

# A survey of veterinarians in 6 US states regarding their experience with nursing beef calf respiratory disease

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## Abstract

Bovine respiratory disease (BRD) is the leading cause of death of nursing beef calves 3 weeks of age and older, but little is known regarding risk factors for calf BRD. The objective of this survey was to describe observations and practices relevant to calf BRD by veterinarians in cow-calf practice. Recipients in Eastern (Georgia, Florida, and West Virginia) and Plains (Iowa, Kansas, and Nebraska) states were asked to complete an on-line questionnaire regarding events occurring between August 2011 and July 2012. A total of 574 veterinarians were solicited to participate; 61 (10.6%) returned responses suitable for inclusion, with an equivalent proportion responding from both regions. 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. Infectious agents identified by antemortem or postmortem testing included *Mannheimia haemolytica* (60% of respondents); *Pasteurella multocida* (53%); *Mycoplasma bovis* (37%); bovine respiratory syncytial virus (33%); and bovine viral diarrhea virus (33%). Of responding veterinarians, 80% recommended or administered treatment for an outbreak of nursing-calf BRD in the previous year. Routine administration of respiratory vaccines to nursing beef calves was recommended by 87% of respondents. Respondents identified a variety of risk factors as potentially associated with calf BRD. Two of

these, “introduction of cattle from outside sources” and “occurrence of diarrhea in calves”, were also significantly associated with nursing-calf BRD in a previous survey of producers in the same states.

**Key words:** beef calves, BRD, bovine respiratory disease, pneumonia, survey

## Résumé

Le complexe respiratoire bovin est la cause majeure de mortalité des veaux de boucherie allaitants âgés de 3 semaines ou plus. Néanmoins, on en connaît bien peu sur les facteurs de risque de cette condition chez les veaux. L'objectif de ce questionnaire était de décrire les observations et les pratiques associées à cette condition chez les veaux par des vétérinaires d'élevages vaches-veaux. On a demandé aux répondants d'états de l'est (Géorgie, Floride et Virginie de l'ouest) et des plaines (Iowa, Kansas et Nebraska) de remplir un questionnaire en ligne sur des événements qui prirent place entre août 2011 et juillet 2012. Un total de 574 vétérinaires ont été sollicités et 61 (10.6%) ont retourné des réponses appropriés. La proportion de répondants était similaire dans les deux régions. Les répondants ont rapporté que 18% de leurs clients d'élevages vaches-veaux avaient eu des cas associés au complexe respiratoire bovin chez des veaux allaitants dans l'année précédente et que 14% de leurs clients avaient eu au moins 1 cas de mortalité relié au

complexe. Les agents infectieux identifiés antemortem ou postmortem incluait *Mannheimia haemolytica* (60% des répondants), *Pasteurella multocida* (53%); *Mycoplasma bovis* (37%); le virus respiratoire syncytial bovin (33%), et le virus de la diarrhée virale bovine (33%). Parmi les vétérinaires répondants, 80% avaient recommandé ou administré un traitement pour une flambée du complexe respiratoire bovin chez les veaux allaitants dans l'année précédente. Les répondants ont identifié une multitude de facteurs de risque associés au complexe chez les veaux. Parmi eux, l'introduction de bovins provenant de l'extérieur et la présence de diarrhée chez les veaux étaient aussi significativement associés au complexe chez les veaux allaitants dans un autre questionnaire distribué préalablement aux producteurs de ces mêmes états.

