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Protocol for a Scoping/Systematic Review: Scoping Review Prevention of Shipping Fever in cow-calf operations

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Abstract

Background: The judicious use of antimicrobials in the livestock industry has become a topic of increasing interest over the last few years. Bovine respiratory disease (BRD) is considered mainly a problem of feedlot cattle or dairy calves, but a survey on the use of antimicrobials in California cow-calf operations revealed that BRD is in the top three diseases that ranchers treat most frequently with antimicrobials. There are both viral and bacterial causative agents that are associated with BRD. The pathogenesis of these agents often depends on the immune status of the animals and stress is considered to play major role in exacerbating the problem. In cow-calf operations these stressors can be in the form of management procedures such as processing of calves where they may be castrated, vaccinated, receive ear tags or being branded. Weaning is another stressful event in the life of a calf where the effects can be synergized if the calf is also transported at the same time. Due to the climate and landscape in California, cattle are often transported to different pastures in the summer and winter to take advantage of availability of feed year-round in different parts of the state at different times of the year. Vaccination, immune modulation, improving immune status through mineral supplementation and good colostrum[1] can all play a role in prevention of the disease relative to transportation. In this review we explore the available literature for evidence of effective methods to prevent BRD in cattle in California after transportation.

Objectives: The objective of this scoping review is to examine and describe the existing literature on methods for the prevention of BRD that can be implemented in cow-calf operations in California and therefore reduce the use of antimicrobials due to BRD.

Design: Primary research on prevention of BRD due to shipping stress will be considered for inclusion. The process for selection and inclusion of the studies will be reported in a flow chart according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA). The results will be summarized in tables and charts describing study types, interventions and outcomes.

Introduction

Rationale

BRD is caused by multiple organisms, with the most prominent ones being *Bovine Respiratory Syncytial Virus, Bovine Viral Diarrhea Virus, Infectious Bovine Rhinotracheitis Virus [2], Mannheimia hemolytica, Pasteurella multocida, Histophilus somnus*, among others [3]. Often the course of the disease is an

infection with one of the viruses that damage the respiratory mucosa followed by opportunistic infection with commensal bacteria with the end result of a bronchopneumonia [4]. Stress lowers the immune response and has been associated with outbreaks [5]. The term shipping fever describes the phenomenon where cattle that are transported to feedlots often break with pneumonia most frequently in the days and weeks after arrival at the feedlot following transportation on trucks.

The typical signs of BRD are depression, anorexia, abnormal respiration and an elevated rectal temperature but diagnosis of BRD based on clinical signs is not straightforward. Monitoring for BRD in cow-calf operations can be difficult due to the extensive range where cattle are pastured. Cattle often hide sickness and unlike in a feedlot situation it is not always easy to spot an animal that has decreased appetite. Taking a rectal temperature requires restraint of the animal, which can be resource intensive on range. Treatment of BRD involves antimicrobials where early treatment is most successful. Delay in treatment often results in multiple doses of antimicrobials given.

California Department of Food and Agriculture's Antimicrobial Use and Stewardship group (CDFA-AUS) conducts a statewide program to promote actions that reduce the use of antimicrobials and therefore reduce the development of resistant bacteria associated with livestock and poultry that can have negative public health impacts. Although much research has focused on prevention of BRD in feedlot settings, the applicability of these methods to cow-calf operations is not always given. We are therefore conducting a review of the literature with the goal in mind to assemble preventative measures for reducing BRD following transportation that are applicable to cow-calf operations.

The proposed scoping review is part of the effort by CDFA-AUS to develop best practices for California cow-calf operations. It is expected that the usefulness of the resulting tools and documents will expand beyond the state boundaries. Although the scoping review will be conducted with practices and conditions in California in mind, the information gained may be applicable to a much broader audience. The proposed scoping review addresses the need for information on ways to prevent or treat this disease using non-antimicrobial approaches.

Objectives

The primary objective of this scoping review is to provide a comprehensive overview on the prevention of BRD in cow calf operations including the use of vaccines, immune modulators or herd health strategies such as anthelmintics or mineral supplementation to prevent BRD in cattle due to shipping stress. We aim to identify the existing literature and describe the methods, interventions used, and outcomes reported. Further objectives are to identify the need for systematic reviews in specific areas with abundant information or further research in areas with lacking information.

