

Risk factors for BRD on cow-calf operations

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Abstract

Surveys of cow-calf producers indicate that bovine respiratory disease (BRD) in nursing (preweaned) beef calves is recognized on approximately 20% of operations. In the US BRD is reported to be the leading cause of death in preweaning calves 3 weeks of age and older. As compared to feedlot BRD or dairy calf BRD, relatively little information has historically been available regarding risk factors for the nursing calf BRD. Information regarding risk factors can support the development of management practices that prevent BRD by limiting exposure of calves to risk factors. Evidence available to date indicates that at the calf level, male calves, calves born with a twin, calves born to a heifer, and calves that experience dystocia requiring major assistance are at increased risk for preweaning BRD. At the herd level, nursing calf BRD risk is associated with factors that increase the opportunity for introduction of pathogens new to the herd, calf diarrhea, and events that provide opportunities for close contact among cows and calves. Because risk factors to date have been identified in cross-sectional surveys and thus are not necessarily causative, research is needed to determine whether modification of risk factors identified to date can decrease subsequent BRD on cow-calf operations.

Key words: bovine, cattle, BRD, risk factors

Résumé

Sondages auprès des éleveurs-naisseurs indiquent que le complexe respiratoire bovin (CRB) en soins infirmiers (preweaned) veaux de boucherie est reconnu sur environ 20 % des opérations. Dans la nous est signalée à BRD être la principale cause de décès au poids avant sevrage des veaux l'âge de 3 semaines et plus. Par rapport au parc d'engraissement BRD ou veau laitier BRD, relativement peu d'informations ont été historiquement disponibles concernant les facteurs de risque pour le veau de soins infirmiers BRD. Informations concernant les facteurs de risque peuvent soutenir le développement des pratiques de gestion qui empêchent BRD en limitant l'exposition des veaux à des facteurs de risque. Les éléments disponibles à ce jour indiquent qu'au niveau du mollet, veaux mâles, les veaux nés dans une chambre à lits jumeaux, les veaux nés à une génisse, et les veaux que l'expérience une dystocie nécessitant une aide majeure sont à risque accru de poids avant sevrage BRD. Au niveau du troupeau, soins infirmiers calf BRD Risque est associée à des

facteurs qui augmentent les chances d'introduction d'agents pathogènes nouveaux au troupeau, veau, et des événements que la diarrhée offrent des possibilités de contact étroit entre les vaches et les veaux. Parce que les facteurs de risque ont été identifiés à ce jour dans des enquêtes transversales et ne sont donc pas nécessairement causal, la recherche est nécessaire pour déterminer si la modification des facteurs de risque identifiés à ce jour peuvent diminuer sur BRD subséquente d'exploitations de naissance.

Introduction

Surveys by the USDA National Animal Health Monitoring System (NAHMS) confirm that bovine respiratory disease (BRD) is the leading cause of mortality in US feedlot cattle,⁸ weaned dairy heifers,⁹ and nursing beef calves 3 weeks of age and older.¹⁰ Thus BRD has a significant impact on the profitability of cattle operations and on the health and welfare of cattle. Management practices play a role in the development of BRD; therefore, modification of management procedures along with adoption of practices to improve immunity and limit pathogen exposure have been effective in curtailing respiratory disease in feedlot cattle in some situations.^{2,5} Thus, identification of risk factors for BRD may provide opportunities to improve health and productivity of cattle by providing a basis for the development of management strategies that limit exposure of cattle to BRD risk factors. Much is known about the management practices that increase BRD risk in feedlot cattle and dairy calves; in contrast, less is known about the management-related risk factors for BRD in nursing (preweaned) beef calves on cow-calf operations. This review will summarize currently available information regarding factors that appear to put nursing calves on cow-calf operations at risk for BRD.

Herd-Level Risk Factors

A survey of Canadian cow-calf producers in the province of Québec¹ found that farms with fewer than 40 cows were less likely to report a problem with nursing calf BRD than farms with 40 or more cows; 16% of producers with fewer than 40 cows reported the occurrence of nursing calf BRD, while 36% of producers with 40 or more cows reported calf BRD. In this study there were regional differences in the rate of recognition of nursing calf BRD, with producers in the northern regions of the province reporting treatment of a larger proportion of their nursing calves for BRD than

producers in the southern and central regions. The rate of nursing calf BRD was associated with calving season length, with a longer calving season being associated with more cases of calf BRD.

An analysis of USDA NAHMS data collected by survey of 443 US producers in 24 states found that the rate of nursing calf BRD was increased in herds that imported steers from outside sources, herds composed of 2-breed or 3-breed crossbred or composite cattle (versus single-breed cattle), herds that administered antibiotics in feed to prevent calf BRD, and herds that were considered the primary source of income for the producer (versus herds that were considered a supplemental source of income).⁴ The monthly number of visits to the herd by outsiders was associated with calf BRD, but the relationship between number of visits and the calf BRD rate was not linear.