## Introduction

Bovine respiratory disease (BRD) is the leading cause of death for all classes of cattle and calves in the United States (US), with animal deaths alone costing producers over \$643 million annually (2010 estimate).<sup>20</sup> Recent US Department of Agriculture (USDA) National Animal Health Monitoring Systems (NAHMS) surveys confirm that BRD is the leading cause of mortality in US feedlot cattle,<sup>17</sup> weaned dairy heifers,<sup>18</sup> and nursing beef calves 3 weeks of age or older.<sup>19</sup> 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 in feedlot cattle and dairy calves.<sup>4,6,10,14,22</sup> Modification of management procedures, along with adoption of practices to improve immunity and limit pathogen exposure, have been effective in curtailing BRD in some situations.<sup>4,10,15</sup> Thus, knowledge of management-related risk factors for BRD may provide opportunities to improve health and productivity in certain classes of cattle. Although much is known about the management practices that increase BRD risk in feedlot cattle and dairy calves, little is known about management-related risk factors for nursing-calf BRD on cow-calf operations. This knowledge gap is significant, because respiratory disease was reported to be the leading cause of preweaning death for calves 3 weeks of age or older on US cow-calf operations.<sup>19</sup> Some 16% of preweaning deaths in calves born alive have been attributed to BRD.<sup>16</sup>

Epidemiologic characteristics of nursing-calf BRD on North American cow-calf operations have not been extensively described. Two reports described the pattern of respiratory disease occurring over several years in nursing calves in the herd at the USDA Agricultural Research Service Meat Animal Research Center.<sup>11,13</sup> Over 20 years, the annual incidence of preweaning calf

BRD in the Meat Animal Research Center herd varied from 3 to 24%, with an average annual incidence of 11%. Annual case fatality risk among calves with BRD varied from 7 to 17%, with an annual average of 13%. A recent analysis of USDA NAHMS data collected from 443 US cow-calf operations found that the mean percent (+/- SD) of calves affected with preweaning BRD was 3.0% +/- 7.1%. The mean rate of preweaning calf BRD over all operations was relatively low at 1.5 +/- 3.7 cases per 10,000 calf-days, but the rate ranged from 0 to 75.0 cases per 10,000 calf-days, indicating that a few herds had relatively high rates of preweaning calf BRD.<sup>7</sup> Available data indicate that BRD in nursing calves can be an important problem on some cow-calf operations.

The objective of this study was to survey veterinarians in cow-calf practice in 6 US states to describe their observations and practices related to nursing-calf BRD on cow-calf operations they served. The states selected for this survey were also the focus of a mail survey of US cow-calf producers to determine herd-level risk factors for nursing-calf BRD; results of that study are presented elsewhere.<sup>23</sup> Both producers and practitioners were surveyed to provide a more complete picture of characteristics and risk factors in nursing-calf BRD. The overall goal of the work was to identify factors that might logically be addressed in future research to inform the design of disease mitigation strategies for nursing-calf BRD.

## Materials and Methods

An on-line questionnaire was developed using a software program.<sup>a</sup> Seven veterinarians engaged in cow-calf practice were asked to pre-test a preliminary version of the questionnaire. Following pre-testing the questionnaire was finalized, and veterinarians who were members of the American Association of Bovine Practitioners (AABP) and/or the Academy of Veterinary Consultants (AVC) in Georgia, Florida, West Virginia ("Eastern states"), and Iowa, Kansas, and Nebraska ("Plains states") were contacted by e-mail in August 2012 and asked to complete the questionnaire. The survey was limited to veterinarians in these 6 states in order to allow comparison of responses to those obtained in an earlier survey of cow-calf producers in the same states.<sup>23</sup> The e-mail message included a short invitation statement, a list of participating researchers in each state, and a deadline for completion of the survey, along with a link that took participants directly to the on-line questionnaire. Information was requested regarding events occurring in the previous year (between August 1, 2011 and July 31, 2012). E-mail reminders were sent 1 and 2 weeks after the initial contact. The questionnaire was accessible for 5 weeks after the initial invitation was sent. Descriptive statistics were calculated and re-

sponses by veterinarians in the 2 regions were compared by the Fisher's Exact test for categorical variables and the Mann-Whitney test for continuous variables, with significance set at  $P < 0.05$ .

## Results

E-mail messages soliciting participation in the survey were sent to 574 veterinarians, with 486 sent to Plains veterinarians and 88 sent to Eastern veterinarians. A total 61 veterinarians (10.6%) returned responses suitable for inclusion, with 52 (10.7%) returned by Plains veterinarians and 9 (10.2%) returned by Eastern veterinarians. The number of responses received from each state were: 17 from Iowa, 15 from Kansas, 20 from Nebraska, 2 each from Florida and West Virginia, and 5 from Georgia.