Methods

Eligibility criteria

The following studies will be included:

- Original scientific reports
- Review papers, commentaries, letters to the editor will not be considered
- All study designs (observational and experimental) except case reports or case series.
- Study population restricted to cattle domesticated members of the genus *Bos*

- Intervention described is applicable to cow-calf operations
- Published in English language in or after 1990
- No geographical restrictions
- Study compares an intervention for the prevention of BRD in cattle to either a placebo or another intervention or evaluated a risk factor for BRD between exposed and non-exposed.
- Contains a quantifiable outcome including but not limited to incidence of disease, cause-specific mortality, duration of disease, weight gain.
- Study design includes diagnosis for any of the causative agents of BRD: Bovine coronavirus, bovine respiratory syncytial virus, bovine rhinotracheitis virus, parainfluenza virus 3, bovine viral diarrhea virus, *Pasteurella multocida, Histophilus somus, Mannheimia hemolytica, Bibersteinia trehalosi, Mycoplasma bovis* or a clinical diagnosis. Studies where owners are asked to estimate incidence will be considered if they were given a case definition. Studies that mention a diagnosis by trained personnel, e.g. pen riders, or a veterinarian without case definitions will be accepted.
- Peer-reviewed or conference proceedings of >500 words (no letters to the editor, lay articles, reviews, unpublished studies, theses or dissertations).

All study designs except case series or case studies will be considered as these latter study types do not include hypothesis testing. Conference proceedings for the American Association of Bovine Practitioners, the World Buriatrics Association, American College of Veterinary Internal Medicine, American Veterinary Medical Association and the Conference of Research Workers in Animal Diseases will be reviewed for the last 20 years. The conference proceedings mentioned are the most likely sources for unpublished research abstracts we are interested in. In addition, the bibliographies of studies fitting the search criteria will be examined for studies not captured by the search. The decision to limit publications to English language only was made so that interested veterinarians or producers would be able to look up and read all studies included. 1990 was chosen as the earliest timepoint for study publication to limit the number of publications that aren't electronically available as we are expecting a large number of publications captured by our search criteria.

Information sources

A literature search using the following databases and interfaces will be designed and conducted through the Carlson Health Library at the School of Veterinary Medicine at the University of California Davis with input from other study team members.

Database	Interface
Medline	PubMed
CAB Abstracts	CAB Direct
Biosis	Web of Science

Search strategy:

Research Question: What measures can prevent shipping fever in cattle on California cow-calf operations due to intrastate transport?

<u>Databases and Interfaces Searched:</u>

Database	Interface	Date Coverage	Date Searched
Medline	Pubmed	1966 to Current	07.02.2020
CAB Abstracts	CAB Direct	1972 - Current	07.02.2020
Biosis	Web of Science	1926 - Current	07.02.2020

Full Search Strategy:

Searcher: Megan Van Noord

Peer Reviewer: Erik Fausak

PubMed

Search	Query	Items Found
#1 *Terms to describe BRD*	"Cattle Diseases"[Mesh:NoExp] OR "Bovine Respiratory Disease Complex"[Mesh] OR "Bovine Respiratory Disease"[tiab] OR "Shipping Fever"[tiab] OR pneumonia[tiab] OR pneumonias[tiab] OR pneumonic[tiab] OR "Bronchopneumonia"[Mesh] OR bronchopneumonia[tiab] OR bronchopneumonias[tiab] OR "Fog Fever"[tiab] OR "pulmonary adenomatosis"[tiab]	177,668
#2 *Terms to describe viruses that can cause BRD*	"Coronavirus"[Mesh] OR coronavirus[tiab] OR coronaviruses[tiab] OR deltacoronavirus[tiab] OR deltacoronaviruses[tiab] OR "M protein, Coronavirus" [Supplementary Concept] OR "Respiratory Syncytial Virus, Bovine"[Mesh] OR "Infectious Bovine Rhinotracheitis"[Mesh] OR "Herpesvirus 1, Bovine"[Mesh] OR "IBR-IPV Virus"[tiab] OR "IBR-IPV Viruses"[tiab] OR "Infectious Bovine Rhinotracheitis Virus"[tiab] OR "Infectious Pustular Vulvovaginitis Virus"[tiab] OR "Bovine Herpesvirus 1"[tiab] OR "Respiratory Syncytial Virus, Bovine"[Mesh] OR "Bovine respiratory syncytial virus"[tiab] OR "BRSV"[tiab] OR "Parainfluenza Virus 3, Bovine"[Mesh] OR "Bovine parainfluenza virus 3" OR "parainfluenza3"[tiab] OR "PI3"[tiab] OR "Diarrhea Viruses, Bovine Viral"[Mesh] OR "Bovine Viral Diarrhea Virus"[tiab] OR "Bovine Viral Diarrhea Viruses"[tiab] OR "Bovine Diarrhea Virus"[tiab] OR "Bovine Diarrhea Viruses"[tiab] OR "Bovine Pestivirus"[tiab] OR "Bovine Pestiviruses"[tiab]	46,990
#3 *Terms to describe bacteria that can cause BRD*	"Pasteurellaceae"[Mesh] OR pasteurellaceae[tiab] OR "pasteurellosis"[tiab] OR histophilus[tiab] OR Hemophilus[tiab] OR Haemophilus[tiab] OR mannheimia[tiab] OR "M. glucosida"[tiab] OR "M. granulomatis"[tiab] OR "M. ruminalis"[tiab] OR "M. varigena"[tiab] OR pasteurella[tiab] OR "Bibersteinia trehalosi"[Supplementary Concept] OR bibersteinia[tiab] OR "Mycoplasma"[Mesh:NoExp] OR "Mycoplasma bovis"[Mesh] OR "Mycoplasma bovigenitalium"[Mesh] OR "mycoplasma dispar"[tiab] OR "Mycoplasma bovirhinus"[tiab] OR "Ureaplasma spp."[tiab]	51,140
#4	#1 OR #2 OR #3	264,660

#5 Terms to describe cattle	"Cattle"[Mesh] OR cattle[tiab] OR cow[tiab] OR cows[tiab] OR bos[tiab] OR bovine[tiab] OR bovines[tiab] OR bovinae[tiab] OR heifer[tiab] OR heifers[tiab] OR bullocks[tiab] OR oxen[tiab] OR steer[tiab] OR steers[tiab] OR Angus[tiab] OR Ayrshire[tiab] OR Boran[tiab] OR Brahman[tiab] OR Brangus[tiab] OR Braunvieh[tiab] OR Charolais[tiab] OR Fleckvieh[tiab] OR Friesian[tiab] OR Gelbvieh[tiab] OR Gir[tiab] OR Hereford[tiab] OR Holstein[tiab] OR Jersey[tiab] OR Limousin[tiab] OR Longhorn[tiab] OR Nellore[tiab] OR Ongole[tiab] OR Sahiwal[tiab] OR Sanga[tiab] OR Shorthorn[tiab] OR Simmental[tiab] OR Wagyu[tiab] OR beef[ti] OR calf[tiab] OR calves[tiab] OR calving[tiab]	484,196
#6 Terms to describe transportation or location	"Transportation"[Mesh] OR transport*[tiab] OR "in transit"[tiab] OR boat[tiab] OR ship*[tiab] OR truck*[tiab] OR train*[tiab] OR plane[tiab] OR planes[tiab] OR freight[tiab] OR railroad[tiab] OR railroads[tiab] OR cargo[tiab] OR feedlot[tiab] OR feedlots[tiab]	1,262,568
#7 Combines BRD concepts with cattle terms and transportation terms	(#4 AND #5 AND #6) AND English[lang]	2,063
#8 Removed letters, editorials, case reports	#7 NOT ("Letter" [Publication Type] OR "Editorial" [Publication Type] OR "Case Reports" [Publication Type])	2,018
#9 Publication date from 1950-present	#8 AND ("1950/01/01"[Date - Publication] : "3000"[Date - Publication])	2,018

