these tests, we were able to measure knowledge gains immediately.

Producer Practices Self-Assessment

In addition to the curriculum, we developed a 33-item self-assessment questionnaire to help producers identify potential risk factors for BRD on their operations. At the beginning of each workshop, participants were asked to respond to herd demographic, management, and veterinary involvement questions on a carbonless copy paper questionnaire. The top sheet had only the questions for them to respond to. Upon completion of the questionnaire, the producers removed and kept the bottom sheet of the carbonless copy, which showed their responses as well as practices considered less risky. Because of the questionnaire format, producers could identify their own risk areas and take home customized suggested solutions for reducing potential BRD risks. We kept the top sheet of the questionnaire for our analysis. Self-assessment questions were not weighted by importance and were not linked to the pretest or posttest knowledge evaluations.

Data Management and Analysis

We analyzed data from the pretests and posttests by comparing producers' knowledge about BRD management before and after the program. Additionally, we collected results from the producer practices self-assessments and analyzed those data using a spreadsheet program and a statistical software program (Epi Info V.7, Centers for Disease Control and Prevention, Atlanta, GA). Statistics included descriptive statistics, odds ratios with 95% confidence intervals, and results of chi-square test for trend analyses. A specific focus of the self-assessment was producer-reported veterinary involvement on the producers' ranches. The self-assessment included a question asking producers about the level of veterinary involvement with their herds to which producers answered by choosing from response options ranging from 1 to 5, wherein 1 = *I work closely with my veterinarian on all aspects of herd health and reproduction*, 3 = *Veterinary calls involve annual pregnancy checks and occasional problems*, and 5 = *I don't work with a veterinarian*. We used chi-square test for trend analyses to evaluate levels of veterinary involvement in herds relative to cattle operation herd size. We also evaluated associations between levels of veterinary involvement and different management practices reported by producers.

Results

Knowledge Assessment

The pretest and posttest evaluations documented gains by producers in self-reported knowledge of the 11 topic areas of the curriculum (Table 1). Greatest gains were recorded for the topics of costs associated with BRD (100% of participants reported a greater degree of knowledge following the program), BRD risks at feedlot arrival (91%), and organisms that cause BRD and associated biosecurity measures (81%). The knowledge gains related to costs associated with BRD and BRD risks at feedlot arrival are particularly

important because pretest results indicated that well over half of the respondents had little or no knowledge in these topic areas prior to participation in the program. Conversely, at pretest, producers reported high levels of knowledge for the topics of reduction of weaning stress and low-stress handling practices; accordingly, less than 50% of producers had increases in knowledge in these areas. Beyond the reports of knowledge gain, 61 of the 93 respondents (65.6%) reported that they would make changes to their operations on the basis of information gained from the workshop.

Table 1.

Preprogram and Postprogram Knowledge Levels of Cow-Calf Producers Participating in an Educational Program on Bovine Respiratory Disease (BRD)

Curriculum content topic area	% having little to no knowledge before	% showing increase in knowledge
Effects of pregnant cow management and nutrition on calf health	22%	61%
Effects of calving difficulty on calf health	24%	66%
Identification and treatment of BRD in calves	37%	72%
Reduction of weaning stress	16%	39%
Low-stress cattle handling practices	11%	49%
Use of vaccinations to reduce BRD	34%	75%
Factors at feedlot arrival that can influence BRD	67%	91%
Reduction of transportation-related stress	67%	75%
Organisms that cause BRD and biosecurity measures to control them	27%	81%
Financial costs and benefits of preconditioning calves to reduce BRD	23%	61%
Costs associated with BRD	64%	100%

Producer Practices Self-Assessment

Ninety-three of 165 producers attending the meetings completed and returned the practices self-assessment. Those producers had operations ranging from no animals (interested in raising cattle) to 4,380 head. Sixty percent of producers had a herd size of less than 100 head, 35% had a herd size between 100 and 400 head, and about 6% had more than 400 head of cattle. The producers identified whether they had a commercial cow-calf operation, raised seed stock (breeding stock for sale to commercial operations), or had a small-acreage farm. Many producers listed more than one operation type. The most prevalent type was the commercial operation (46 producers, 53%), followed by small-acreage farm (34 producers, 40%). The most common marketing methods used by the ranchers were public live auction (23 producers, 25%) and direct-to-consumer marketing (21 producers, 23%).