The mean ( $\pm$  SD) number of cow-calf clients served by the respondent's practice tended to be higher ( $P = 0.07$ ) for Plains respondents (156  $\pm$  195; range, 6 to 1000) than for Eastern respondents (74  $\pm$  65; range, 5 to 200). The mean ( $\pm$  SD) percent of the respondent's time spent working with cow-calf producers was greater ( $P = 0.03$ ) for Plains respondents (49%  $\pm$  21%; range, 12 to 85%) than for Eastern respondents (31%  $\pm$  29%; range, 3 to 80%). Other responses were generally not statistically significantly different between the 2 regions, thus the reported results are the combined responses of Eastern and Plains veterinarians.

Respondents reported that 18%  $\pm$  19% (range, 0 to 80%) of their cow-calf clients had nursing calves with BRD in the previous year, and that 14%  $\pm$  22% (range, 0 to 83%) of their clients had nursing-calf deaths due to BRD in the previous year. Five percent ( $\pm$  7%; range, 0 to 31%) of their clients had 5% or more of their nursing calves affected with BRD in the previous year, and 4%  $\pm$  6% (range, 0 to 25%) of clients had 5% or more

of their nursing calves affected with BRD in multiple years. In comparison, 18%  $\pm$  17% (range, 0 to 75%) of respondents' cow-calf clients had a problem with calf diarrhea in the previous year.

Respondents were asked to rank the pattern of nursing-calf BRD that occurred in herds they had evaluated. The most common pattern of disease reported was "sporadic cases in calves 3 months of age and older", followed by "sporadic cases in calves less than 3 months of age", "sudden outbreaks affecting multiple calves 3 months of age or older", and then "sudden outbreaks affecting multiple calves less than 3 months of age".

Respondents were asked to report tests they had submitted for diagnosis of infectious agents associated with nursing-calf BRD, and the infectious agents identified by antemortem or postmortem testing. Plains respondents reported submitting 9 ( $\pm$  15) nursing calves with BRD for necropsy in the previous year, while Eastern respondents reported submitting 1 ( $\pm$  2) calf ( $P = 0.002$ ). This difference may have been related to the larger number of cow-calf clients served by Plains veterinarians. Antemortem diagnostic methods used in the year before the survey to diagnose infectious agents associated with nursing-calf BRD are presented in Table 1. Infectious agents identified by antemortem or postmortem diagnostic testing from nursing calves with BRD are presented in Table 2.

Respondents were asked whether they had recommended or administered any treatment for an outbreak of nursing-calf BRD in the previous year, and 49 respondents (80%) responded affirmatively. Respondents who had recommended or administered any treatments for calf BRD outbreaks in the previous year were asked to report what treatments they recommended or administered (Table 3). Respondents were also asked to identify all specific antimicrobial drugs they had recommended or administered for calf BRD in the past

**Table 1.** Percent of all respondents (n = 60) reporting various diagnostic methods when asked which antemortem tests they used to diagnose infectious agents associated with nursing-calf BRD in the year prior to the survey.

Diagnostic test	Percent of respondents using this method
Bovine viral diarrhea virus (BVDV) ear notch IHC or ELISA	67
Nasopharyngeal swabs for virus testing	25
Nasopharyngeal swabs for bacterial testing	25
Viral serology (single sample)	22
Viral serology (paired sampling)	12
Other*	10
Tracheal wash or bronchoalveolar lavage for bacterial testing	7
Tracheal wash or bronchoalveolar lavage for virus testing	3

\*One respondent each reported using "histopathology", "exam", "FA (fluorescent antibody) tests", "gross findings", "necropsy submissions", or "histology and culture".

**Table 2.** Percent of all respondents (n = 60) who diagnosed specific infectious agents by antemortem or postmortem diagnostic testing of nursing calves with bovine respiratory disease in the year prior to the survey.