CAB Abstracts

Search	Search Term	Results
#1	title:("Bovine Respiratory Disease" OR "Shipping Fever" OR pneumonia OR pneumonias OR pneumonic OR bronchopneumonia OR bronchopneumonias OR "Fog Fever" OR "pulmonary adenomatosis") OR ab:("Bovine Respiratory Disease" OR "Shipping Fever" OR pneumonia OR pneumonias OR pneumonic OR bronchopneumonia OR bronchopneumonias OR "Fog Fever" OR "pulmonary adenomatosis")	56,464
#2	title:(coronavirus OR coronaviruses OR deltacoronavirus OR deltacoronaviruses OR "IBR-IPV Virus" OR "IBR-IPV Viruses" OR "Infectious Bovine Rhinotracheitis Virus" OR "Infectious Pustular Vulvovaginitis Virus" OR "Bovine Herpesvirus 1" OR "Bovine respiratory syncytial virus" OR "BRSV" OR "Bovine parainfluenza virus 3" OR "parainfluenza3" OR "PI3" OR "Bovine Viral Diarrhea Virus" OR "Bovine Viral Diarrhea Viruses" OR "Bovine Diarrhea Virus" OR "Bovine Diarrhea Viruses" OR "Bovine Pestivirus" OR "Bovine Pestiviruses") OR ab:(coronavirus OR coronaviruses OR	17,350

	deltacoronavirus OR deltacoronaviruses OR "IBR-IPV Virus" OR "IBR-IPV Viruses" OR "Infectious Bovine Rhinotracheitis Virus" OR "Infectious Pustular Vulvovaginitis Virus" OR "Bovine Herpesvirus 1" OR "Bovine respiratory syncytial virus" OR "BRSV" OR "Bovine parainfluenza virus 3" OR "parainfluenza3" OR "PI3" OR "Bovine Viral Diarrhea Virus" OR "Bovine Viral Diarrhea Viruses" OR "Bovine Diarrhea Virus" OR "Bovine Diarrhea Viruses" OR "Bovine Pestivirus" OR "Bovine Pestiviruses")	
#3	title:(pasteurellaceae OR "pasteurellosis" OR histophilus OR Hemophilus OR Haemophilus OR mannheimia OR "M. glucosida" OR "M. granulomatis" OR "M. ruminalis" OR "M. varigena" OR pasteurella OR bibersteinia OR "mycoplasma dispar" OR "Mycoplasma bovirhinus" OR "Ureaplasma spp.") OR ab:(pasteurellaceae OR "pasteurellosis" OR histophilus OR Hemophilus OR Haemophilus OR mannheimia OR "M. glucosida" OR "M. granulomatis" OR "M. ruminalis" OR "M. varigena" OR pasteurella OR bibersteinia OR "mycoplasma dispar" OR "Mycoplasma bovirhinus" OR "Ureaplasma spp.")	23,450
#4	#1 OR #2 OR #3	91,692
#5	od:("Bos") OR up:(bos) OR title:(cattle OR cow OR cows OR bos OR bovine OR bovines OR bovinae OR heifer OR heifers OR bullocks OR oxen OR steer OR steers OR Angus OR Ayrshire OR Boran OR Brahman OR Brangus OR Braunvieh OR Charolais OR Fleckvieh OR Friesian OR Gelbvieh OR Gir OR Hereford OR Holstein OR Jersey OR Limousin OR Longhorn OR Nellore OR Ongole OR Sahiwal OR Sanga OR Shorthorn OR Simmental OR Wagyu) OR ab:((cattle OR cow OR cows OR bos OR bovine OR bovines OR bovinae OR heifer OR heifers OR bullocks OR oxen OR steer OR steers OR Angus OR Ayrshire OR Boran OR Brahman OR Brangus OR Braunvieh OR Charolais OR Fleckvieh OR Friesian OR Gelbvieh OR Gir OR Hereford OR Holstein OR Jersey OR Limousin OR Longhorn OR Nellore OR Ongole OR Sahiwal OR Sanga OR Shorthorn OR Simmental OR Wagyu)	671,492
#6	#4 AND #5	18,790
#7	title:(transportation OR transport OR transported OR "in transit" OR boat OR boats OR ship OR ships OR shipment OR shipments OR shipped OR shipping OR truck OR trucks OR tuckload OR truckloads OR auction OR auctions OR train OR trains OR plane OR planes OR freight OR railroad OR railroads OR cargo OR feedlot OR feedlots OR imported OR importation OR importations) OR ab:(transportation OR transport OR transported OR "in transit" OR boat OR boats OR ship OR ships OR shipment OR shipments OR shipped OR shipping OR truck OR trucks OR tuckload OR truckloads OR auction OR auctions OR train OR trains OR plane OR planes OR freight OR railroad OR railroads OR cargo OR feedlot OR feedlots OR imported OR importation OR importations)	468,458
#8	#6 AND #7	1,776
#9	#8 AND yr:[1950 TO 2020] AND Language: English	1,248
#10	#9 AND Document type: Journal article OR Journal issue OR Conference proceedings OR Conference paper OR Miscellaneous OR Abstract only	1,167