A mail survey of 459 US cow-calf producers in 3 eastern states (Georgia, Florida, and West Virginia) and 3 Plains states (Iowa, Kansas, and Nebraska)¹² found that the occurrence of nursing calf BRD was significantly associated with larger herd size, the occurrence of respiratory disease in cows, and the occurrence of diarrhea in calves. Calving season length was associated with calf respiratory disease in Plains but not eastern herds, with Plains herds calving in less than 3 months recognizing less calf BRD than Plains herds calving over 3 months or longer. The proportion of calves treated for BRD (i.e., the cumulative treatment incidence) was negatively associated with larger herd size and checking cows for pregnancy, and positively associated with winter calving, bringing calves into the herd from outside sources, giving calves supplemental feed not available to the cows (creep feed), and using a heat synchronization program for cows and/or heifers. Thus, in larger herds producers were more likely to identify calves with preweaning BRD, but they treated a smaller proportion of their calves for BRD than producers with smaller herds.

In an effort to expand on information gained by survey of producers in 6 US states,⁹ an on-line survey of veterinarians engaged in cow-calf practice in the same states was undertaken.¹⁰ Members of AABP and/or the Academy of Veterinary Consultants (AVC) located in Georgia, Florida, and West Virginia (eastern states) and Iowa, Kansas, and Nebraska (Plains states) were asked to complete the questionnaire with information regarding events occurring in the previous year. Five hundred seventy-four veterinarians were solicited to participate, 486 and 88 Plains and eastern veterinarians, respectively. Sixty-one veterinarians (10.6%) returned responses suitable for inclusion, including 52 (10.7%) Plains and 9 (10.2%) eastern veterinarians. In general, responses from the 2 regions were not different. Respondents reported that 18% of their cow-calf clients recognized cases of nursing calf BRD in the previous year, and 14% of their clients had at least 1 calf die of BRD. Five percent of clients were reported to have 5% or more of their calves affected by BRD. In order to diagnose infectious agents associated

with calf BRD antemortem, 67% of respondents submitted ear notches for bovine viral diarrhea virus (BVDV) testing, 25% submitted nasopharyngeal swabs for viral or bacterial testing, and smaller numbers used other tests. Sixty percent of respondents reported identifying *Mannheimia haemolytica* by antemortem or postmortem testing; 53% identified *Pasteurella multocida*, 37% identified *Mycoplasma bovis*, 33% identified bovine respiratory syncytial virus (BRSV), and 33% identified BVDV.

Veterinarians responding to the survey identified a variety of risk factors as potentially associated with BRD; at least 2 of these, "introduction of cattle from outside sources" and "occurrence of diarrhea in calves" were also significantly associated with nursing calf BRD in the producer survey. The risk factor identified as contributing to nursing calf BRD by the largest proportion of veterinarians was "weather", with 85% of respondents identifying weather as an important risk factor. Seventy-three percent of veterinarians identified "inadequate colostrum consumption" as a risk factor for calf BRD; 63% identified "introducing new cattle into the herd" and "failure to give calves respiratory vaccines" as significant factors, and 60% identified "failure to give cows respiratory vaccines" as significant. Smaller proportions of veterinarians identified other factors to be significant.¹⁰

Although it was not possible to specifically survey veterinarians providing service for the producers who responded to the producer survey⁹ (because the producer survey was anonymous), limiting both surveys to the same states was judged to provide roughly comparable information. Indeed, in the producer survey, 21% of operations reported observing 1 or more calves with BRD, and this was comparable to the 18% average percent of operations experiencing calf BRD as reported by veterinarians surveyed. Some risk factors identified by a relatively large proportion of veterinarians surveyed were found to be associated with calf BRD in the producer survey, while others were not. Over 50% of veterinarians identified introduction of cattle new to the herd and the occurrence of calf diarrhea in the herd as factors associated with calf BRD, and these were associated with occurrence of calf BRD, or cumulative calf BRD incidence, in the producer survey. Introduction of steers from outside sources was a herd-level risk factor for nursing calf BRD in another recent study;³ together these reports suggest that introduction of outside cattle of 1 kind or another may be a real risk factor for nursing calf BRD. In contrast, giving calves supplemental (creep) feed and using a heat synchronization program were associated with cumulative calf BRD incidence in the producer survey, but were considered by fewer than 10% of veterinarians responding here to be risk factors for calf BRD. Discrepancies in risk factors identified in the 2 surveys could have been due to the fact that significant risk factors in the producer survey were identified by regression analysis and modeling of data collected in the mail survey, while the risk factors identified in the survey of veterinarians represented their informed opinion. While both methods of assessing

possible risk factors have merit, properly controlled research that tests manipulation of 1 or more of the risk factors identified by these studies is necessary to confirm whether these factors truly modify the risk of calf BRD in herds where the disease is a problem.