Pathogen	Percent of respondents identifying this pathogen
<i>Mannheimia haemolytica</i>	60
<i>Pasteurella multocida</i>	53
<i>Mycoplasma bovis</i>	37
Bovine respiratory syncytial virus (BRSV)	33
Bovine viral diarrhea virus (BVDV)	33
Infectious bovine rhinotracheitis virus (IBRV)	25
<i>Histophilus somni</i>	23
Coronavirus	12
<i>Bibersteinia trehalosi</i>	5
Parainfluenza type 3 virus (PI3V)	2
Other*	2

\*One respondent reported a diagnosis of *Salmonella*.

**Table 3.** Percent of all respondents (n = 49) who recommended or administered various treatments to treat or control an ongoing outbreak of nursing-calf bovine respiratory disease in the year prior to the survey.

Treatment	Percent of respondents recommending or administering this treatment
Antimicrobial treatment of individual cases as they occur	92
Mass antimicrobial treatment of all calves in the group	71
Vaccination: MLV intranasal infectious bovine rhinotracheitis virus/parainfluenza-3 virus +/- bovine respiratory syncytial virus (IBRV/PI3V +/- BRSV)	61
NSAID to individual cases as they occur	59
Vaccination: MLV or inactivated SC or IM viral (IBRV and/or PI3V and/or BRSV and/or BVDV)	57
Vaccination: SC or IM bacterial ( <i>Mannheimia haemolytica</i> and/or <i>Pasteurella multocida</i> and/or <i>Histophilus somni</i> and/or <i>Mycoplasma bovis</i> )	43
Mass NSAID treatment of all calves in the group	4
Other*	4

\*One respondent reported recommending coronavirus vaccine, and 1 respondent reported that they treated sick calves and vaccinated healthy calves.

year (Table 4). There may have been some confusion regarding this question, as more respondents listed antimicrobials they had recommended (n = 60) than had made recommendations for treatment of an outbreak in the past year (n = 49). Perhaps the antimicrobial drugs reported had been recommended by our respondents in recent years, but not specifically in the past year.

Respondents were asked whether they routinely recommended or administered respiratory vaccines to nursing calves, and 53 respondents (87%) said they

did. When respondents answering in the affirmative were asked to report why they recommended vaccines to nursing calves, 93% said they recommended vaccines to prevent respiratory disease in calves while they were still nursing, 68% said they recommended respiratory vaccines to treat or shorten an outbreak of respiratory disease in nursing calves, and 96% said they recommended vaccines to prevent respiratory disease in the calves after weaning. Respondents who indicated that they recommended respiratory vaccines for nursing calves

**Table 4.** Percent of respondents (n = 60) who recommended or administered various antimicrobials for treatment of nursing calves with bovine respiratory disease.

Antimicrobial	Percent of respondents recommending this antimicrobial
Tulathromycin* (Draxxin®)	82
Florfenicol† (Nuflor®, Nuflor Gold®, or Resflor Gold®)	80
Enrofloxacin‡ (Baytril®) or danofloxacin (Advocin™)	70
Ceftiofur§ (Naxcel®, Excenel®, or Excede®)	62
Oxytetracycline	33
Tilmicosin   (Micotil®)	30
Gamithromycin¶ (Zactran®)	17
Penicillin	15
Sulfonamides	8
Other#	3

\*Draxxin, Zoetis, Florham Park, NJ

†Nuflor, Nuflor Gold, Resflor Gold, Merck Animal Health, Summit, NJ

‡Baytril 100, Bayer Animal Health, Shawnee, KS

§Naxcel, Excenel, Excede, Zoetis, Florham Park, NJ

||Micotil 300, Elanco Animal Health, A Division of Eli Lilly and Company, Indianapolis, IN

¶Zactran, Merial Limited, Duluth, GA

#One respondent reported recommending ampicillin, and another reported recommending spectinomycin.

**Table 5.** Percent of respondents (n = 53) who recommended administration of various respiratory vaccines to nursing calves in the year prior to the survey.