BIOSIS

Search	Query	Items Found

#1	(TI=("Bovine Respiratory Disease" OR "Shipping Fever" OR pneumonia OR pneumonias OR pneumonic OR bronchopneumonia OR bronchopneumonias OR "Fog Fever" OR "pulmonary adenomatosis") OR TS=("Bovine Respiratory Disease" OR "Shipping Fever" OR pneumonia OR pneumonias OR pneumonic OR bronchopneumonia OR bronchopneumonias OR "Fog Fever" OR "pulmonary adenomatosis")) AND DS=("respiratory system disease")	53,602
#2	(TI=(coronavirus OR coronaviruses OR deltacoronavirus OR deltacoronaviruses OR "IBR-IPV Virus" OR "IBR-IPV Viruses" OR "Infectious Bovine Rhinotracheitis Virus" OR "Infectious Pustular Vulvovaginitis Virus" OR "Bovine Herpesvirus 1" OR "Bovine respiratory syncytial virus" OR "BRSV" OR "Bovine parainfluenza virus 3" OR "parainfluenza3" OR "PI3" OR "Bovine Viral Diarrhea Virus" OR "Bovine Viral Diarrhea Viruses" OR "Bovine Diarrhea Virus" OR "Bovine Diarrhea Viruses" OR "Bovine Pestivirus" OR "Bovine Pestiviruses") OR TS=(coronavirus OR coronaviruses OR deltacoronavirus OR deltacoronaviruses OR "IBR-IPV Virus" OR "IBR-IPV Viruses" OR "Infectious Bovine Rhinotracheitis Virus" OR "Infectious Pustular Vulvovaginitis Virus" OR "Bovine Herpesvirus 1" OR "Bovine respiratory syncytial virus" OR "BRSV" OR "Bovine parainfluenza virus 3" OR "parainfluenza3" OR "PI3" OR "Bovine Viral Diarrhea Virus" OR "Bovine Viral Diarrhea Viruses" OR "Bovine Diarrhea Virus" OR "Bovine Diarrhea Viruses" OR "Bovine Pestivirus" OR "Bovine Pestiviruses")) *AND* **TAXA NOTES**: (Viruses)	18,363
#3	(TI=(pasteurellaceae OR "pasteurellosis" OR histophilus OR Hemophilus OR Haemophilus OR mannheimia OR "M. glucosida" OR "M. granulomatis" OR "M. ruminalis" OR "M. varigena" OR pasteurella OR bibersteinia OR "mycoplasma dispar" OR "Mycoplasma bovirhinus" OR "Ureaplasma spp.") OR TS=(pasteurellaceae OR "pasteurellosis" OR histophilus OR Hemophilus OR Haemophilus OR mannheimia OR "M. glucosida" OR "M. granulomatis" OR "M. ruminalis" OR "M. varigena" OR pasteurella OR bibersteinia OR "mycoplasma dispar" OR "Mycoplasma bovirhinus" OR "Ureaplasma spp.")) *AND* **TAXA NOTES**: (Bacteria)	46,317
#4	#1 OR #2 OR #3	114,662
#5	TA=(Bovidae 85715) OR TI=(cattle OR cow OR cows OR bos OR bovine OR bovines OR bovinae OR heifer OR heifers OR bullocks OR oxen OR steer OR steers OR Angus OR Ayrshire OR Boran OR Brahman OR Brangus OR Braunvieh OR Charolais OR Fleckvieh OR Friesian OR Gelbvieh OR Gir OR Hereford OR Holstein OR Jersey OR Limousin OR Longhorn OR Nellore OR Ongole OR Sahiwal OR Sanga OR Shorthorn OR Simmental OR Wagyu) OR TS=(cattle OR cow OR cows OR bos OR bovine OR bovines OR bovinae OR heifer OR heifers OR bullocks OR oxen OR steer OR steers OR Angus OR Ayrshire OR Boran OR Brahman OR Brangus OR Braunvieh OR Charolais OR Fleckvieh OR Friesian OR Gelbvieh OR Gir OR Hereford OR Holstein OR Jersey OR Limousin OR Longhorn OR Nellore OR Ongole OR Sahiwal OR Sanga OR Shorthorn OR Simmental OR Wagyu)	865,821
#7	#4 AND #5	12,425
#8	TI=(transportation OR transport OR transported OR "in transit" OR boat OR boats OR ship OR ships OR shipment OR shipments OR shipped OR shipping OR truck OR trucks OR tuckload OR truckloads OR auction OR auctions OR train OR trains OR plane OR planes OR freight OR railroad OR railroads OR cargo OR feedlot OR feedlots OR imported OR importation OR importations) OR TS=(transportation OR transport OR transported OR "in transit" OR boat OR	4,101,011