All but one of the producers who completed a self-assessment reported performing at least one practice with the potential to increase BRD risk in calves. The number of risky practices identified through the self–assessments ranged from 0 to 22 per operation, with an average of 10 such practices. The five most common risky practices for BRD identified in our survey were not testing cattle to evaluate trace mineral status (question 7), bringing new cattle onto the premises (question 21), not separating cow-calf pairs from those yet to calve during the calving season (question 11), not using nutrient requirement tables to determine energy and protein requirements (question 1), and not knowing the BVD status of the herd (question 25) (Table 2).

Table 2.

Cow-Calf Producer Responses to Self-Assessment of Calf Bovine Respiratory Disease (BRD) Risk Factors (*n* = 93)

Question	No. selecting risk-increasing response (response selected)	No. selecting risk-decreasing response (response selected)
Winter feeding of cows and replacement heifers management		
1. Do you use nutrient requirement tables to determine energy and protein requirements?	57 (no)	36 (yes)
2. Do you have your forages tested for nutrient content?	51 (no)	42 (yes)
3. Do you evaluate and record the body condition score of individual animals?	51 (no)	36 (yes)
4. Do you provide protein supplement to cows and heifers as needed?	18 (no)	73 (yes)
5. Do you provide an energy supplement to cows and heifers as needed?	19 (no)	72 (yes)
6. Do you provide a trace mineral supplement containing copper, selenium, etc.?	2 (no)	91 (yes)
7. Have you tested your cattle to evaluate trace mineral status such as copper or selenium?	72 (no)	21 (yes)
Dystocia prevention and calving management		
8. Do you have more than 1 in 20 cows that are hard pulls or C-sections?	7 (yes)	84 (no)
9. Do you have more than 1 in 20 heifers that are hard pulls or C-sections?	1 (yes)	89 (no)
10. Do you use smaller breed bulls or consider birth weight EPDs when selecting heifer bulls?	5 (no)	86 (yes)
11. Do you separate cow/calf pairs from those yet	61 (no)	29 (yes)

to calve during the calving season?		
12. Are cattle yet to calve moved to clean ground during the calving season?	36 (no)	56 (yes)
13. Do you evaluate calves for evidence of nursing within 12 hours of birth?	4 (no)	87 (yes)
14. Do you have colostrum replacer or frozen colostrum available during the calving season?	17 (no)	73 (yes)
15. Do you regularly evaluate calves for illness between birth and weaning?	5 (no)	86 (yes)
16. Do you use specific criteria to identify sick calves?	32 (no)	60 (yes)
Vaccination and biosecurity management		
17. Are cows and replacement heifers vaccinated with IBR-PI3-BVDV-BRSV before breeding?	24 (no)	69 (yes)
18. If using a killed virus vaccine, do you booster in 2 to 4 weeks?	51 (no)	24 (yes)
19. Are calves vaccinated with a product containing IBR-PI3-BVDV-BRSV?	22 (no)	69 (yes)
20. If using a killed virus vaccine for calves, do you booster in 2 to 4 weeks?	47 (no)	27 (yes)
21. Do you ever bring any new cattle (cows, heifers, bulls) to your premises?	71 (yes)	21 (no)
22. If yes to 21, are they tested for BVD-PI negative?	54 (no)	29 (yes)
23. If yes to 21, are incoming cattle isolated from the herd for a minimum of 14 days	29 (no)	51 (yes)
24. Do your cattle have contact (fence line, shared truck transport, shared grazing) with other cattle?	53 (yes)	39 (no)
25. Do you know the BVD PI status of your herd?	55 (no)	36 (yes)
Handling and low-stress management		
26. Do you and your employees use low-stress cattle handling techniques?	3 (no)	90 (yes)
27. Do cattle flow smoothly through your handling facilities?	7 (no)	86 (yes)
28. When working cattle, do people yell, shout or whistle loudly, or use a hot shot and dogs?	15 (yes)	78 (no)