Vaccine	Percent of respondents recommending this vaccine
Modified live SC or IM viral IBRV and/or PI3V and/or BRSV and/or BVDV vaccine	87
SC or IM <i>Mannheimia haemolytica</i> +/- <i>Pasteurella multocida</i> bacterin-toxoid	87
Modified live intranasal IBRV/PI3V/BRSV vaccine	59
Modified live intranasal IBRV/PI3V vaccine	30
SC or IM <i>Histophilus somni</i>	30
Inactivated SC or IM viral IBRV and/or PI3V and/or BRSV and/or BVDV vaccine	28
SC or IM <i>Mycoplasma bovis</i>	6
Other*	2

\*One respondent reported recommending coronavirus vaccine.

were asked to report the youngest age they would recommend that nursing calves be vaccinated. Thirty-four percent said the youngest age they would recommend vaccinating was 0 to 29 days of age, 60% said 30 to 120 days, and 6% said 121 to 180 days. When respondents were asked whether they recommended that a booster vaccine be given before weaning, 77% said “yes” and 23% said “sometimes”. No respondent said “no”. Respondents were asked to report which vaccines they had recommended for nursing calves in the past year, and these responses are shown in Table 5.

Respondents were asked to report in general how likely they felt their clients were complying with their recommendations for treating and preventing nursing-calf respiratory disease. Forty-nine percent said “very likely”, 36% said “likely”, 3% said “unlikely”, and 12% said “very unlikely”. Respondents were invited to write in factors they thought made clients more or less likely to comply with their recommendations for treating and preventing nursing-calf BRD. Some recurring themes were evident in the responses, and are summarized in Table 6.

**Table 6.** Summary of factors reported by responding veterinarians as contributing to the likelihood of cow-calf client compliance with their recommendations for treatment and prevention of nursing-calf bovine respiratory disease.

<b>Factors that make a client <u>more</u> likely to comply with veterinarian's recommendations for treating and preventing nursing-calf bovine respiratory disease (BRD) (n = 59)</b>	<b>Percent reporting this factor</b>
Previous experience with similar problem/positive outcomes from previous advice	32
Their trust in their veterinarian	22
Availability of facilities/convenience/long acting antimicrobials	19
High number of calves dying	12
Price/value of calves	7
<b>Factors that make a client <u>less</u> likely to comply with veterinarian's recommendations for treating and preventing nursing-calf BRD (n = 57)</b>	
Lack of facilities/labor; effort required to catch calves	46
Cost of treatment	26
Time	14
Multiple doses required/complicated treatment regimen	12
No previous history of respiratory disease	9

**Table 7.** Factors identified by respondents (n = 60) as contributing to the occurrence of nursing-calf bovine respiratory disease. Respondents were asked to select from a list provided on the questionnaire.

<b>Factor</b>	<b>Percent identifying this factor as contributing to occurrence of nursing-calf BRD</b>
Weather	85%
Inadequate colostrum consumption	73%
Introducing new cattle into the herd	63%
Failure to give calves respiratory vaccines*	63%
Failure to give cows respiratory vaccines	60%
Calf diarrhea in the herd	52%
Vitamin and/or mineral deficiency for cows/calves	52%
Protein and/or energy deficiency for cows/calves	50%
Calving cows and/or heifers in confinement	50%
Presence of bovine viral diarrhea virus persistently infected cattle in the herd	50%
Dystocia	48%
Respiratory disease in cows or replacement heifers	37%
Long calving season	35%
Fenceline contact with neighbor cows	33%
Using intensive grazing	13%
Other†	8%
Heat synchronization of cows and/or heifers	7%
Creep feeding calves	5%
Segregating cow-calf pairs by age	2%

\*Significantly different ( $P = 0.042$ ) response from Plains vs Eastern veterinarians: 69% of Plains veterinarians selected this factor as significant, while only 25% of Eastern veterinarians did.

†Other factors reported: "dry dusty conditions and wind"; "calves unable to get adequate water"; "not controlling dust and flies"; "genetics-Angus more prone"; and "adding cows, especially a put-together herd".