	boats OR ship OR ships OR shipment OR shipments OR shipped OR shipping OR truck OR trucks OR tuckload OR truckloads OR auction OR auctions OR train OR trains OR plane OR planes OR freight OR railroad OR railroads OR cargo OR feedlot OR feedlots OR imported OR importation OR importations)	
#9	#7 AND #8	2,083
#10	#9 *AND* **LANGUAGE:** (English) Indexes=BIOSIS Previews Timespan=1950-2020	1,935

Study Records:

Search results will be imported into EndNote™ (Clairvate Analytics, Philadelphia, USA) and duplicate entries removed. Resulting references will be imported into DistillerSR™ (Evidence Partners, Ottawa, Canada) where they undergo a second screen for duplicate entries, a 2-level screen for inclusion and data extraction.

Selection Process:

We apply a 2-level screen for study inclusion to references identified in the initial search.

Level 1 will evaluate the title/abstract for the inclusion and level 2 will be at the full text level. Publications where disagreement exist or reviewers choose "unable to decide", consensus will be sought with the help of a third reviewer.

The criteria for passing level 1 at the title/abstract level will consist of the following questions:

- Is the article in English?
- Does the study compare an intervention for the prevention of BRD in cattle to either placebo or another intervention or does it evaluate a risk factor for BRD between exposed and non-exposed?

Two reviewers (S-YC and PB) will be evaluating the references independently. In order to consider the citations for level 2 review, all the questions for level one should be answered "yes", otherwise the citation will be removed. For publications where there is disagreement between reviewers, consensus will be sought with the help of a third reviewer (GM). Studies where no conclusion can be reached based on the title or abstract will be labelled as "unable to decide" and be evaluated at the full text level. Pre-testing of a random sample of 20 studies at level 1 will be completed by all reviewers to validate screening questions and reach consensus on wording and interpretation of criteria.

The criteria to pass level 2 screening at the full text level are the following questions that will be answered with "yes", "no" or "unable to decide":

- Is the full text available in English?
- Has the study been published in 1990 or later?
- Is the study a case report or case series?
- Does the study compare an intervention for the prevention of BRD in cattle to either placebo or another intervention or does it evaluate a risk factor for BRD between exposed and non-exposed?

- Does the study protocol include a diagnosis for BRD based on the pathogen (viral or bacterial) or a clinical diagnosis? Studies where owners are asked to estimate incidence will be considered if they were given a case definition.
- Can the intervention be generalized to cow-calf operations in California (i.e. not only specific for dairies or feedlots)? Cattle are not handled more than 2 days in a row; vaccination regimens are acceptable; supplements or medication in feed is acceptable
- Does the study report a quantifiable outcome to evaluate the efficacy (e.g.. incidence of BRD, cause specific mortality due to BRD, weight gain)?
- Is the study published in a peer-reviewed journal or conference proceedings >500 words?

In order to be included in the data extraction step, both reviewers must have answered "yes" for all the questions above, if there are discrepancies between the two reviewers, consensus will be sought by a third reviewer. Pre-testing for a randomly selected subset of 10 studies will be performed to validate the questions and reach consensus on wording and interpretation criteria.