29. Do you consider temperament (excitability) when culling or choosing replacements?	6 (no)	86 (yes)
30. Do you wean calves at least 45 days before transporting to a buyer or a feeding facility?	37 (no)	53 (yes)
31. Do you delay weaning calves if extreme weather events are forecast (hot, cold, windy, rain)?	18 (no)	71 (yes)
32. Do you process calves (vaccination, castration, ear tagging, branding) at weaning?	31 (yes)	61 (no)
33. Do you use low-stress weaning techniques?	25 (no)	63 (yes)

Note. Not every producer responded to every question, and sums of responses do not always equal 93. The responses of "Do not know" and "Sometimes" were classified as "No." BRSV = bovine respiratory syncytial virus, BVD = bovine viral diarrhea, BVDV = bovine viral diarrhea virus, EPD = expected progeny difference, IBR = infectious bovine rhinotracheitis, PI3 = parainfluenza virus-3, PI = persistently infected.

Fifty-five (62%) of the respondents to all the self-assessment questions reported performing more than nine practices considered risky. Those producers having less than 100 head were more likely to report performing more than nine practices considered risky (70% of 53 producers) compared to those in other herd size categories (Table 3). Producers having less than 100 head of cattle were 1.4 times more likely to conduct more than nine risky practices as compared to those with 100 head or more (95% CI [1.1, 6.4]).

Table 3.

Proportions of Responding Cow-Calf Producers Conducting More than Nine Practices That Could Increase Bovine Respiratory Disease Risk

Demographic variable	No. of ranchers	% of ranchers	% of ranchers conducting >9 risky practices
Herd size			
<100 head	53	60%	70%
100–400 head	31	35%	52%
>400 head	5	6%	40%
Operation type			
Commercial	46	88%	70%
Seed stock (breeding animals)	6	12%	17%

Note. Four producers did not report herd size. Many producers identified more than one operation type. For the operation type categories shown here, "Commercial" included any producer who indicated having a commercial operation or who identified his or her operation as a primary income source, and "Seed stock (breeding animals)" included any producer who did not indicate having a commercial operation and indicated having an operation involving seed stock.

The proportions of producers responding with a ranking of 1, 2, 3, 4, or 5 for level of veterinary involvement

in their herd were 20%, 9%, 42%, 17%, and 5%, respectively, with 6% not responding. We used a chi-square test for trend analysis (with responses of 4 and 5 combined due to small numbers) to analyze the level of veterinary involvement by herd size (Table 4). Results indicated that a higher level of veterinary involvement was associated with larger herd size (more than 100 head; $p = .03$) (Table 4). Eighty percent of producers with more than 400 head of cattle considered the involvement of their veterinarian to be high (Table 4).

Table 4.

Veterinary Involvement in Cow-Calf Herd Reported by Responding Producers ($n = 93$)

	<100 head		**100–400 head**		**>400 head**		**Total**
Veterinary involvement (1 = *high* to 5 = *low*)	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**
1	7	13.2%	8	27.6%	4	80.0%	19
2	5	9.4%	3	10.3%	0	0.0%	8
3	26	49.1%	12	41.4%	1	20.0%	39
4	10	18.9%	6	20.7%	0	0.0%	16
5	5	9.4%	0	0.0%	0	0.0%	5

Note. Six producers did not report level of veterinary involvement.