Respondents were asked to indicate factors they thought contributed to the occurrence of nursing-calf BRD by selecting from a list provided on the questionnaire; the responses are shown in Table 7. Respondents were also invited to write in comments regarding why they thought their clients with nursing-calf BRD had problems with the disease. In general, comments expanded on issues related to factors listed in Table 7. In addition to these factors, “genetics” and “dry and dusty conditions” were mentioned as likely contributing factors by multiple respondents. “Genetics” was raised in the context of either a specific breed type being unusually susceptible (e.g. Angus or black colored cattle), or herds that have calves selected for good growth. These relationships may be real, or they may be due instead to the fact that black cattle are over-represented in US beef cattle herds, or that a health problem like BRD is more noticeable in calves that are growing well, because it seems inconsistent with high growth. A few respondents mentioned that nursing-calf BRD is sometimes a problem that is hard to explain, especially when it occurs in herds that seem to be well managed. In contrast, other respondents said nursing-calf BRD seemed to be preventable if producers were attentive to issues such as nutrition, timely vaccination of cows and calves, and limiting new introductions to the herd.

### Discussion

Results of this survey provide a unique view of the problem of BRD in nursing (preweaning) beef calves, because they represent observations and practices of veterinarians engaged in cow-calf practice in 2 major US calf-producing regions. While results of this study must be interpreted in light of the limitations of surveys, including the possibility of bias related to low response rate and the possibility of errors in recall, the study provides veterinarians working with cow-calf producers insight into approaches their peers use to deal with nursing-calf BRD. The impressions of practitioners related to risk factors for nursing-calf BRD also provide some guidance to researchers who wish to test strategies for control of the disease.

It was of interest to determine whether practices by veterinarians in the 2 regions surveyed differed. In most cases, the responses from the 2 regions were not statistically significantly different; this may have been due in part to the small number of responses from the Eastern region and the overall low response rate. When statistically significant differences were found between regions, the results were reported separately since it could not be assumed that they were homogenous. However, given the small number of responses obtained from both regions, the importance of regional differences reported here should not be over interpreted.

The overall response rate of 10.6% was typical for an on-line survey;<sup>3</sup> however, a higher response rate was desired. We elected to sample AABP and AVC members in the 6 target states, as this population was considered likely to contain a relatively high proportion of veterinarians in cow-calf practice, the target population of the survey. It is possible that fewer AABP and AVC members in the target states are engaged in cow-calf practice than expected. The length of the questionnaire may have deterred responses, although veterinarians who pre-tested the questionnaire did not express concerns about the length. Another possibility is related to written-in comments on the questionnaire, which indicated that veterinarians differ in their opinions regarding the relative importance of nursing-calf BRD. This is supported by their responses, which indicate that some respondents had no producers with nursing-calf BRD problems in the previous year. Research by others has also indicated that many cow-calf producers see few or no calves with preweaning BRD, while a few operations have many affected calves.<sup>7</sup> Thus it is possible that a relatively large proportion of AABP and AVC members see few or no operations affected with preweaning calf BRD, and thus were not motivated to complete the questionnaire. Administration of the survey in the summer may have also impacted response rate. Summer was chosen because veterinarians in beef-cattle practice are typically not as busy; however, many may take time for activities outside of work during this season, leaving them with little time or motivation for completing a work-related survey.

Information regarding viral and bacterial pathogens that are important contributors to nursing beef-calf BRD is limited. This is likely related to the effort, time, and stress associated with capturing individual calves to collect samples for microbiologic assessment. Moreover, results of microbiologic testing can be difficult to interpret if they are collected too late or too early in an outbreak, or if too few calves are sampled. Consistent with this, none of the specified antemortem tests were submitted by more than 25% of respondents, with the exception of ear notches submitted to identify bovine viral diarrhea virus persistently infected cattle, which were submitted by 67% of respondents.