Data Charting Process:

Full text publications will be acquired and uploaded into the review management software DistillerSR. Data extraction will be performed by using structured pre-tested forms in DistillerSR that will include:

Study characteristics:

- Publication year, year of study conduct
- Region and country where study was performed
    - California
    - United States or Canada
    - Other Western hemisphere
    - Europe
    - Asia
    - Africa
    - Australia/New Zealand
- Study population:
    - production system beef / dairy), age groups (preweaned, weaned, breeding/milking), breeds, sex, commercial / research herd, etc.)
    - Age groups (preweaned, weaned, breeding/milking, not stated)
    - Breeds (Angus, Hereford, Holstein, Angus/Holstein X, etc.)
    - Sex
    - Herd type
    - Housing
- How was diagnosis of BRD established?
    - Laboratory testing (PCR, culture, necropsy)
    - Ultrasound / auscultation
    - Clinical diagnosis
    - Other

- Publication type:
    - Peer reviewed journal
    - Conference abstract
    - Other
- Study type
    - Observational
        - Cohort
        - Case-control
        - Cross sectional
    - Experimental
        - Was group allocation randomized?
        - Was there a control group?
        - Were the researchers blinded?
- Unit of analysis

- Follow-up period

For experimental studies

- Study Groups
    - Intervention
    - Comparison
        - Placebo
        - No intervention
        - Other
- Sample size
    - Equal group allocation
    - Sample size per group

Intervention or risk factor

- Prevention intervention type or risk factor:
    - Vaccine (MLV, Attenuated)
    - Other conventional herd health management, anthelmintics, minerals, colostrum?
    - Commercial immune stimulant, herbal remedies, etc.
    - Genotype
    - Risk factor for BRD, e.g. age, season, group size, travel time

Results

- Outcome
    - Incidence of the disease
    - Disease severity (severity score, duration of illness)

- o   Weight gain
- o   Mortality
- o   Other
- Association between interventions and outcome
    - o   Intervention/risk factor 1
    - o   Intervention/risk factor 2, if applicable, etc.
- Significance of results
    - o   Statistically sig. improved outcome in exposed (P<=.05 or 95% CI excluding 0)
    - o   Statistically sig. worse outcome in exposed (P<=0.05 or 95% CI excluding 0)
    - o   Statistically no difference between groups (P>0.05 or 95% CI including 0)
    - o   Statistical results not provided

The standardized data abstraction tool will be calibrated by testing it on the first 10 studies and any issues concerning ambiguity or inconsistency will be resolved by revising the data abstraction tool accordingly.

Results

Descriptive figures for the process of screening and the studies selected will be created. To illustrate the inclusion process of the studies, we will create a flow chart that includes the number of studies identified in the initial search, number of duplicates eliminated, number and reasons of citations eliminated in the 2 levels of screening and final number of studies included in the review.

Figures describing the studies by study population, study type, specific pathogen identified, etc. will be created.

A table summarizing the interventions, the significance and the direction of the effect (if it was favorable for the prevention or not) will be reported. We will consider the 95% confidence intervals including the null value or p-values > 0.05 as non-significant.

Confidence in Cumulative Evidence:

Quality of evidence will not be evaluated as part of this scoping review.

Discussion

Limitations:

In this scoping review we aim to provide a broad overview of a body of research. Our goal is to provide most of the information available without excluding sources of information based on the quality of research performed. The conclusions drawn from this review must be considered with this caveat in mind.

Conclusions:

This scoping review will provide a summary of primary research investigating vaccination for the prevention of BRD that can be generalized to different cow-calf operations. Results will inform on the

necessity to perform systematic reviews, uncover future research needs, or help inform best practices on the judicious use of antimicrobials surrounding this disease.

References:

1.   Wittum, T.E. and L.J. Perino, *Passive immune status at postpartum hour 24 and long-term health and performance of calves.* Am J Vet Res, 1995. **56**(9): p. 1149-54.
2.   Mosier, D., *Review of BRD pathogenesis: the old and the new.* Anim Health Res Rev, 2014. **15**(2): p. 166-8.
3.   Confer, A.W., *Update on bacterial pathogenesis in BRD.* Anim Health Res Rev, 2009. **10**(2): p. 145-8.
4.   Guterbock, W.M., *The impact of BRD: the current dairy experience.* Anim Health Res Rev, 2014. **15**(2): p. 130-4.
5.   Edwards, T.A., *Control methods for bovine respiratory disease for feedlot cattle.* Vet Clin North Am Food Anim Pract, 2010. **26**(2): p. 273-84.