We evaluated each BRD risk factor for its association with producer-reported veterinary involvement on the cattle operations. With greater veterinary involvement, producers were more likely to use nutrient tables for formulating cow rations ($p = .005$), do forage testing ($p = .01$), test the herd for trace mineral status ($p = .01$), select bulls for lower-birth-weight calves ($p = .005$), move pregnant cows to clean calving grounds before calving ($p = .03$), and use BRD-related vaccines for cows and heifers ($p = .001$).

Discussion

Our project helped cow-calf producers identify and learn about management practices that could reduce their herds' risk for BRD in preweaned calves. Knowledge gains from before to after the educational program were more than 60% for most of the topics we covered. The exceptions were knowledge gains for low-stress weaning practices and low-stress handling. However, prior to our survey WSU Extension had placed emphasis on providing Washington producers with educational programs and information on low-stress weaning and low-stress handling. Therefore, we feel that lack of change in pretest-to-posttest knowledge is due to the application and effectiveness of these programs.

Equally important, results of the producer practices self-assessment we implemented provided additional insights into producers' educational needs. Self-assessments before an educational event can help learners focus on what is important to them and create awareness. In addition, the simple act of asking the question about a practice can produce significant changes in behavior due to the question-behavior effect

(Spangenberg, Kareklas, Devezer, & Sprott, 2016). Most producers reported conducting at least one practice considered risky, and over half reported conducting more than nine, highlighting the importance of herd health management assessments and the need for continuing education for producers.

The risk for BRD in cow-calf herds can be altered through management changes on the ranch (Woolums et al., 2013). Two practices that are most likely to increase BRD risk are bringing in new cattle to an operation without taking necessary precautions and failing to vaccinate cows, heifers, and calves with a respiratory pathogen vaccine. Many of our participants reported performing these practices. The combination of these two factors can put a herd at high risk for an outbreak of calf respiratory disease, and producers should be educated on this circumstance.

Producers having smaller herds (fewer than 100 head) were more likely than those having larger herds to report conducting more than nine practices considered risky. These findings are corroborated by a report where owners of larger herds treated a smaller proportion of calves for BRD compared to owners of small herds (Woolums et al., 2013). In a study of cattle herds in Alberta, Canada, herd-level treatment risk was lower for larger herds (Murray et al., 2016). According to the 2012 U.S. Department of Agriculture Census of Agriculture, there were 8,881 producers in Washington State with less than 100 head of cattle (U.S. Department of Agriculture National Agricultural Statistics Service, 2012). In Washington State, most calves reared on small operations are sold at auction and enter feedlots. Calves from small herds with many BRD risk factors increase BRD incidence risk in feedlots when they are commingled with calves from multiple sources. To decrease disease incidence within the state, these small-herd owners could be targeted for BRD management education. Extension educators should work closely with small-herd owners and their veterinarians to help them better understand BRD importance and implement preventive measures that could decrease risk in their herds, neighboring herds, and feedlot cattle.

Veterinary involvement on the operations of participants in our study was associated with several factors considered to put cow-calf herds at lower risk for BRD. Producers who had more than 400 head of cattle were more likely to work closely with a consulting veterinarian. Our observations are similar to results from a study of western Canadian cow-calf herds indicating that producers with more than 220 breeding cows were more intensive users of veterinary services than producers with less than 85 breeding cows (Waldner, Jelinksi, & McIntyre-Zimmer, 2013). Extension educators can take steps to ensure that cattle producers are aware of the importance of veterinary involvement in reducing BRD risk factors.

Conclusions

There is no single management intervention to decrease BRD incidence in cow-calf herds. However, self-assessment can help producers identify their own specific practices that put their herds at risk. Such self-assessment coupled with a curriculum such as ours for educating cow-calf producers about common risk factors for BRD is an effective combination for increasing awareness and knowledge. Extension professionals should consider including self-assessment tools in their programs to create awareness or cognitive dissonance in their clients and to facilitate understanding of clients' educational needs.

Acknowledgments

The work described herein was supported by a subaward from the Agriculture and Food Research Initiative Competitive Grant no. 2011-68004-30367 from the U.S. Department of Agriculture National Institute of Food

and Agriculture and a grant from the Western Center for Risk Management Education. Additional team members included Sarah Lopez and Sandy Poisson.