In a small number of reports, reference has been made to the isolation of *Mannheimia haemolytica* and *Pasteurella multocida*<sup>12</sup> or bovine respiratory syncytial virus and *M. haemolytica*<sup>21</sup> from nursing beef calves with BRD. Consistent with the possible relevance of *M. haemolytica*, this bacteria was the pathogen most often reported to have been identified by antemortem or postmortem testing by veterinarians responding to this survey, and *P. multocida* was reported nearly as often (Table 2). In contrast to the small amount of information supporting *M. haemolytica* as a common contributor to

nursing-calf BRD, the pathogen has not commonly been isolated from dairy calves with BRD,<sup>1,2</sup> although it can be an important contributor to some fatal cases of BRD in dairy calves.<sup>8</sup> The fact that bacterial pathogens were reported to have been identified by more veterinarians responding to this survey than viral pathogens may have been due to pathogens being predominantly identified at necropsy of dead calves, when bacteria might persist after viral infection has resolved.

The relatively high proportion of respondents who recommend vaccination of nursing beef calves (87%) was of interest. This may have been biased by a high level of interest in respiratory disease control by the veterinarians responding to this survey. In comparison, a recent NAHMS survey indicated that between 13 and 33% of cow-calf operations administered respiratory vaccines to calves in the preweaning period,<sup>19</sup> indicating that the practice may not be widespread. In our producer survey,<sup>23</sup> 15% of Eastern producers and 52% of Plains producers reported administering respiratory vaccines to nursing calves, suggesting that giving respiratory vaccines to preweaning beef calves may be more common in the Plains than in the Eastern region. In support of this possibility, “failure to give calves respiratory vaccines” was the only risk factor in this survey cited significantly more often by Plains veterinarians than Eastern veterinarians as associated with calf BRD (Table 7).

Of the responding veterinarians who recommended administration of respiratory vaccines to nursing calves, 68% of them said that they recommended vaccines to treat or shorten an outbreak of nursing-calf BRD. While administration of vaccines in the face of an outbreak is anecdotally discussed and recommended, we are not aware of any controlled research supporting the efficacy of the practice. One report suggests that vaccination of calves with a modified-live BRSV vaccine in the early stages of a BRSV outbreak actually made disease worse.<sup>9</sup> However, vaccination in the face of outbreaks of undifferentiated nursing-calf BRD seems to be a common practice, based on anecdote and the responses of veterinarians responding to this survey.

Therefore, it seems unlikely that vaccination in the face of outbreaks commonly makes disease worse. Disease due to BRSV in particular can be made worse by immunopathologic responses,<sup>5</sup> thus vaccination with BRSV vaccine in outbreaks caused by BRSV may be risky due to the possibility of inducing harmful immune responses. However, all reports of BRSV vaccine-enhanced disease have described cattle that received parenteral vaccines, and it is not known whether an intranasal BRSV vaccine would be more or less likely to enhance disease if given during an outbreak of BRSV. More research is needed to confirm the efficacy and safety of vaccination to treat or control outbreaks of undifferentiated BRD in nursing calves.

One objective of this study was to compare observations and practices of veterinarians in the 6 target states with characteristics and risk factors identified in a mail survey of cow-calf producers in the same states.<sup>23</sup> Although it was not possible to specifically survey veterinarians providing service to producers who responded to the producer survey (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, which is comparable to the 18% of operations experiencing calf BRD as reported by veterinarians surveyed here.

Herd-level risk factors associated with identification of any cases of nursing-calf BRD in the producer survey<sup>23</sup> included larger herd size, identification of respiratory disease in cows and/or replacement heifers, and occurrence of diarrhea in calves. Calving season length was associated with the occurrence of calf BRD in Plains but not Eastern herds. Risk factors associated with cumulative treatment incidence in the producer survey included winter calving, bringing calves into the herd from outside sources, giving calves supplemental feed, and using a heat synchronization program. Larger herd size, and checking cows and/or replacement heifers for pregnancy, was negatively associated with cumulative treatment incidence. Producers with larger herds were more likely to see at least 1 nursing-calf with BRD, but over the course of the preweaning period they treated a smaller proportion of calves for BRD than smaller herds.<sup>23</sup>

Some risk factors identified by a relatively large proportion of veterinarians responding to this survey (Table 7) were found to be associated with calf BRD in the producer survey, while others were not. Over 50% of veterinarians identified introduction of new cattle 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 (calf diarrhea) or cumulative calf BRD incidence (introducing calves from outside sources) in the producer survey. Introduction of steers from outside sources was a herd-level risk factor for nursing-calf BRD in another recent study.<sup>7</sup> Together, these reports suggest that introduction of outside cattle of one 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 a higher 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. This discrepancy could occur because producers responding to the survey were not necessarily working with veterinarians who responded to the survey, so it is likely the 2 groups of respondents were not describing the same herds. Also, the 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 here are the informed opinion of the responding veterinarians. 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.