It is important to note that the herd-level risk factors described above were all identified in cross-sectional surveys. Thus, it is not possible to determine from these studies whether the factors associated with nursing calf BRD were causative. That is, since these results were identified from data collected at 1 point in time, it is not possible to say whether nursing calf BRD came before or after the risk factors identified. More research will be needed to determine whether the factors listed above (or others) are actually causative, and whether manipulation of management practices related to these or other factors can mitigate nursing calf BRD. However, it is noteworthy that some common themes are identifiable in the risk factors reported to date. Larger herd size has been repeatedly linked to the occurrence of nursing calf BRD; this may simply be because herds with more calves have more animals that have the opportunity to develop BRD. Practices that may be a source of introduction of pathogens new to the herd have been related to calf BRD in multiple studies, such as introduction of weaned steers³ or calves from outside sources.⁹ Also, practices that increase opportunities for calves to come into close contact with other calves or cows, such as creep feeding calves,⁹ or estrus synchronization of cows,⁹ may increase risk for nursing calf BRD by providing more opportunities for calves to contact other cattle shedding respiratory pathogens, and for respiratory pathogen shedding in the group to be amplified. Longer calving season, which has been associated with calf BRD in 2 studies,^{1,9} may increase opportunity for transmission of respiratory pathogens to older calves with waning immunity from younger calves who may be shedding pathogens. Our group recently completed a case-control study of herd-level risk factors for nursing calf BRD (manuscript in progress), and factors identified in previous surveys were again found to be significantly associated with nursing calf BRD in this case-control study.

Taken together, the research to date suggests that practices that increase opportunity for introduction of pathogens new to the herd, and practices that may increase opportunity for transmission of infectious agents among cows and calves through close congregation, should be a particular focus in efforts to develop evidence-based practices to control nursing calf BRD.

Calf-Level Risk Factors

Calf-level factors associated with preweaning respiratory disease over several years in a large US herd included the year of the calf's birth, the location of the calf's group on the operation, whether or not the calf experienced dystocia requiring major assistance, the calf's sex (with male calves be-

ing at greater risk), and the age of the calf's dam (with calves born to heifers being at greater risk).⁶ Other investigators reported that calves born with a twin, and male calves, were significantly more likely to be identified with respiratory disease in the first 45 days of life.¹¹ The relationship between male sex and increased risk for preweaning BRD has been repeatedly identified, but the cause of this association is not yet known. In a recent study aimed at assessing the impact of vaccinating cows in late gestation on nursing calf BRD,⁷ male calves were again found to be more likely to develop BRD than female calves in the same herd. Interestingly, there was a trend ($p = 0.07$) toward a significant interaction that suggested that the efficacy of pre-calving vaccination differed by calf sex such that male calves received no benefit from pre-calving vaccination of the dams, but female calves did. This may indicate that the currently unknown factor or factors that increase BRD risk for male calves cannot be counteracted by maternal immunity, but maternal immunity may be beneficial for heifer calves. Researchers evaluating Canadian cow-calf herds found that higher serum antibody titers to bovine herpesvirus-1 (BHV-1), bovine viral diarrhea virus (BVDV), and bovine coronavirus (BCV) in cows vaccinated for these pathogens were associated with decreased risk of respiratory disease in their calves.³

Conclusions

Nursing calf BRD is the leading cause of death for calves 3 weeks of age and older on US cow-calf operation; approximately 20% of operations recognize nursing calf BRD. At the calf level, male sex has been repeatedly identified as a risk factor for nursing calf BRD, although the cause of this is not currently known. Calves born with a twin and calves born to heifers have been found at increased risk for developing preweaning BRD; also, the year the calf is born and the location on the operation where the calf is born have also been linked to calf BRD risk. At the herd level, surveys of producers indicate that factors that increase the likelihood of new infectious agents being introduced to the herd, the occurrence of calf diarrhea, and practices that lead to congregation of cows and calves (e.g., estrus synchronization of cows) are associated with increased nursing calf BRD risk. It is important to remember that association does not equal causation; factors associated with calf BRD do not necessarily cause calf BRD. Thus, research is needed to test the effect of modifying factors that have been found to be associated with calf BRD on the subsequent occurrence of preweaning BRD on cow-calf operations. Until such research results are available, the research to date suggests that practices that may increase opportunity for introduction of pathogens new to the herd, calf diarrhea, and practices that may increase opportunity for transmission of infectious agents among cows and calves through close congregation, should be a particular focus in efforts to develop evidence-based practices to control preweaning calf BRD.

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