References

Duffey, L., Paterson, J., King, M., & Rolfe, K. (2008). Ranch management practices of beef quality assurance (BQA) and non-BQA certified producers in Montana. *Journal of Extension*, *46*(5), Article 5RIB7. Available at: https://www.joe.org/joe/2008october/rb7.php

Griffin, D. (1997). Economic impact associated with respiratory disease in beef cattle. *Veterinary Clinics of North America Food Animal Practice*, *13*, 367–377. Retrieved from https://www.sciencedirect.com/science/article/pii/S0749072015303029?via%3Dihub

Hanzlicek, G. A., Renter, D. R., White, B. J., Wagner, B., Dargatz, D. A., Sanderson, M. W., . . . Larson, R. E. (2013). Management practices associated with the rate of respiratory tract disease among preweaned beef calves in cow-calf operations in the United States. *Journal of the American Veterinary Medical Association*, *242*, 1271–1278. Retrieved from https://avmajournals.avma.org/doi/full/10.2460/javma.242.9.1271

Muggli-Cockett, N., Cundiff, L., & Gregory, K. (1992). Genetic analysis of bovine respiratory disease in beef calves during the first year of life. *Journal of Animal Science*, *70*, 2013–2019. Retrieved from https://academic.oup.com/jas/article-abstract/70/7/2013/4632005?redirectedFrom=fulltext

Murray, C. F., Fick, L. J., Pajor, E. A., Barkema, H. W., Jelinski, M. D., & Windeyer, M. C. (2016). Calf management practices and associations with herd-level morbidity and mortality on beef cow-calf operations. *Animal*, *10*, 468–477. Retrieved from https://www.cambridge.org/core/journals/animal/article/calf-management-practices-and-associations-with-herdlevel-morbidity-and-mortality-on-beef-cowcalf-operations/49D074D2E3C52B5ED2377427D5550935

Snowder, G. D., Van Vleck, L. D., Cundiff, L., & Bennett, G. L. (2005). Influence of breed, heterozygosity, and disease incidence on estimates of variance components of respiratory disease in preweaned beef calves. *Journal of Animal Science*, *83*, 1247–1261. Retrieved from https://academic.oup.com/jas/article/83/6/1247/4803126

Spangenberg, E. R., Kareklas, I., Devezer, B., & Sprott, D. E. (2016). A meta-analytic synthesis of the question-behavior effect. *Journal of Consumer Psychology*, *26*, 441–458. Retrieved from http://dx.doi.org/10.1016/j.jcps.2015.12.004

U.S. Department of Agriculture. (2011). Cattle and calves nonpredator death loss in the United States, 2010 (pp. i, ii, 20). Retrieved from www.aphis.usda.gov/animal_health/nahms/general/downloads/cattle_calves_nonpred_2010.pdf

U.S. Department of Agriculture National Agricultural Statistics Service. (2012). 2012 census of agriculture—State data. Table 11. Cattle and Calves—Inventory and Sales: 2012 and 2007. Retrieved from https://www.nass.usda.gov/Publications/AgCensus/2012/Full_Report/Volume_1,_Chapter_2_US_State_Level/st99_2_011_011.pdf

Waldner, C., Jelinksi, M. D., & McIntyre-Zimmer, K. (2013). Survey of western Canadian beef producers regarding calf-hood diseases, management practices, and veterinary service usage. *Canadian Veterinary*

Journal, *54*, 559–564. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3659451/

Woolums, A. R., Berghaus, R. D., Smith, D. R., White, B. J., Engelken, T. J., Irsik, M. B., . . . Waggoner, E. R. (2013). Producer survey of herd-level risk factors for nursing beef calf respiratory disease. *Journal of the American Veterinary Medical Association*, *243*, 538–547. Retrieved from https://avmajournals.avma.org/doi/full/10.2460/javma.243.4.538