### Conclusions

This survey of veterinarians engaged in cow-calf practice in 6 US states indicated that nursing (preweaning)-calf BRD is recognized as a problem by a proportion of cow-calf producers, with the exact proportion of operations affected varying widely in the experience of the responding veterinarians. Respondents reported that 18% of their cow-calf clients recognized cases of nursing-calf BRD in the year prior to the survey, and 14% of their clients had at least 1 calf die of BRD. Some 5% of their cow-calf clients had 5% or more of their calves affected by BRD. Observations and practices of Eastern and Plains veterinarians often agreed, although the small number of Eastern veterinarians responding to the survey makes it impossible to draw strong conclusions about practices that may vary between these regions. Plains veterinarians submitted more calves with BRD for necropsy than Eastern veterinarians, although this may have been related to the larger number of cow-calf operations served by Plains veterinarians. *Mannheimia haemolytica* and *P. multocida* were the pathogens most commonly found in antemortem or postmortem testing of calves with BRD, but this may have been biased by the proportion of postmortem diagnoses of calves that died, because 25% or fewer respondents submitted antemortem diagnostic testing for most respiratory pathogens. Treatment of individual calves or entire groups of calves with antimicrobials was the most commonly reported practice for addressing an ongoing outbreak of calf BRD, and newer-generation antimicrobials were more commonly recommended than older-generation products. Some 87% of respondents recommended or administered respiratory vaccines to preweaning calves, and of these, 68% recommended vaccines to treat or control an ongoing outbreak of calf BRD. More research is needed to confirm the efficacy and safety of vaccination to treat or control outbreaks of undifferentiated BRD in nursing calves. A variety of risk factors was identified by respondents as potentially being associated with BRD, and 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 a survey of producers in the same states.

### Endnote

\*Qualtrics, Qualtrics Inc., Provo UT

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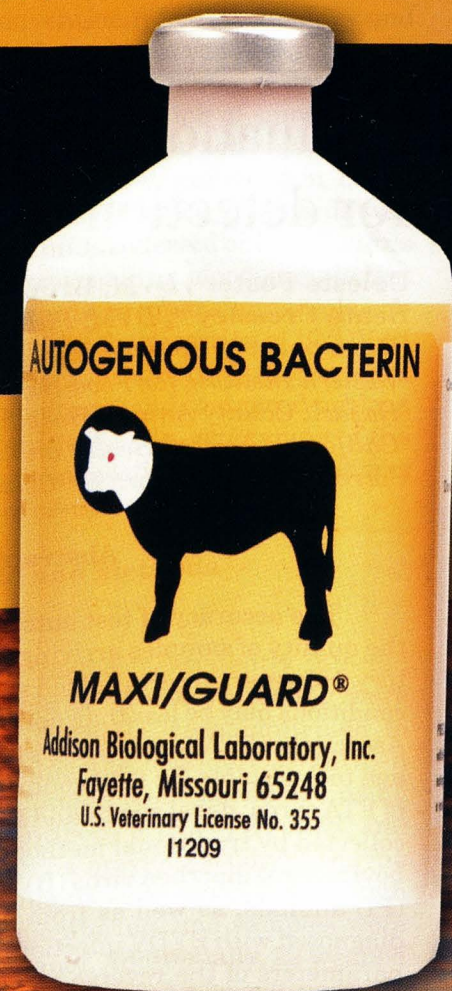
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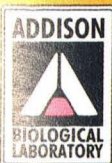


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